Question 1

Which of the following solutions will have the lowest freezing point?
A) 0.010 m Rb I
B) 0.010 m K2SeO4
C) 0.035 m CH3OH
D) 0.015 m SrBr2

Question 2

Benzene has a formula of
A) C3H8.
B) C6H10.
C) C6H6.
D) C8H16.

Question 3

In which compound is nitrogen in its highest possible oxidation state?
A) NH3
B) N2H4
C) HNO2
D) HNO3

Question 4

"Wood alcohol" is the common name for
A) methanol.
B) ethanol.
C) 2-propanol.
D) 1, 2-ethanediol.

Question 5

The ion that has 28 protons and 26 electrons is ________.

Question 6

Which transition metal has the anomalous ground-state electron configuration: [Kr] 4d10?
A) Rh
B) Pd
C) Ag
D) Cd

Question 7

Which is a complex ion?
A) FeBr3
B) CrO42-
C) [Cr(H2O)6]3+
D) Cr2O72-

Question 8

Calcium, strontium, and barium are all prepared commercially by the same method which is
A) electrolysis of the molten metal oxides.
B) electrolysis of the molten metal halides.
C) chemical reduction of the metal oxides with aluminium.
D) chemical reduction of the metal halides with oxygen.
Question 9
What is not an appropriate method for the isolation of elemental boron?
A) refluxing borax with sodium peroxide
B) high temperature reduction of B2O3 with magnesium
C) high temperature reduction of BBr3 with hydrogen over a Ta wire
D) electrolytic reduction of aqueous B(OH)3

Question 10
What is the concentration of an AlCl3 solution if 150. mL of the solution contains 250. mg of Cl- ion?
A) 1.57 × 10⁻² M
B) 3.75 × 10⁻² M
C) 4.70 × 10⁻² M
D) 1.41 × 10⁻¹ M

Question 11
The dissociation equilibrium constants for the protonated form of alanine (a diprotic amino acid, H2X+) are Ka1 = 4.6 × 10⁻³ and Ka2 = 2.0 × 10⁻¹⁰. What is the pH of 50.00 mL of a 0.0500 M solution of alanine after 25.00 mL of 0.100 M NaOH has been added?
A) 2.34
B) 4.85
C) 5.59
D) 6.72

Question 12
If the pressure in a gas container that is connected to an open-end U-tube manometer is 106 kPa and the pressure of the atmosphere at the open end of the tube is 700 mm Hg, the level of mercury in the tube will be
A) 95 mm higher in the arm open to the atmosphere.
B) 95 mm higher in the arm connected to the gas cylinder.
C) 795 mm higher in the arm open to the atmosphere.
D) 795 mm higher in the arm connected to the gas cylinder.

Question 13
The normal boiling point for HBr is higher than the normal boiling point for HCl. This can be explained by
A) larger dipole-dipole forces for HBr.
B) larger dispersion forces for HBr.
C) larger hydrogen-bond forces for HBr.
D) larger dipole-dipole forces, larger dispersion forces, and larger hydrogen-bond forces for HBr.

Question 14
What is the strongest oxidizing agent of the following set: VCl2, CrCl3, KMnO4, KReO4?
A) VCl2
B) CrCl3
C) KMnO4
D) KReO4

Question 15
A solution is 4.50% by weight NaHCO3. How many grams of NaHCO3 are in 450.0 g of solution?
A) 1.000 g
B) 20.2 g
C) 400 g
D) 450 g
Question 16
What is the pH of a solution prepared by mixing 100.00 mL of 0.020 M Ca(OH)₂ with 50.00 mL of 0.200 M NaOH? Assume that the volumes are additive.
A) 12.90
B) 12.97
C) 13.15
D) 13.45

Question 17
Which of the following must be true in order for this reaction to always proceed spontaneously?
A) K = Q
B) K > Q
C) K < Q
D) None of these, spontaneity is dependent on reaction conditions.

Question 18
Electrical resistance of a metal ______ with increasing temperature.
A) can decrease or increase
B) decreases
C) does not change
D) increases

Question 19
Element A has a valence shell configuration of ns²np⁴ while Element B has a valence shell configuration of ns²np⁵ where n = energy level. Which of the following statements is true regarding these elements?
A) The ionization energy of A is lower than the ionization energy of B.
B) The electron affinity of A is higher than the electron affinity of B.
C) Element A and B are transition metals.
D) Element A and B have the same I.E.

Question 20
What is the anhydride of sulfuric acid?
A) SO₂
B) SO₃
C) S₂O₃
D) S₂O₅

Question 21
Which of the following molecules is the most highly oxidized, in other words, the one with the most number of C-O bonds?
A) acetaldehyde
B) ethanoic acid
C) dimethyl ether
D) ethylene

Question 22
Adenosine triphosphate (ATP) plays an important role in energy transfer within cells. ATP can be considered to be an ester of triphosphoric acid, which is formed by the combination of three phosphoric acid molecules with the elimination of two water molecules. What is the formula of triphosphoric acid?

Question 23
In C₃H₇NH₃H₇, which intermolecular forces are present?
A) Dispersion, hydrogen bonding and dipole-dipole forces are present.
B) Only dipole-dipole and ion-dipole forces are present.
C) Only dispersion and dipole-dipole forces are present.
D) Only hydrogen bonding forces are present.

Question 24

Which is the crystal field energy level diagram for a square pyramidal ML5 complex that contains a single ligand on the z-axis?
A) (A)
B) (B)
C) (C)
D) (D)

Question 25

In the protein, Val-Tyr-His-Pro, which amino acid contains the N-terminal group?
A) histidine
B) proline
C) tyrosine
D) valine

Question 26

Which statement about nuclear reactions is true?
A) New elements are never produced in a nuclear reaction.
B) Nuclear reactions involve valence electrons.
C) The rate of a nuclear reaction is affected by catalysts.
D) Tremendous amounts of energy are involved in nuclear reactions.

Question 27

Which of the following species will have the highest ionization energy?
A) Na+
B) Na2+
C) Na3+
D) Na4+

Question 28

What are the possible values of n and ml for an electron in a 3d orbital?
A) n = 1, 2, or 3 and ml = 2
B) n = 1, 2, or 3 and ml = -2, -1, 0, +1, or +2
C) n = 3 and ml = 2
D) n = 3 and ml = -2, -1, 0, +1, or +2

Question 29

What is the pressure in a gas container that is connected to an open-end U-tube manometer if the pressure of the atmosphere is 722 torr and the level of mercury in the arm connected to the container is 8.60 cm higher than the level of mercury open to the atmosphere?
A) 636 mm Hg
B) 713 mm Hg
C) 731 mm Hg
D) 808 mm Hg

Question 30

Because of the high heat and low humidity in the summer in Death Valley, California, a visitor requires about one quart of water for every two miles traveled on foot. Calculate the approximate number of liters required for a person to walk 30. kilometers in Death Valley.
A) 8.8 L
B) 35 L
Question 31

Which element has the chemical symbol, P?
A) lead
B) phosphorus
C) platinum
D) potassium

Question 32

Which group of elements reacts violently with water?
A) halogens
B) noble gases
C) alkali metals
D) alkaline earth metals

Question 33

Diopside, CaMgSi2O6, is an example of a(n) _______ (orthosilicate, single-strand silicate, double-strand silicate, and cyclic silicate).

Question 34

By analogy with the oxoacids of sulfur, H2TeO3 would be named
A) hydrotellurous acid.
B) pertelluric acid.
C) telluric acid.
D) tellurous acid.

Question 35

What is true about the relationship of Kp and Kc for the reaction:
2 CH4(g) + 3 O2(g) <-- --> 2 CO(g) + 4 H2O(g)?
A) Kp < Kc
B) Kp = Kc
C) Kp > Kc
D) Kp and Kc are not related.

Question 36

Which of the following instruments directly measures the pressure of a gas?
A) spectrometer
B) manometer
C) polarimeter
D) gas chromatograph

Question 37

None of the listed compounds contains a ring. Which has at least one singly-bonded carbon atom?
A) C5H12
B) C4H6
C) C6H12
D) All of these

Question 38

A particular superconductor has eight copper atoms on corners and eight copper atoms on edges of its unit cell. How many copper atoms are
attributed to a single unit cell of this superconductor?
A) 1  
B) 3  
C) 5  
D) 16  

Question 39

According to the kinetic molecular theory of gases, raising the temperature of a gases increases the average kinetic energy and the frequency of ________.

Question 40

The human body is thought to contain ________ different kinds of proteins.
A) 90,000  
B) 150,000  
C) 200,000  
D) 110,000  

Question 41

The equilibrium constant, Kp, equals 3.40 at 25°C for the isomerization reaction:  
cis-2-butene <--> trans-2-butene.  
If a flask initially contains 3.00 atm of each gas, in what direction will the system shift to reach equilibrium?
A) It will shift left.  
B) It will shift right.  
C) The system is already at equilibrium.  
D) The system is not at equilibrium and will remain in an unequilibrated state.  

Question 42

Vinegar is a 5.0% solution by weight of acetic acid (CH3CO2H) in water. Given that Ka = 1.8 \times 10^{-5} for acetic acid and assuming the density of vinegar to be 1.00 g/cm3, what is the pH of this vinegar solution?
A) 2.00  
B) 2.41  
C) 2.87  
D) 4.74  

Question 43

Undersea flora prefer a maximum concentration of OH- of 1.58 \times 10^{-5}. The concentration of H3O+ in the seawater is ________, and this solution is ________ (acidic, basic, neutral).

Question 44

A gas absorbs 0.0 J of heat and then performs 13.1 J of work. The change in internal energy of the gas is
A) 26.2 J  
B) 13.1 J  
C) -26.2 J  
D) -13.1 J  

Question 45

How many chloride ions are there in 3.00 mol of aluminum chloride?
A) 3.00 chloride ions  
B) 9.00 chloride ions  
C) 1.81 \times 10^{24} chloride ions  
D) 5.42 \times 10^{24} chloride ions  
Question 46

Which of the following is an allotrope of carbon?
A) diamond  
B) glass  
C) coal  
D) carbon monoxide  

Question 47

In a galvanic cell constructed from Pb(s) | Pb+2(aq) || Hg+1 | Hg(s), which of the electrodes will gain mass?
A) the anode, Pb (s)  
B) the cathode, Pb (s)  
C) the anode, Hg (s)  
D) the cathode, Hg (s)  

Question 48

What is the pH of a solution prepared by mixing 50.00 mL of 0.10 M NH3 with 20.00 mL of 0.10 M NH4Cl? Assume that the volume of the solutions are additive and that Kb = 1.8 × 10-5 for NH3.
A) 8.86  
B) 10.26  
C) 9.65  
D) 11.13  

Question 49

Sintering is
A) a filtration process through a molecular sieve.  
B) the process of heating particles of a powder below the melting point so that they fuse together.  
C) the process of rapid cooling of a material to yield a superconducting mixture.  
D) the process of removing metals from ore by passing material through a magnetic field.  

Question 50

The condensed formula of the smallest molecule that contains the ether functional group is ________.  

Question 51

Round off 477,503 to four significant figures.
A) 4775  
B) 4776  
C) 4.775 × 105  
D) 4.776 × 105  

Question 52

Based on molecular orbital theory, in order to weaken the N—N bond in N2, electrons should be
A) added.  
B) removed.  
C) either added or removed.  
D) neither added nor removed.  

Question 53

The equilibrium constant, K, for the reaction shown below has a value 1.8 × 10-5. In this reaction which is the strongest acid and which is the strongest base?
CH3CO2H(aq) + H2O(l) ←→ H3O+(aq) + CH3CO2-(aq)
A) CH3CO2H and CH3CO2-
Question 54

Which of the following exhibits ion-dipole forces?
A) KBr(s)
B) NaF(aq)
C) Ag(s)
D) Cl2(g)

Question 55

Cr^{2+} has ________ d electrons.

Question 56

Based on formal charges, what is the S—O bond order in SO₄²⁻?
A) 1
B) 1.3
C) 1.5
D) 2

Question 57

Sodium metal and water react to form hydrogen and sodium hydroxide. If 11.96 g of sodium react with water to form 0.52 g of hydrogen and 20.80 g of sodium hydroxide, what mass of water was involved in the reaction?
A) 9.36 g
B) 11.96 g
C) 20.28 g
D) 21.32 g

Question 58

What is the oxidation state of the Cr atom in [Ni(en)₃]³⁺[Cr(CN)₆]²⁻?
A) +2
B) +3
C) +4
D) +6

Question 59

When the equation for the reaction of KBr(aq) with MnO₂(s) to produce Br₂ and Mn²⁺(aq) in acidic solution is balanced, the coefficient in front of the Br₂ is ________.

Question 60

Isoelectronic means having the same number of electrons. The dipositive ion that is isoelectronic with Br⁻ is ________.

Question 61

The enthalpy for the following reaction is 136 kJ. If the reaction takes place in a closed container, which one of the following reaction conditions will not decrease the concentration of water vapor?

2 NaHCO₃(s) ←→ Na₂CO₃(s) + CO₂(g) + H₂O(g)
A) remove CO₂
B) cool the container
C) decrease the volume of the container
D) add some NaHCO₃
Question 62
What is the weight percent of vitamin C in a solution made by dissolving 1.30 g of vitamin C, C₆H₈O₆, in 55.0 g of water?
A) 0.195%
B) 0.242%
C) 2.31%
D) 2.36%

Question 63
Chemical equations are balanced in order to obey the law of
A) definite proportions.
B) mass action.
C) mass conservation.
D) multiple proportions.

Question 64
An oxygen molecule has a mass of 5.3 × 10⁻²⁶ kg and an approximate diameter of 3.6 × 10⁻¹⁰ m. If the molecule is moving at 400 m/s (1000 mph) with an uncertainty in velocity of 1 m/s, the uncertainty in position
A) is less than or equal to 5 × 10⁻²⁶ m.
B) must be equal to 5 × 10⁻²⁶ m.
C) must be equal to 1 × 10⁻⁹ m.
D) is greater than or equal to 1 × 10⁻⁹ m.

Question 65
Which substance has the highest standard molar entropy at 25°C?
A) C(graphite)
B) C₂H₄(g)
C) CH₃OCH₃(l)
D) BaCO₃(s)

Question 66
What is the highest possible oxidation state for chromium?
A) +2
B) +4
C) +7
D) +6

Question 67
The intermolecular forces formed when KI is dissolved in water are ________ forces.

Question 68
The number of metallic elements in period 3 of the periodic table is ________.

Question 69
Which of the following does not affect the solubility of a solute in a given solvent?
A) hydrogen bonding of the solute
B) nonpolarity of the solvent
C) rate of stirring
D) temperature of the solvent and solute
Question 70

Molarity is defined as moles of solute per
A) kilogram of solvent.
B) liter of solution.
C) mole of solute.
D) total moles present.

Question 71

List all the elements that have a ground-state configuration with five unpaired electrons in the 3d subshell.
A) Mn, Fe, Co, Cu, and Zn
B) Cr and Mn
C) Cr
D) Mn

Question 72

Consider a bimolecular reaction in the gas phase. Which one of the following changes in condition will not cause an increase in the rate of the reaction?
A) add a catalyst
B) increase the temperature at constant volume
C) increase the volume at constant temperature
D) All of these will increase the rate of reaction.

Question 73

An ionic compound crystallizes in a unit cell having a face-centered cubic array of anions, X−, and half of the tetrahedral holes filled with metal ions, Mn+. The empirical formula of this ionic compound is
A) MX.
B) MX2.
C) M2X.
D) M2X7.

Question 74

Which of the following scenarios involves a transfer of heat from system to surroundings?
A) evaporating rubbing alcohol from your skin
B) solidifying molten gold into a gold bar
C) melting solid gallium metal with heat from your hand
D) none of these

Question 75

Which one of the following amino acids contains a polar side chain?
A) valine
B) glycine
C) cysteine
D) alanine

Question 76

How many grams of chromium metal are plated out when a constant current of 8.00 A is passed through an aqueous solution containing Cr3+ ions for 160. minutes?
A) 13.8 g
B) 24.6 g
C) 41.2 g
D) 124 g
Question 77

What is the most metallic element of group 4A?
A) Ge
B) Sb
C) Sn
D) Pb

Question 78

In the protein, Asn-Phe-Cys-Lys, which amino acid contains the C-terminal group?
A) asparagine
B) cysteine
C) lysine
D) phenylalanine

Question 79

What is the pH of a solution made by mixing 30.00 mL of 0.10 M acetic acid with 40.00 mL of 0.10 M KOH? Assume that the volumes of the solutions are additive. Ka = 1.8 × 10-5 for CH3CO2H.
A) 8.26
B) 9.26
C) 11.13
D) 12.15

Question 80

What is the molar concentration of sulfate ions in a 0.450 M K2SO4 solution?
A) 0.225 M
B) 0.450 M
C) 0.900 M
D) 1.35 M

Question 81

In which compound is the oxidation state of hydrogen not +1?
A) H2S
B) H2O2
C) KH
D) KHSO4

Question 82

What is the concentration of FeCl3 in a solution prepared by dissolving 10.0 g of FeCl3 in enough water to make 275 mL of solution?
A) 2.24 × 10-4 M
B) 0.224 M
C) 4.46 M
D) 4.46 × 103 M

Question 83

A car drives 80 km/h. If the car is driven for 122 minutes, how many miles has the car traveled?
A) 262
B) 364,000
C) 101
D) 24.4

Question 84
What is the molecular structure of germanium that is used in semiconductors?
A) body centered
B) diamond-like
C) graphite-like
D) simple cubic

Question 85
What volume of 5.00 × 10⁻³ M HNO₃ is needed to titrate 100.00 mL of 5.00 × 10⁻³ M Ca(OH)₂ to the equivalence point?
A) 12.5 mL
B) 50.0 mL
C) 100. mL
D) 200. mL

Question 86
At 300 K a 500.0 mL solution containing 0.4314 g of dextrose has an osmotic pressure of 89.6 mm Hg. What is the molar mass of dextrose?

Question 87
A solution is prepared by dissolving 17.75 g sulfuric acid, H₂SO₄, in enough water to make 100.0 mL of solution. If the density of the solution is 1.1094 g/mL, what is the molality?
A) 0.1775 m H₂SO₄
B) 0.1810 m H₂SO₄
C) 1.810 m H₂SO₄
D) 1.940 m H₂SO₄

Question 88
What is the mass of a single ozone molecule, O₃?
A) 2.656 × 10⁻²³ g
B) 7.969 × 10⁻²² g
C) 16.0 g
D) 48.0 g

Question 89
What is the ground-state electron configuration of Se²⁻?
A) [Ar]3d¹⁰4s²4p²
B) [Ar]3d¹⁰4s²4p⁴
C) [Ar]3d¹²4s²4p⁴
D) [Ar]3d¹⁰4s²4p⁶

Question 90
A balloon contains 0.76 mol N₂, 0.18 mol O₂, 0.031 mol He and 0.026 mol H₂ at 739 mm Hg. What is the partial pressure of O₂?
A) 19 mm Hg
B) 23 mm Hg
C) 130 mm Hg
D) 560 mm Hg

Question 91
What is the weight percent of a caffeine solution made by dissolving 4.00 g of caffeine, C₈H₁₀N₄O₂, in 75.0 g of benzene, C₆H₆?
A) 0.0506%
B) 0.0533%
C) 5.06%
D) 5.33%
Question 92

What is the de Broglie wavelength of a 300. g object moving at a velocity of 25.0 m/s (about 100 mph)?

A) $8.84 \times 10^{-41}$ m
B) $8.84 \times 10^{-35}$ m
C) $8.84 \times 10^6$ m
D) $8.84 \times 10^{12}$ m


Question 93

The first ionization energy of gallium is greater than that of aluminum and the first ionization energy of thallium is greater than that of indium. A possible explanation for this is:

A) This is the normal trend in ionization energy.
B) Both Ga and Tl prefer to lose three electrons rather than one.
C) Both Ga and Tl follow transition elements which are excellent shielders of nuclear charge.
D) Ga follows a series of transition elements and Tl follows both a series of transition elements and inner transition elements which are poor shielders of nuclear charge.


Question 94

How many of the following numbers contain 3 significant figures?

- 0.509
- 1.050
- 0.0500
- $1.06 \times 10^{24}$

A) one
B) two
C) three
D) four


Question 95

The term “carbohydrates” refers to a large class of polyhydroxylated

A) alcohols and carboxylic acids.
B) aldehydes and ketones.
C) amines and amides.
D) ethers and esters.


Question 96

Which of these neutralization reactions has a pH < 7 when equal molar amounts of acid and base are mixed?

A) CH₃CO₂H(aq) + NaOH(aq) $\rightarrow$ H₂O(l) + NaCH₃CO₂(aq)
B) HCl(aq) + C₅H₅N(aq) $\rightarrow$ C₅H₅NHCl(aq)
C) HBr(aq) + KOH(aq) $\rightarrow$ H₂O(l) + KBr(aq)
D) H₂SO₄(aq) + 2 NaOH(aq) $\rightarrow$ 2 H₂O(l) + Na₂SO₄(aq)


Question 97

How many significant figures are there in the answer for the following problem?

23.1 + 0.5588 + 17 = ?

A) one
B) two
C) three
D) four


Question 98

Manganese crystallizes in a body-centered cubic structure. What is the coordination number of each atom?

A) 4
B) 6
C) 8
D) 12

Question 99
What is the entropy of 105 molecules in 1010 boxes?
A) 1.59 \times 10^{-21}
B) 3.45 \times 10^{-20}
C) 1.38 \times 10^{-17}
D) 3.18 \times 10^{-17}

Question 100
A complex ion that has a broad absorption band at 530 nm in its visible absorption spectrum will appear to be
A) red.
B) colorless.
C) green.
D) aqua.

Question 101
How long must a constant current of 50.0 A be passed through an electrolytic cell containing aqueous Cu^{2+} ions to produce 3.00 moles of copper metal?
A) 0.311 hours
B) 0.621 hours
C) 1.61 hours
D) 3.22 hours

Question 102
According to the kinetic molecular theory, the pressure of a gas in a container will decrease if the
A) number of collisions with the container wall increases.
B) number of moles of the gas increases.
C) temperature of the gas decreases.
D) volume of the container decreases.

Question 103
How many H^{+} ions can the acid, H_{2}CO_{3}, donate per molecule?
A) 0
B) 1
C) 2
D) 3

Question 104
What factor affects the rate of a chemical reaction?
A) collision frequency
B) fraction of collisions with sufficient energy
C) orientation of molecules
D) All of these

Question 105
In which of the following solutions would solid AgCl be expected to be the least soluble at 25°C?
A) 0.1 M HCl
B) 0.1 M KCl
C) 0.1 M BaCl_{2}
D) 0.1 M K NO_{3}

Question 106
If niobium loses all of its valence electrons when it reacts with fluorine, what is the formula of the neutral binary compound that results?

Question 107
Which of the following compounds exhibits only dispersion and dipole-dipole intermolecular interactions?
A) Na
B) HCl
C) BH3
D) CH3NHCH4

Question 108
Classify bonds in As4 as largely ionic, nonpolar covalent, or polar covalent.

Question 109
What is the oxidation number of the sulfur atom in S8?
A) -2
B) 0
C) +6
D) +8

Question 110
What is the equilibrium constant expression (Ka) for the acid dissociation of hydrocyanic acid HCN? The equation of interest is
\[
\text{HCN}(aq) + \text{H}_2\text{O}(l) \rightleftharpoons \text{H}_3\text{O}^+(aq) + \text{CN}^-(aq).
\]
A) \(Ka = \frac{[\text{H}_3\text{O}^+][\text{CN}^-]}{[\text{HCN}][\text{H}_2\text{O}]}\)
B) \(Ka = \frac{[\text{H}_3\text{O}^+][\text{CN}^-]}{[\text{HCN}]}\)
C) \(Ka = \frac{[\text{HCN}][\text{H}_2\text{O}]}{[\text{H}_3\text{O}^+][\text{CN}^-]}\)
D) \(Ka = \frac{[\text{HCN}][\text{H}_2\text{O}]}{[\text{H}_3\text{O}^+][\text{CN}^-]}\)

Question 111
The reaction for the decomposition of dinitrogen monoxide gas to form an oxygen radical is: . If the activation energy is 250 kJ/mol and the frequency factor is 8.0 \times 10^{11} s^{-1}, what is the rate constant for the first-order reaction at 1000 K?
A) 1.1 \times 10^{-3} s^{-1}
B) 7.0 \times 10^{-2} s^{-1}
C) 1.6 \times 10^{13} s^{-1}
D) 9.1 \times 10^{24} s^{-1}

Question 112
Which statement is not consistent with the chemistry of group 4A elements?
A) Elements have the outer valence electron configuration of ns^{2}np^{2}.
B) The most common oxidation state for the elements of the group is +4.
C) The +4 oxidation state compounds are ionic and the +2 oxidation state compounds are covalent.
D) The +2 oxidation state for lead is the most stable.

Question 113
What is the general trend in ionization energy and electron affinity values?
A) Both decrease as one traverses a period from left to right and both decrease as one descends a group.
B) Both decrease as one traverses a period from left to right and both increase as one descends a group.
C) Both increase as one traverses a period from left to right and both decrease as one descends a group.
D) Both increase as one traverses a period from left to right and both increase as one descends a group.

Question 114
The volume of 350. mL of gas at 25°C is decreased to 250. mL at constant pressure. What is the final temperature of the gas?
Question 115
How long must a constant current of 50.0 A be passed through an electrolytic cell containing aqueous Cu²⁺ ions to produce 3.50 moles of copper metal?
A) 0.267 hours
B) 0.533 hours
C) 1.88 hours
D) 3.75 hours

Question 116
Which process decreases the neutron/proton ratio?
A) alpha emission
B) beta emission
C) electron capture
D) positron emission

Question 117
Mass defect is the mass lost when
A) an atom is formed from individual protons, neutrons, and electrons.
B) a nucleus is formed from individual protons and neutrons.
C) electrons are removed from an atom.
D) electrons are added to an atom.

Question 118
Which element has the chemical symbol, Au?
A) antimony
B) americium
C) gold
D) lead

Question 119
Using shorthand notation, the ground-state electron configuration of the chromium ion in CrCl₂ is ________.

Question 120
How many protons (p) and neutrons (n) are in an atom of Sr?
A) 38 p, 52 n
B) 38 p, 90 n
C) 52 p, 38 n
D) 90 p, 38 n

Question 121
Which one of the following instruments would be the least suitable for detecting particles given off in radioactive decay?
A) electron microscope
B) Geiger counter
C) photographic film
D) scintillation counter
Question 122

A solution has a density of 1.023 g/mL and a concentration of 0.0800 g/dL. What is the concentration in parts per million?
A) 700 ppm  
B) 1408 ppm  
C) 550 ppm  
D) 818 ppm  

Question 123

Which one of the following is an electrical insulator?
A) alumina  
B) germanium doped with antimony  
C) gold  
D) tellurium  

Question 124

A 1.00 L flask contains nitrogen gas at 25°C and 1.00 atm pressure. What is the final pressure in the flask if an additional 0.50 g of N2 gas is added to the flask and the flask cooled to -55°C?
A) 1.01 atm  
B) 1.05 atm  
C) 0.319 atm  
D) 3.13 atm  

Question 125

Which covalent bond is the most polar?
A) H—I  
B) H—F  
C) H—Cl  
D) H—Br  

Question 126

Which compound, shown with its dipole moment, is expected to exhibit the smallest percent ionic character?
A) CCl4  
B) HBr  
C) KCl  
D) CH2Cl2  

Question 127

A radioisotope has a neutron/proton ratio which is too low. Which of the following processes will not occur for such a nucleus?
A) alpha emission  
B) beta emission  
C) electron capture  
D) positron emission  

Question 128

For a particular orbital, as one goes away from the nucleus along the z-axis, the probability density decreases to zero, then increases, and finally decreases without increasing a second time. This is consistent with a
A) 2s orbital.  
B) 4px orbital.  
C) 3f orbital.  
D) 4s orbital.  
Question 129
Which statement is true?
A) The cathode is positive for a galvanic cell and negative for an electrolytic cell.
B) Electrons flow through the external circuit to the cathode in a galvanic cell and to the anode in an electrolytic cell.
C) Oxidation occurs at the anode in a galvanic cell and at the cathode in an electrolytic cell.
D) Oxidation occurs at the cathode in a galvanic cell and at the anode in an electrolytic cell.

Question 130
A 1.8 mole sample of gas at STP has a _______ entropy than 1.8 mole of gas at 273 K and 835 mm Hg.

Question 131
How many cations are there in 50.0 g of sodium phosphate?
A) 1.84 × 10^{23} cations
B) 5.51 × 10^{23} cations
C) 1.97 × 10^{24} cations
D) 5.92 × 10^{24} cations

Question 132
Nitric oxide reacts with oxygen to form nitrogen dioxide:
\[ 2 \text{NO}(g) + \text{O}_2(g) \rightarrow 2 \text{NO}_2(g) \]
What is Kc for the forward reaction if the equilibrium concentration of NO is 0.200 M, O2 is 0.100 M, and NO2 is 0.200 M at 25°C?
A) 3.5
B) 0.200
C) 0.10
D) 10.0

Question 133
What is the molar solubility of AgCl in 0.10 M NaCN if the colorless complex ion Ag(CN)\(_2\)- forms? Ksp for AgCl is 1.8 × 10^{-10} and Kf for Ag(CN)\(_2\)- is 1.0 × 10^{21}.
A) 0.050 M
B) 0.10 M
C) 0.20 M
D) 0.40 M

Question 134
One kilogram is slightly more than _______ U.S. pounds.
A) 0.5
B) 1
C) 2
D) 5

Question 135
Using shorthand notation, the ground-state electron configuration for F- is predicted to be ________.

Question 136
When iron(III) oxide reacts with hydrochloric acid, iron(III) chloride and water are formed. How many grams of iron(III) chloride are formed from 10.0 g of iron(III) oxide and 10.0 g of hydrochloric acid?
A) 11.1 g
B) 14.8 g
C) 20.3 g
D) 35.1 g
Question 137

Which of the following solutions has the highest concentration of hydroxide ions [OH⁻]?
A) pH = 3.21
B) pH = 7.83
C) pH = 10.93
D) pH = 12.04

Question 138

Which of the following is the smallest unit?
A) 13 centi
B) 3.0 deci
C) 3.3 × 10³ milli
D) 1.5 × 10⁶ nano

Question 139

Of the following, which has the shortest de Broglie wavelength?
A) an airplane moving at a velocity of 350 mph
B) a helium nucleus moving at a velocity of 800 mph
C) a nitrogen molecule moving at a velocity of 900 mph
D) a nitrogen molecule moving at a velocity of 5000 mph

Question 140

Aniline, C₆H₅NH₂, Ka = 4.3 × 10⁻¹₀ at 25°C is an industrially important amine used in the making of dyes. Determine the pH of an aniline solution made by dissolving 3.90 g of aniline in enough water to make 100 mL of solution.
A) 4.87
B) 9.13
C) 9.74
D) 10.74

Question 141

A person is most likely to experience serious tissue damage when exposed to which of the following forms of electromagnetic radiation?
A) microwaves
B) ultraviolet
C) radio waves
D) x-rays

Question 142

The oxidation state of chlorine in ClO₄⁻ is
A) 0
B) +5
C) -5
D) +7

Question 143

A college runner set a school record of 3:59.37 in the mile run. Assuming that the distance was measured accurately to five significant figures, what was the runner’s average speed in kilometers per hour?
A) 9.3454 km/hr
B) 10.375 km/hr
C) 24.203 km/hr
D) 26.869 km/hr
Question 144
What mass percent of 235U (the fissionable isotope) is used in the fuel in nuclear power plants?
A) 3%
B) 14%
C) 30%
D) 85%

Question 145
What molality of pentane is obtained by dissolving 25 g pentane, C₅H₁₂, in 245.0 g hexane, C₆H₁₄?
A) 0.093 m
B) 0.11 m
C) 1.4 m
D) 100 m

Question 146
The number of nucleons in an atom or ion is the same as the
A) atomic number.
B) charge on the atom or ion.
C) mass number.
D) none of these

Question 147
Which of the following can function as a chelating agent?
A) I⁻
B) NH₃
C) C₂O₄²⁻
D) H₂O

Question 148
The chemical system shown below is at equilibrium. Which change in conditions will not result in a spontaneous forward reaction?
\[ N₂(g) + 3H₂(g) \rightleftharpoons 2NH₃(g) \quad K_p = 4 \times 10^5 \]
A) adding a catalyst
B) adding more N₂
C) decreasing the NH₃
D) increasing the pressure

Question 149
Which element of group 4A is the most abundant in the earth's crust?
A) C
B) Si
C) Sn
D) N

Question 150
What is the pH of the solution formed when 25 mL of 0.173 M NaOH is added to 35 mL of 0.342 M HCl?

Question 151
Though we would expect an increase in atomic radii going down a group from the second to the third transition series of elements, the actual radii are nearly identical. The term commonly used to describe this phenomenon is the
A) atomic disparity.
B) effective nuclear charge.
C) lanthanide contraction.
D) transition default.

**Question 152**

If the number of moles of gas is halved at constant temperature and volume, the pressure of the gas
A) is doubled.
B) is halved.
C) is one-fifth.
D) remains the same.

**Question 153**

What is the molecular geometry of TeF5-?
A) octahedral
B) seesaw
C) square pyramidal
D) trigonal bipyramidal

**Question 154**

When pressure-volume measurements are made on 1.0 mol of gas at constant temperature, a plot V versus P results in a
A) hyperbola.
B) parabola.
C) sine curve.
D) straight line.

**Question 155**

At STP the number of liters of O2 required to react with 11.2 liters of CH4 to form only CO2 and H2O is ________ liters.

**Question 156**

In an electron capture reaction a proton is converted into a ________.

**Question 157**

The reaction CaCO3(s) <-- --> CaO(s) + O2(g) is endothermic 298 K. The effect of adding a catalyst to the system at equilibrium will ________ (decrease, increase, have no effect on) the total quantity of CaCO3 once equilibrium is reestablished.

**Question 158**

What is W in Boltzmann's formula, S = k ln W?
A) a fraction indicating the probability of obtaining a result
B) a random number
C) the number of ways of obtaining the state
D) the work times Avogadro's number

**Question 159**

Radon belongs to the ________ group of the periodic table.
A) alkali metal
B) alkaline earth metal
C) halogen
D) noble gas

**Question 160**

What is the strongest acid among the following?
Question 161

The chemical formula for chlorous acid is
A) H ClO(aq).
B) H ClO2(aq).
C) H ClO3(aq).
D) H Cl O4(aq).

Question 162

The orbital hybridization on the carbon atom in S CN - is
A) sp.
B) sp2.
C) sp3.
D) sp3d2.

Question 163

A compound having A ions on each corner and B ions on each face of a cubic unit cell has the empirical formula ________.

Question 164

Four heavy elements (A, B, C, and D) will fission when bombarded by neutrons. In addition to fissioning into two smaller elements, A also gives off a beta particle, B gives off gamma rays, C gives off neutrons, and D gives off alpha particles. Which element would make a possible fuel for a nuclear reactor?
A) element A
B) element B
C) element C
D) element D

Question 165

A reaction reaches dynamic equilibrium at a given temperature when
A) the amount of products exceeds the amount of reactants.
B) kfwd equals krev.
C) opposing reactions cease and the system is static.
D) the relative amounts of reactants and products are constant and ratefwd = raterev.

Question 166

Barium has a radius of 224 pm and crystallizes in a body-centered cubic structure. What is the edge length of the unit cell?
A) 259 pm
B) 317 pm
C) 448 pm
D) 517 pm

Question 167

According to kinetic molecular theory, which of the following will decrease the rate of reaction?
A) increase the temperature
B) increase the concentration
C) increase the size of the molecule
D) increase the size of the reaction vessel
Question 168

Which has the highest entropy in each set?
I. H₂O(s), H₂O(l), H₂O(g) at 0.1°C, 4.40 atm
II. H₂O(l) at 0°C, H₂O(l) at 23°C, H₂O(l) at 100°C (all at 1.0 atm pressure)
A) H₂O(l) in set I and H₂O(l) at 0°C in set II
B) H₂O(s) in set I and H₂O(l) at 100°C in set II
C) H₂O(g) in set I and H₂O(l) at 0°C in set II
D) H₂O(g) in set I and H₂O(l) at 100°C in set II

Question 169

What is the chemical symbol for niobium?
A) Au
B) Nb
C) Pb
D) Nn

Question 170

Which of the following notations represents the dipeptide shown below?
A) Phe-Thr
B) Thr-Phe
C) Ser-Tyr
D) Tyr-Ser

Question 171

The pH of a 0.150 M formic acid/0.250 M sodium formate buffer = ________? The Ka of formic acid is 1.8 × 10⁻⁴.

Question 172

In a reversible reaction, when the rate of the forward reaction equals the rate of the reverse reaction, the reaction is at ________.

Question 173

Which element has the ground-state electron configuration [Xe]6s² ⁴?
A) Re
B) Ir
C) Eu
D) Gd

Question 174

For an electron in a given atom, the larger n, the
A) larger the average distance from the nucleus and the higher the orbital energy.
B) larger the average distance from the nucleus and the lower the orbital energy.
C) smaller the average distance from the nucleus and the higher the orbital energy.
D) smaller the average distance from the nucleus and the lower the orbital energy.

Question 175

The compound CCl₄ contains
A) ionic bonds.
B) nonpolar covalent bonds.
C) polar covalent bonds, with partial negative charges on the Cl atoms.
D) polar covalent bonds, with partial negative charges on the C atoms.
Question 176

Orbitals used by carbon for bonding in C2H6, C2H4, and C2H2 are ________, ________, and ________, respectively.

Question 177

What is the hydronium ion concentration in a solution prepared by mixing 50.00 mL of 0.10 M HCN with 50.00 mL of NaCN? Assume that the volumes of the solutions are additive and that Ka = 4.9 × 10⁻¹⁰ for HCN.
A) 4.9 × 10⁻¹¹ M
B) 4.9 × 10⁻¹⁰ M
C) 4.9 × 10⁻⁹ M
D) 7.0 × 10⁻⁶ M

Question 178

Calculate the pH for an aqueous solution of acetic acid that contains hydronium ion.
A) 2.41 × 10⁻¹² M
B) 4.15 × 10⁻³ M
C) 2.38
D) 11.62

Question 179

At a given temperature and pressure, which of the following would be expected to have the greatest molar entropy?
A) F₂ (s)
B) F₂ (l)
C) F₂ (g)
D) All of these would be expected to have the same molar entropy.

Question 180

Salt solubilities can be compared by the concentration of cation formed when the salt dissolves in the general reaction: MaXb(s) ←→ a Mb⁺(aq) + b X⁻(aq). Given the following salts and their equilibrium constants for the reaction above at 25°C, which salt is the least soluble?
A) AgCl, Kc = 1.8 × 10⁻¹⁰
B) Ag₂SO₄, Kc = 1.2 × 10⁻⁵
C) CaCO₃, Kc = 2.6 × 10⁻⁹
D) CaF₂, Kc = 1.5 × 10⁻¹⁰

Question 181

Calculate the solubility (in g/L) of calcium fluoride in water at 25°C if the Ksp for Ca F₂ is 3.5 × .
A) 9.6 × 10⁻⁴ g/L
B) 2.1 × 10⁻⁴ g/L
C) 3.3 × 10⁻² g/L
D) 4.1 × 10⁻² g/L

Question 182

The change in the Gibbs free energy for dissolving solute in a saturated solution is
A) negative.
B) zero.
C) positive.
D) positive at low temperatures and negative at high temperatures.

Question 183

Which compound contains only carbons and hydrogens?
A) methyl ethanoate
B) acetylene
Question 184

Which of the following is a semiconductor?

A) Ca  
B) B  
C) K  
D) Pb  


Question 185

Which of the following is the correct chemical formula for a molecule of iodine?

A) I  
B) I-  
C) I+  
D) I2  


Question 186

Molarity is defined as ________, whereas molality is defined as ________.


Question 187

Which one of the following compounds contains the smallest percent oxygen by mass?

A) CO2  
B) N2O4  
C) P10O5  
D) C9H20O  


Question 188

A gaseous compound, C, undergoes catalytic decomposition at an initial rate of 0.45 M/s when [C]o = 3.0 × 10^-3 M and 0.45 M/s when [C]o = 9.0 × 10^-3 M. Therefore, this is a ________ order reaction.


Question 189

Which of the following statements is not consistent with the properties of a molecular solid?

A) a compound that conducts electricity when molten  
B) a low melting solid  
C) a solid formed by the combination of two nonmetallic elements  
D) a solid that is a nonconductor of electricity  


Question 190

Using shorthand notation, the ground-state electron configuration for Tl+ is predicted to be ________.


Question 191

A 0.50 M solution of a weak acid HA has the same pH as a 0.075 M solution of HCl. Calculate the Ka for HA.

A) 0.50  
B) 0.075  
C) 0.1324  
D) 0.01125  


Question 192

The output of a pendant manufacturer is 4335 pounds per week. If each pendant weighs 0.0133 pounds, how many pendants does the manufacturer...
Question 193

By analogy with the oxoanions of sulfur, H2TeO3 would be named
A) hydrotellurous acid.
B) pertelluric acid.
C) telluric acid.
D) tellurous acid.

Question 194

What is the molar mass of aspartic acid, C4H7O4N?
A) 43 g/mol
B) 70 g/mol
C) 133 g/mol
D) 197 g/mol

Question 195

Elements A and Q form two compounds, AQ and A2Q3. The mass ratio (mass Q)/(mass A) for AQ is 0.286. What is the mass ratio (mass Q)/(mass A) for A2Q3?
A) 0.191
B) 0.429
C) 2.33
D) 5.24

Question 196

Which is a net ionic equation for the neutralization of a weak acid with a strong base?
A) HBr(aq) + NaOH(aq) → H2O(l) + NaBr(aq)
B) H3O+(aq) + OH−(aq) → 2 H2O(l)
C) HF(aq) + LiOH(aq) → H2O(l) + LiF(aq)
D) HF(aq) + OH−(aq) → H2O(l) + F−(aq)

Question 197

Which cation in each set is expected to have the larger (more negative) hydration energy?
I. Li+ or Na+
II. Rb+ or Cu2+
A) Li+ in set I and Rb+ in set II
B) Li+ in set I and Cu2+ in set II
C) Na+ in set I and Rb+ in set II
D) Na+ in set I and Cu2+ in set II

Question 198

Which ion has the largest radius?
Ca2+, Ca+, Br−, K+
A) Ca2+
B) Ca+
C) Br−
D) K+

Question 199
Which of the following species has its N atom or atoms in the -1 oxidation state?

A) N2H4  
B) NH2OH  
C) N2O  
D) HONO  

Question 200

Which of the following correctly ranks the following temperatures from smallest to largest?

23°C, 17°F, 273K, 1°C

A) 23°C < 17°F < 273K < 1°C  
B) 1°C < 17°F < 23°C < 273K  
C) 273K < 23°C < 1°C < 17°F  
D) 17°F < 273K < 1°C < 23°C  

Question 201

The Boltzmann formula is \( S = k \ln W \). A perfect crystal has a molar entropy of 0 at absolute zero because

A) \( W = 0 \).  
B) \( W = 1 \).  
C) \( W = N_A \).  
D) \( k = 1 \).  

Question 202

The decomposition of ammonia is: \( 2 \text{NH}_3(g) \rightleftharpoons \text{N}_2(g) + 3 \text{H}_2(g) \). If the pressure of ammonia is \( 1.0 \times 10^{-3} \text{ atm} \), and the pressures of \( \text{N}_2 \) and \( \text{H}_2 \) are each 0.20 atm, what is the value for \( K_p \) at 400°C for the reverse reaction?

A) \(-6.2 \times 10^{-4}\)  
B) \(-1.6 \times 10^{3}\)  
C) \(6.2 \times 10^{-4}\)  
D) \(1.6 \times 10^{3}\)  

Question 203

What is the relation between joules (J), volts (V), and coulombs (C)?

A) \(1 \text{ J} = 1 \text{ V} \times 1 \text{ C}\)  
B) \(1 \text{ J} = 1 \text{ V} \div 1 \text{ C}\)  
C) \(1 \text{ J} = 1 \text{ C} \div 1 \text{ V}\)  
D) \(1 \text{ J} = 1 \text{ V} \times 1 \text{ C}^2\)  

Question 204

At STP if 1.00 mole of gas occupies 22.4 L then 0.200 mole of gas would occupy ________ L under the same conditions.  

Question 205

Freezing point depression, boiling point elevation, vapor pressure lowering, and osmotic pressure are examples of ________ properties, which depend on the amount but not the chemical identity of dissolved particles.  

Question 206

A reaction with an activation energy, \( E_a = 51.2 \text{ kJ/mol} \) will proceed ________ times faster when the temperature is raised from 20 °C to 30 °C.  

Question 207

Which of the following volumes is equal to 60.0 mL?

A) 60.0 cm³  
B) 60.0 mm³  
C) 0.600 L  
**Question 208**

For the reaction \( \text{H}_2(\text{g}) + \text{S}(\text{s}) \rightleftharpoons \text{H}_2\text{S}(\text{g}) \), if the rate constant for the forward reaction is greater than the rate constant for the reverse reaction, the value of \( K_c \) must be ________ (equal to, greater than, less than) 1.


**Question 209**

The tripositive ion with the electron configuration \([\text{Ar}]^3\text{d}^6\) is ________.


**Question 210**

Which of the following contains an atom that does not obey the octet rule?

A) \( \text{NaCl} \)
B) \( \text{SiO}_2 \)
C) \( \text{BrF}_3 \)
D) \( \text{BrF} \)


**Question 211**

Methane and oxygen react to form carbon dioxide and water. What mass of water is formed if 3.2 g of methane reacts with 12.8 g of oxygen to produce 8.8 g of carbon dioxide?

A) 7.2 g
B) 8.8 g
C) 14.8 g
D) 16.0 g


**Question 212**

What is the expected freezing point of a 0.50 m solution of \( \text{K}_2\text{SO}_4 \) in water? \( K_f \) for water is 1.86°C/m.

A) -0.93°C
B) -1.9°C
C) -2.8°C
D) -6.5°C


**Question 213**

The normal boiling point occurs when the

A) intermolecular forces within the liquid phase are broken.
B) temperature of the pure liquid equals the external temperature.
C) vapor pressure of a pure liquid equals an external pressure of one atmosphere.
D) vapor pressure of the liquid equals the external pressure.


**Question 214**

The equilibrium constant, \( K_p \), equals 3.40 at 25°C for the isomerization reaction:

\[ \text{cis-2-butene} \rightleftharpoons \text{trans-2-butene}. \]

If a flask initially contains 1.00 atm of each gas, in what direction will the system shift to reach equilibrium?

A) It will shift left.
B) It will shift right.
C) The system is already at equilibrium.
D) The system is not at equilibrium and will remain in an unequilibrated state.


**Question 215**

For hydrogen, what is the wavelength of the photon emitted when an electron drops from a 4d orbital to a 2p orbital in a hydrogen atom? The Rydberg constant is \( 1.097 \times 10^{-2} \text{ nm}^{-1} \).

A) 656.3 nm
Question 216
What is the average speed (actually the root-mean-square speed) of a carbon monoxide molecule at 27°C?
A) 450 m/s
B) 412 m/s
C) 514 m/s
D) 517 m/s

Question 217
Which of the following statements does not describe a physical property of chlorine?
A) Chlorine combines with sodium to form table salt.
B) The color of chorine gas is green.
C) The density of chlorine gas at standard temperature and pressure is 3.17 g/L.
D) The freezing point of chlorine is -101°C.

Question 218
The molecule CH₃CH₂CO₂CH₂CO₂H contains an ________ functional group and a ________ functional group.

Question 219
A KCl solution is prepared by dissolving 25.0 g KCl in 250.0 g of water at 25°C. What is the vapor pressure of the solution if the vapor pressure of water at 25°C is 23.76 mm Hg?
A) 21.6 mm Hg
B) 22.7 mm Hg
C) 23.2 mm Hg
D) 24.9 mm Hg

Question 220
How many lone pairs are there in the Lewis structure of O₂?
A) 3
B) 1
C) 0
D) 4

Question 221
Of the following, which atom has the largest atomic radius?
A) Na
B) Cl
C) K
D) Br

Question 222
How many Fe(II) ions are there in 5.00 g of FeSO₄?
A) 5.46 × 10⁻²⁶ iron(II) ions
B) 1.98 × 10²² iron(II) ions
C) 1.83 × 10²⁵ iron(II) ions
D) 4.58 × 10²⁶ iron(II) ions

Question 223
Naturally occurring organic molecules that dissolve in nonpolar solvents are called ________ of which the most plentiful in nature are ________ and ________.


**Question 224**

The equilibrium constant, K, can be calculated from
A) E°.
B) E.
C) either E° or E.
D) neither E° nor E.


**Question 225**

Sodium hydroxide is available commercially as a 50.0% by weight aqueous solution. The density of the solution is 1.53 g/mL. Calculate the molarity of this sodium hydroxide solution.

A) 0.450 M
B) 19.1 M
C) 25.0 M
D) 125. M


**Question 226**

What is the most stable oxidation state for Bi in bismuth compounds?
A) -2
B) +1
C) +3
D) +2


**Question 227**

Isoeugenol is the compound which gives the characteristic odor to nutmeg and contains carbon, hydrogen, and oxygen. If a 0.500 g sample of isoeugenol is combusted it gives 1.341 g of CO2 and 0.329 g of H2O. Isoeugenol has a molecular weight of 164 g/mol. What is the molecular formula of isoeugenol?
A) C2H2O
B) C5H6O
C) C8H4O4
D) C10H12O2


**Question 228**

What is the pH of a solution made by mixing 100.0 mL of 0.10 M HNO3, 50.0 mL of 0.20 M HCl, and 100.0 mL of water? Assume that the volumes are additive.
A) 0.30
B) 0.82
C) 1.00
D) 1.10


**Question 229**

What statement is most inconsistent about the chemistry of iron?
A) Iron(III) hydroxide is very soluble and reacts readily with hydroxide to form Fe(OH)4-.
B) Iron reacts with hydrochloric acid in the absence of air to yield iron(II) ion and hydrogen gas.
C) Iron reacts with nitric acid to yield iron(III) ion and nitric oxide.
D) The most common oxidation states of iron are +2 (ferrous) and +3 (ferric).


**Question 230**

In a nuclear reaction, the symbol for a beta particle is ________.

Question 231

Monosaccharides are classified as either ________ or ________.

Question 232

What is the Henderson-Hasselbalch equation for the acidic buffer HA/A-?
A) pH = -log[H3O+]
B) pH = 14 - pOH
C) pH = pKa - log([A-]/[HA])
D) pH = pKa - log([A-]/[HA])

Question 233

Which of the following pairs have the most similar chemical properties?
A) alkynes and esters
B) alkenes and aromatics
C) amines and carboxylic acids
D) ketones and aldehydes

Question 234

Which of the following has the greatest mass?
A) 1.55 × 10^23 molecules of O2
B) 4.00 g of O2
C) 0.125 mol of O2
D) All of these have the same mass.

Question 235

How many protons (p) and neutrons (n) are in an atom of calcium-46?
A) 20 p, 26 n
B) 20 p, 46 n
C) 26 p, 20 n
D) 46 p, 20 n

Question 236

How many grams of H2 gas are there in a 5.00-L cylinder at 4.00 × 10^3 mm Hg and 23°C?
A) 1.08 g
B) 2.16 g
C) 0.542 g
D) 823 g

Question 237

Sodium hypochlorite, NaOCl, is the active ingredient in household bleach. What is the concentration of hypochlorite ion if 20.00 mL of bleach requires 28.30 mL of 0.500 M HCl to reach the equivalence point?
A) 0.208 M
B) 0.353 M
C) 0.708 M
D) 1.21 M

Question 238

The heat of vaporization of water at 100°C is 40.66 kJ/mol. Calculate the quantity of heat that is absorbed/released when 20.00 g of steam condenses to liquid water at 100°C.
A) 45.2 kJ of heat are absorbed.
B) 45.2 kJ of heat are released.
Question 239

An element has two naturally occurring isotopes. One has an abundance of 37.4% and an isotopic mass of 184.953 amu, and the other has an abundance of 62.6% and a mass of 186.956 amu. What is the atomic weight of the element?

A) 185.702 amu
B) 185.954 amu
C) 186.207 amu
D) 186.956 amu


Question 240

Which of the following have their valence electrons in the same shell?

A) Rb, Sb, I
B) Ga, Sn, Bi
C) As, Sb, Bi
D) Ar, Kr, Br


Question 241

Calculate the molality of a solution with 53 grams of KCl in 2000 mL of water. (density of water is 1.00 g/mL).

A) 0.027
B) 0.27
C) 0.00071
D) 0.0027


Question 242

Which compound contains hydrogen atoms that form two types of bonds?

A) B2H6
B) C2H2
C) C6H6
D) N2H4


Question 243

Calculate the kinetic energy of a 150-g baseball moving at a speed of 38. m/s (85 mph).

A) 5.7 J
B) 1.1 × 102 J
C) 5.7 × 103 J
D) 1.1 × 105 J


Question 244

How many moles are in 1.50 g of ethylamine, CH3CH2NH2?

A) 0.0222 mol
B) 0.0332 mol
C) 90.16 mol
D) 45.08 mol


Question 245

At a certain temperature, bromine and nitric oxide react to form nitrosyl bromide:

Br2(g) + 2 NO(g) ←→ 2 NOBr(g).

When initial amounts of Br2, NO, and NOBr are mixed, the concentration of NOBr increases. Which statement below is true?

A) Kc < Q
B) Kc > Q
C) Kc = Q
### Question 246

A motorcycle emits 9.5 g of carbon monoxide per kilometer driven. How many pounds of carbon monoxide does the motorcycle generate over 5.0 years if the motorcycle is driven 15,000 miles per year?

- A) $8.9 \times 10^1$ lb CO
- B) $9.8 \times 10^2$ lb CO
- C) $2.5 \times 10^3$ lb CO
- D) $2.3 \times 10^4$ lb CO


### Question 247

The boiling point of a solution containing a nonvolatile solute will be ________ than the boiling point of the pure solvent, whereas the boiling point of a solution of two volatile liquids will be ________ than the boiling point of the more volatile liquid and ________ than the boiling point of the less volatile liquid.


### Question 248

A diode has a negative bias when the p-type semiconductor is attached to the ________ (negative, positive) battery terminal, which ________ (inhibits, permits) electron flow.


### Question 249

The brown color associated with photochemical smog is due to NO2(g), which is involved in an equilibrium with N2O4(g) in the atmosphere.

$$2 \text{ NO}_2(g) \rightleftharpoons \text{ N}_2\text{O}_4(g)$$

Predict the signs of the enthalpy and entropy change for the forward reaction.

- A) The enthalpy change is negative and the entropy change is negative.
- B) The enthalpy change is negative and the entropy change is positive.
- C) The enthalpy change is positive and the entropy change is negative.
- D) The enthalpy change is positive and the entropy change is positive.


### Question 250

Arrange the following 0.10 M aqueous solutions in order of increasing pH:

- NaOH, HBr, NaCH3CO2, KBr, NH4Br.

A) HBr, KBr, NH4Br, NaCH3CO2, NaOH
B) NaOH, NaCH3CO2, NH4Br, KBr, HBr
C) NaOH, NaCH3CO2, KBr, NH4Br, HBr
D) HBr, NH4Br, KBr, NaCH3CO2, NaOH


### Question 251

How many protons (p) and neutrons (n) are in an atom of Ra?

- A) 88 p, 138 n
- B) 88 p, 226 n
- C) 138 p, 88 n
- D) 226 p, 88 n


### Question 252

A baseball with a mass of 150 g is moving at a velocity of 40 m/s (90 mph). If the uncertainty in the velocity is 0.1 m/s, the uncertainty in position

A) may be zero.
B) must be less than or equal to 4 × 10^{-33} m.
C) must be 4 × 10^{-33} m.
D) must be greater than or equal to 4 × 10^{-33} m.


### Question 253
Which is an amino acid acidic side chain?
A) -CH₃  
B) -CH₂OH  
C) -CH₂CO₂H  
D) -CH₂CH₂CH₂CH₂NH₂

Question 254

Tablets of ascorbic acid, or Vitamin C, C₆H₈O₆, are taken as a dietary supplement. If a typical tablet contains 500 mg, how many atoms of carbon (C) are in a tablet?

Question 255

Photochemists use electromagnetic radiation to initiate chemical reactions, often by providing the energy required to break bonds within a molecule. Lowering which of the following will result in electromagnetic radiation having more energy per photon?
A) amplitude  
B) frequency  
C) intensity  
D) wavelength

Question 256

Elements are classified as metals, nonmetals, or semimetals. At room temperature a certain element exists as a dull yellow solid that is a poor conductor of electricity and is brittle. This element is most likely a ________.

Question 257

The VSEPR model predicts the H—B—H bond angle in BH₃ to be
A) 90°.  
B) 109.5°.  
C) less than 120° but greater than 109.5°.  
D) 120°.

Question 258

What is the mole fraction of oxygen in a gas mixture that is 27% oxygen and 73% nitrogen by volume?
A) 0.24  
B) 0.27  
C) 0.32  
D) 0.37

Question 259

Which is expected to have the largest dispersion forces?
A) C₂H₄  
B) C₈H₁₆  
C) Cl₂  
D) N₂H₄

Question 260

Galvanized steel is steel coated with a layer of
A) Fe₂O₃.  
B) Ag.  
C) Pb.  
D) Zn.

Question 261
Molybdenum has an anomalous electron configuration. Write the electron configuration of Mo using shorthand notation.

A) [Kr] 5s0 4d6
B) [Kr] 5s0 4d0 5p6
C) [Kr] 5s1 4d5
D) [Kr] 5s2 4d4


Question 262

When a liquid is heated at its boiling point, the
A) ionic bonds are broken, allowing sublimation to occur.
B) temperature of the liquid decreases.
C) temperature of the liquid remains the same as long as any liquid is present.
D) temperature of the vapor phase decreases.


Question 263

Organic molecules containing only carbon and hydrogen and having only single bonds are called ________ hydrocarbons, or ________.


Question 264

Which of the following can function as a bidentate ligand?
A) sulfide
B) hydroxide
C) oxalate
D) fluoride


Question 265

Which contains the greatest number of bromide ions?
A) 50 mL of 2.0 M KBr
B) 100 mL of 1.0 M BaBr2
C) 20 mL of 2.5 M FeBr3
D) All contain the same number of chloride ions.


Question 266

Which statement is true concerning the standard states of F2(g) and C12H22O11(aq)?
A) The standard state for F2(g) is the pure gas at 1 atm and for C12H22O11(aq) is the pure solid at 1 atm.
B) The standard state for F2(g) is the pure gas at 1 mol/L and for C12H22O11(aq) is the pure solid at 1 atm.
C) The standard state for F2(g) is the pure gas at 1 atm and for C12H22O11(aq) is the solution at a concentration of 1 mol/L.
D) The standard state for F2(g) is the pure gas at 1 mol/L and for C12H22O11(aq) is the solution at a concentration of 1 mol/L.


Question 267

Under which of the following conditions would one mole of Kr have the highest entropy, S?
A) 47°C and 45 L
B) 157°C and 45 L
C) 47°C and 55 L
D) 157°C and 55 L


Question 268

Which is classified as an amphoteric binary oxide?
A) B2O3
B) CO2
C) Ga2O3
D) Rb2O

Question 269

What is the selenide ion concentration \([\text{Se}^2-]\) for a 0.400 M \(\text{H}_2\text{Se}\) solution that has the stepwise dissociation constants of \(\text{Ka}_1 = 1.3 \times 10^{-4}\) and \(\text{Ka}_2 = 1.0 \times 10^{-11}\)?

A) 7.2 × 10^{-3} M  
B) 1.3 × 10^{-4} M  
C) 5.2 × 10^{-5} M  
D) 1.0 × 10^{-11} M  

Question 270

In which of the following sets do all species have the same number of electrons?

A) I-, Xe, Cs2+  
B) C, N3-, O2-  
C) Mg2+, Ca2+, Ba2+  
D) S, S2-, S2+  

Question 271

Identify the following solutions as acidic, basic, or inert.

\(\text{NaNO}_2\) _______  
\(\text{NaNO}_3\) _______  
\(\text{C}_5\text{H}_5\text{NHClO}_4\) _______  

Question 272

Commercially oxygen is usually obtained by

A) decomposition of mercury(II) oxide.  
B) decomposition of potassium chlorate.  
C) electrolytic decomposition of water.  
D) fractional distillation of air.  

Question 273

A crude type of disappearing ink is based on the following endothermic equilibrium:

\[
\text{[Co(H}_2\text{O})_6\text{]Cl}_2 \text{ (aq)} \rightleftharpoons \text{[CoCl}_2\text{(H}_2\text{O})_4\text{]} \text{ (aq)} + 2 \text{H}_2\text{O (l)}
\]

(colorless) 
(blue)

If the reactant solution is used to write on a piece of paper and the paper is allowed to partially dry, what can be done to bring out the colored handwriting?

A) add water  
B) decrease the volume  
C) put the paper in a freezer  
D) put the paper in an oven  

Question 274

The element antimony has an atomic weight of 121.757 amu and only two naturally-occurring isotopes. One isotope has an abundance of 57.3% and an isotopic mass of 120.904 amu. Based on these data, what is the mass of the other isotope?

A) 121.757 amu  
B) 122.393 amu  
C) 122.610 amu  
D) 122.902 amu  

Question 275

The electronegativity is 2.1 for H and 1.9 for Sb. Based on these electronegativities \(\text{SbH}_3\) would be expected to

A) be ionic and contain \(\text{H}^-\) ions.  
B) be ionic and contain \(\text{H}^+\) ions.  
C) have polar covalent bonds with a partial negative charges on the H atoms.  
D) have polar covalent bonds with a partial positive charges on the H atoms.
Question 276

A 1.40 M solution of CaCl₂ in water has a density of 1.11 g/mL. What is the molality?
A) 1.90 m CaCl₂  
B) 2.30 m CaCl₂  
C) 1.47 m CaCl₂  
D) 1.44 m CaCl₂

Question 277

Based on the activity series, which metal dissolves in hydrochloric acid to produce hydrogen gas, but does not react with steam or liquid water?
A) Mg  
B) Hg  
C) Sn  
D) K

Question 278

The standard cell potential for the following galvanic cell is 1.21 V.
Al(s)|Al³⁺(aq)||Fe²⁺(aq)|Fe(s)
When [Al³⁺] = 0.10 M and [Fe²⁺] = 0.10 M, will the cell potential at 25°C be less than, the same as, or greater than 1.21 V?

Question 279

Identify the set of Lewis acids.
A) BH₃, BF₃, Cu²⁺, CO₂  
B) Cl⁻, OH⁻, NBr₃, H₂O  
C) H₃PO₄, H₂PO₄⁻, HPO₄²⁻, PO₄³⁻  
D) CCl₃⁻, NH₂⁻, CN⁻, F⁻

Question 280

An international group of zookeepers with successful breeding programs made the following animal exchanges last year. Using the same bartering system, how many oryxes can a zoo obtain in exchange for 15 flamingos?
3 oryxes = 1 tiger 2 flamingos = 1 anteater  
1 camel = 6 anteaters 5 lemurs = 1 rhino  
1 rhino = 4 monkeys 3 lemurs = 1 camel  
3 monkeys = 1 tiger 1 rhino = 4 oryxes
A) one oryx  
B) three oryxes  
C) four oryxes  
D) five oryxes

Question 281

Specific gravity of a liquid is often defined as the ratio of the density of a substance to the density of water. If the specific gravity of X relative to water is 0.800 and the specific gravity of Y relative to water is 1.50, which of the following statements is false?
A) If X is a liquid, Y will float on X.  
B) If X is a solid, X will float in water.  
C) If Y is a liquid, water will float on Y.  
D) If Y is a liquid, X will float in Y.

Question 282

Which compound will have the largest dipole moment?
A) cis-1, 2-dichloroethylene  
B) trans-1, 2-dichloroethylene  
C) tetrabromoethylene  
D) tetrachloroethylene
Question 283
Which compound is a saturated hydrocarbon?
A) benzene  
B) cyclohexene  
C) 2-methylpentane  
D) propylene

Question 284
Which of the following does not affect the rate of a bimolecular reaction?
A) concentrations of reactants  
B) presence of a catalyst  
C) temperature  
D) All of these affect the rate.

Question 285
What is the entropy of 50 molecules in a system of 1000 boxes?

Question 286
Vanadium in the +5 oxidation is most often found as compounds of
A) bromides.  
B) chlorides.  
C) oxides.  
D) phosphides.

Question 287
Which of the following statements best describes the difference between vegetable oils and animal fats?
A) Animals fats have more carboxylic acid groups.  
B) Vegetable oils have carbon chains with more unsaturated bonds.  
C) Vegetable oils have more alcohol groups.  
D) Animal fats have more unsaturated bonds.

Question 288
What is the molarity of a solution prepared by diluting 25 mL of 2.0 M HCl with enough water to make 250 mL of solution?

Question 289
A mass of mercury occupies 0.650 L. What volume would an equal mass of ethanol occupy? The density of mercury is 0.789 g/mL.
A) 0.0378 L  
B) 0.650 L  
C) 11.2 L  
D) 5.00 L

Question 290
Which one of the following statements about balanced equations is true? A reaction is balanced by
A) changing the charge on an ion.  
B) changing the formula of the molecule.  
C) multiplying by suitable coefficients.  
D) rearranging atoms in a molecule.
Question 291

An average person receives 40 mrem of radiation from medical procedures annually. If a dose as low as 25 rem can lead to a decrease in white blood cell count, what is the maximum number of medical procedures that involve radiation allowable before white blood cell count decrease occurs?


Question 292

What is the chemical formula for strontium hydroxide?

A) SrH2
B) SrOH
C) SrOH2
D) Sr(OH)2


Question 293

Which of the following best describes CO2? It has a molecular geometry that is

A) linear molecular shape with no lone pairs on the I atom.
B) linear molecular shape with lone pairs on the I atom.
C) non-linear molecular shape with no lone pairs on the I atom.
D) non-linear molecular shape with lone pairs on the I atom.


Question 294

What type of bonding is found in the compound NH3?

A) covalent bonding
B) hydrogen bonding
C) ionic bonding
D) metallic bonding


Question 295

A balloon filled with helium gas at 20°C occupies 3.91 L at 1.00 atm. The balloon is immersed in liquid nitrogen at -196°C, raising the pressure to 5.20 atm. What is the volume of the balloon in the liquid nitrogen?

A) 0.20 L
B) 2.6 L
C) 5.3 L
D) 77 L


Question 296

What is the identity of substance X if 0.380 mol of X weighs 17.5 g?

A) NO2
B) NO3
C) N2O
D) N2O4


Question 297

The normal boiling point for H Br is higher than the normal boiling point for H Cl. This can be explained by

A) larger dipole-dipole forces for H Br.
B) larger dispersion forces for H Br.
C) larger hydrogen-bond forces for H Br.
D) larger dipole-dipole forces, larger dispersion forces, and larger hydrogen-bond forces for H Br.


Question 298

At a certain temperature, Kc equals $1.4 \times 102$ for the reaction:

$$2 \text{ CO(g)} + \text{ O}_2(\text{g}) \rightleftharpoons 2 \text{ CO}_2(\text{g}).$$

If a 5.00-L flask contains 0.400 mol of CO2 and 0.100 mol of O2 at equilibrium, how many moles of CO are also present in the flask?
Question 299

How many subshells are there in the shell with n = 6?
A) 5
B) 6
C) 15
D) 36

Question 300

What is the pH of the resulting solution if 40.00 mL of 0.10 M acetic acid is added to 10.00 mL of 0.10 M NaOH? Assume that the volumes of the solutions are additive. Ka = 1.8 × 10^{-5} for CH3CO2H.
A) 9.73
B) 8.78
C) 5.22
D) 4.27

Question 301

Which of the following elements is not a solid at room temperature?
A) Zn
B) Hg
C) N
D) C

Question 302

Which unit of radiation describes the amount of energy absorbed by a kilogram of tissue exposed to a radiation source?
A) becquerel
B) curie
C) rad
D) rem

Question 303

How many atoms are in one body-centered cubic unit cell of a metal?
A) 1
B) 2
C) 3
D) 4

Question 304

A radioisotope which is neutron poor and very heavy is most likely to decay by
A) alpha emission, electron capture, or positron emission.
B) only alpha emission.
C) only electron capture.
D) only positron emission.

Question 305

What are the F—Se—F bond angles in SeF6?
A) 60°
B) 90°
C) 109.5°
| Question 306 | According to the third law of thermodynamics,  
A) energy is conserved in any transformation of matter.  
B) the entropy increases for any spontaneous process.  
C) the entropy of a perfectly ordered, crystalline substance is zero at 0 Kelvin.  
D) the entropy of the universe increases for any spontaneous process.  
|---|---|
| Question 307 | In order for the reaction HA + HSO3- ←→ A- + H2SO3 to have an equilibrium constant Kc < 1, the Ka of HA must be ________ (greater, less) than the Ka of HSO3-.  
| Question 308 | Which of the following forms a molecular solid?  
A) lithium chloride  
B) water  
C) graphite  
D) gold  
| Question 309 | What percentage of a radioactive substance remains after 6.00 half-lives have elapsed?  
A) 0.781%  
B) 1.56%  
C) 3.12%  
D) 6.25%  
| Question 310 | Which one of the following is expected to be the strongest Lewis acid?  
A) Fe  
B) Fe+  
C) Fe2+  
D) Fe3+  
| Question 311 | Which of the following elements is classified as a semimetal?  
A) gold  
B) astatine  
C) osmium  
D) berkellium  
| Question 312 | Palladium has a face-centered cubic structure and has a density of 12.023 g/cm3. What is its atomic radius?  
A) 388 pm  
B) 151 pm  
C) 220 pm  
D) 245 pm  
| Question 313 | The mixing of different gases by random molecular motion with frequent collisions is called  
A) Dalton’s law.  
|---|---|
B) compressibility.
C) diffusion.
D) effusion.

Question 314
A cake is an example of
A) a compound.
B) an element.
C) mixture.
D) an an anion.

Question 315
What is the Celsius temperature of 100.0 g of chlorine gas in a 4.00-L container at 800 mm Hg?
A) 309°C
B) -236°C
C) 236°C
D) -309°C

Question 316
Using principles discussed in chapters 15 and 19, determine which of the following is the strongest acid.
A) HClO
B) HClO2
C) HClO3
D) HClO4

Question 317
According to the second law of thermodynamics, all reactions proceed spontaneously in the direction that increases the entropy of the
A) surroundings.
B) surroundings x system.
C) system - surroundings.
D) system + surroundings.

Question 318
Which covalent bond is the most polar?
A) Cl—F
B) B—F
C) O—F
D) F—F

Question 319
What is the charge, n, in the ion Si4O10n that is found in talc?
A) 2 -
B) 4 -
C) 8 -
D) 10 -

Question 320
Choose the words that best explain why some metals such as Pt and Au are found naturally as pure elements. Metals with a ______ reduction potential are more likely to form compounds and less likely be found as a pure element.
A) highly positive
B) slightly positive
C) highly negative
D) slightly negative
Question 321
A 0.01 M aqueous solution of which of the following is the most basic?
A) NaClO
B) NaClO2
C) NaClO3
D) NaClO4

Question 322
Why is silicon dioxide added to molten iron in the basic oxygen process?
A) to remove acidic oxides from the molten iron
B) to remove manganese oxide from the molten iron
C) to remove phosphates and carbonates from the molten iron
D) to remove trace amounts of carbon from the molten iron

Question 323
Describe the color changes when sulfur (melting point 113°C, boiling point 445°C) is heated from 25°C to 500°C? It turns from a yellow solid to a
A) dark reddish brown liquid and then boils.
B) reddish brown solid and then into reddish brown liquid and then boils.
C) straw colored liquid which turns dark reddish brown and then it boils.
D) yellow liquid and then it boils.

Question 324
There are three isotopes of oxygen 16O, 17O and 18O. Indicate the number of different types of isotopically substituted diatomic oxygen.
A) 3
B) 5
C) 6
D) 9

Question 325
The SI unit for energy is the ________.

Question 326
The observation that hydrogen and oxygen can react to form two compounds with different chemical and physical properties, one having an O:H mass ratio = 8:1 and the other having an O:H mass ratio = 16:1 is consistent with the law of
A) definite proportions.
B) energy conservation.
C) mass conservation.
D) multiple proportions.

Question 327
Round off 327,504 to three significant figures.
A) 327
B) 328
C) 3.27 x 10^5
D) 3.28 x 10^5

Question 328
What is the molarity of a solution prepared by dissolving 0.80 g of NaOH in enough water to make 250 mL of solution?
Question 329
How many mL of a 0.350 M AlI₃ solution are needed to make 700. mL of a solution that is 0.350 M in I⁻ ion?
A) 500 mL
B) 167 mL
C) 125 mL
D) It is not possible to make a more concentrated solution from a less concentrated solution.

Question 330
An aqueous solution of HCl is named
A) hydrochloric acid.
B) hydrochlorous acid.
C) chloric acid.
D) chlorous acid.

Question 331
Dinitrogen monoxide gas decomposes to form nitrogen gas and oxygen gas. How many grams of nitrogen are formed when 5.54 g of dinitrogen monoxide decomposes?
A) 4.35
B) 17.41
C) 3.53
D) 7.06

Question 332
The ratio of 238U to 206Pb is used to date old mineral samples. Each 1.000 g of 238U that decays eventually produces 0.866 g of 206Pb. If the half-life of 238U is 4.468 × 10⁹ years, what is the age of a mineral that has a 238U/206Pb mass ratio of 2.00?
A) 2.94 × 10⁹ years
B) 3.60 × 10⁹ years
C) 3.87 × 10⁹ years
D) 4.47 × 10⁹ years

Question 333
For a reaction that follows the general rate law, Rate = k[A][B]², what will happen to the rate of reaction if the concentration of A is increased by a factor of 3.00? The rate will
A) decrease by a factor of 1/9.00.
B) decrease by a factor of 1/3.00.
C) increase by a factor of 3.00.
D) increase by a factor of 9.00.

Question 334
Calculate the hydronium ion concentration in an aqueous solution that contains 2.50 × 10⁻⁴ M in hydroxide ion.
A) 4.00 × 10⁻⁹ M
B) 4.00 × 10⁻¹⁰ M
C) 4.00 × 10⁻¹¹ M
D) 5.00 × 10⁻¹¹ M

Question 335
Chlorine has two common isotopes, chlorine-35 and chlorine-37, and an atomic mass of 35.45 amu. The natural abundance of chlorine-35 is ________ (greater than, less than, the same as) the natural abundance of chlorine-37.

Question 336
The binding energy for lithium-7 nuclei is 3.79 × 10₁² J/mol. The binding energy per nucleon for lithium-7 nuclei is ________ MeV/nucleon.
### Question 337

What is the pH of a 0.10 M H₂Se solution that has the stepwise dissociation constants $K_{a1} = 1.3 \times 10^{-4}$ and $K_{a2} = 1.0 \times 10^{-11}$?

- **A)** 2.44
- **B)** 3.89
- **C)** 4.89
- **D)** 5.50

**Answer:** https://biology-forums.com/index.php?topic=290701

### Question 338

At the equilibrium bond length

- A) the attractive forces holding the atoms together are less than the repulsive forces.
- B) the potential energy is a maximum.
- C) the potential energy is a minimum.
- D) the repulsive forces are greater than the attractive forces holding the atoms together.

**Answer:** https://biology-forums.com/index.php?topic=289583

### Question 339

Which has the most negative standard oxidation potential?

- **A)** Sc
- **B)** V
- **C)** Cu
- **D)** Zn

**Answer:** https://biology-forums.com/index.php?topic=291530

### Question 340

Diethyl ether has the molecular formula C₄H₁₀O. Which ball and stick model shown above represents diethyl ether? [gray spheres = C, black spheres = O, unshaded spheres = H]

- A) model a)
- B) model b)
- C) model c)
- D) model d)

**Answer:** https://biology-forums.com/index.php?topic=289125

### Question 341

Of the following, which element has the highest first ionization energy?

- **A)** iodine
- **B)** bromine
- **C)** fluorine
- **D)** chlorine

**Answer:** https://biology-forums.com/index.php?topic=289485

### Question 342

Which of the following is not explained by Dalton’s atomic theory?

- A) conservation of mass during a chemical reaction
- B) the existence of more than one isotope of an element
- C) the law of definite proportions
- D) the law of multiple proportions

**Answer:** https://biology-forums.com/index.php?topic=288885

### Question 343

What is the strongest acid among the following?

- **A)** HF
- **B)** HCl
- **C)** HBr
- **D)** HI

**Answer:** https://biology-forums.com/index.php?topic=290644
Question 344

A buffer solution is prepared by dissolving 0.200 mol of NaH₂PO₄ and 0.100 mol of NaOH in enough water to make 1.00 L of solution. What is the pH of the H₂PO₄⁻/HPO₄²⁻ buffer if the $K_a = 6.2 \times 10^{-8}$?

A) 6.91
B) 7.21
C) 7.51
D) 7.71


Question 345

Which of the following has the greatest mass?

A) $6.0 \times 10^{23}$ atoms of O
B) $3.0 \times 10^{23}$ molecules of O₂
C) $2.0 \times 10^{23}$ molecules of O₃
D) All have the same mass.


Question 346

Which of the following two atoms are isotopes?

A) Ar and Ca
B) C and C
C) Cl and Br
D) Mg and C


Question 347

How many distinct isomers can be drawn for a molecule of C₄H₈?

A) 1
B) 2
C) 3
D) 4


Question 348

Which is expected to have the largest carbon-oxygen bond dissociation energy?

A) CO
B) CO₂
C) H₂CO₃
D) HCOOH


Question 349

When a substance decays by alpha radiation, the mass number of the nucleus _______ and the atomic number _______.

A) increases by 4, increases by 2
B) reduces by 4, reduces by 2
C) increases by 1, increases by 4
D) reduces by 3, reduces by 1


Question 350

What is the geometric structure of P₄ molecules?

A) linear
B) rectangular
C) square planar
D) tetrahedral


Question 351
Question 352

Three atoms have the following properties.
Proton Neutron Electron
Atom X 119 119 119
Atom Y 119 118 119
Atom Z 118 118 119
The elements Y and Z are best described as
A) isotopes.
B) cations.
C) different elements.
D) anions.

Question 353

The nutritional calorie (abbreviated Cal) is equal to
A) 1 mcal.
B) 4.184 J.
C) 4.184 Mcal.
D) 1 kcal.

Question 354

The hydrogen ion, H+, is also referred to as a ________, and a hydrated hydrogen ion, H3O+, is called a ________ ion.

Question 355

A preliminary explanation of the results of many experiments that can be used to make predictions and suggest further experimentations is a
________.

Question 356

The entropy of water at 30°C is ________ than the entropy of water at 37°C.

Question 357

The nutritionist unit Calorie is equal to ________ calories.

Question 358

Dinitrogen monoxide gas decomposes to form nitrogen gas and oxygen gas. How many grams of nitrogen are formed when 30.00 g of dinitrogen monoxide decomposes?
A) 9.545 g
B) 19.09 g
C) 30.00 g
D) 60.00 g

Question 359

Ethylenediaminetetraacetate ion (EDTA4-) is commonly referred to as a ________ ligand.
A) monodentate
B) tridentate
C) pentadentate
D) hexadentate
Question 360

The binding energy is defined as
A) the amount of energy absorbed when electrons are added to an ion.
B) the amount of energy absorbed when protons and neutrons form a nucleus.
C) the amount of energy released when electrons are removed from the atom.
D) the amount of energy required to break apart a nucleus into individual protons and neutrons.

Question 361

What is the total pressure in a 10.0 L flask which contains 0.200 mol of H2(g) and 0.215 mol of N2(g) at 20.0°C?
A) 0.306 atm
B) 0.681 atm
C) 0.693 atm
D) 0.998 atm

Question 362

The equilibrium equation is also known as the law of
A) coefficients.
B) constant concentration.
C) dynamic equilibrium.
D) mass action.

Question 363

Which has been found to be a three dimensional superconductor that conducts equally in all directions?
A) C (diamond)
B) C (graphite)
C) K3C60
D) YBa2Cu3O7

Question 364

Which of the following changes in reaction conditions will not alter the composition of a homogeneous equilibrium mixture of gases in a reaction having unequal moles of gaseous products and reactants?
A) addition of a catalyst
B) addition of reactants
C) decreasing the temperature
D) increasing the volume

Question 365

The factor 10^-2 corresponds to which prefix?
A) deka
B) deci
C) centi
D) milli

Question 366

Metallic character for the main group elements generally
A) increases from left to right across a period and increases down a group.
B) increases from left to right across a period and decreases down a group.
C) decreases from left to right across a period and increases down a group.
D) decreases from left to right across a period and decreases down a group.

Question 367
Which statement below regarding the half-life of a zeroth-order reaction is true?

A) Each half-life is half as long as the preceding half-life.
B) Each half-life is twice as long as the preceding half-life.
C) Each half-life is four times as long as the preceding half-life.
D) The half-life remains unchanged throughout the course of the reaction.


**Question 368**

The four lines observed in the visible emission spectrum of hydrogen tell us that

A) The hydrogen molecules they came from have the formula H4.
B) We could observe more lines if we had a stronger prism.
C) There are four electrons in an excited hydrogen atom.
D) Only certain energies are allowed for the electron in a hydrogen atom.


**Question 369**

Which of the following compounds is an Arrhenius base?

A) CH₃OH
B) CH₃CO₂H
C) HOCl
D) LiOH


**Question 370**

Which of the following statements is true for a supersaturated solution?

A) The solute in the solution is at equilibrium with undissolved solute.
B) The solution contains more than the equilibrium amount of solute.
C) The solution is stable and the solute will not precipitate.
D) A supersaturated solution is more than 50% solute by mass.


**Question 371**

Which of the following numbers has the greatest number of significant figures?

A) 0.5070
B) 0.201
C) 234000
D) 3.69 × 10²⁴


**Question 372**

What is the hydronium ion concentration of an acid rain sample that has a pH of 3.15?

A) 1.41 × 10⁻¹¹ M
B) 7.08 × 10⁻⁴ M
C) 3.15 M
D) 10.85 M


**Question 373**

The oxidation number of the oxygen atoms in CaO₂ is ________.


**Question 374**

Molality is defined as moles of solute per

A) kilogram of solvent.
B) liter of solvent.
C) mole of solvent.
D) total moles present.

Question 375
How would one classify copper mixed with tin?
A) conductor
B) n-type semiconductor
C) p-type semiconductor
D) insulator

Question 376
The nuclear decay process that involves the particle having the greatest mass is ________ emission.
A) alpha
B) beta
C) gamma
D) positron

Question 377
Of H2CO and CO and CO2, the compound having the strongest C—O bond is ________.

Question 378
Identify the smallest item.
A) the width of human hair
B) a white blood cell
C) a virus
D) a sugar

Question 379
When 200. mL of 1.50 × 10⁻⁴ M hydrochloric acid is added to 100. mL of 1.75 × 10⁻⁴ M Mg(OH)₂, the resulting solution will be
A) acidic.
B) basic.
C) neutral.
D) It is impossible to tell from the information given.

Question 380
A buffer prepared by mixing equal moles of an acid having Ka = 4.5 × 10⁻⁴ and a salt of its conjugate base has a pH = ________.

Question 381
In which case should CO₂(g) be more soluble in water?
A) The total pressure is 5 atm and the partial pressure of CO₂ is 0.4 atm.
B) The total pressure is 3 atm and the partial pressure of CO₂ is 0.6 atm.
C) The total pressure is 1 atm and the partial pressure of CO₂ is 0.3 atm.
D) The total pressure is 1 atm and the partial pressure of CO₂ is 0.5 atm.

Question 382
Which of the hydrogen halide acids is used to etch glass?
A) HF
B) HCl
C) HBr
D) HI

Question 383
The normal boiling point of pure benzene is found to be 80.10°C. What is the approximate molecular weight of a nonionizing substance if a solution of
3.55 g of the substance dissolved in 100 g of benzene has a normal boiling point of 80.19°C? Kb = 5.12°C/m for benzene, C6H6.

A) 20 amu
B) 500 amu
C) 2000 amu
D) 20,000 amu


**Question 384**

Interhalogen compounds can be produced by reacting two different halogens together. Which one of the following compounds does not exist?

A) ClF
B) ClBr
C) ClBr₃
D) IF₃


**Question 385**

The number of moles of ions in 35.0 mL of 4.00 M Na₂SO₄ is ________ moles.


**Question 386**

Which of the following transition elements (Cr, Co, Ni, and Cu) have positive oxidation potentials?

A) Cr
B) Cu
C) Cr, Cu, and Ni
D) Cr, Co, and Ni


**Question 387**

Which compound below could have a zero dipole moment?

A) CCl₂F₂ (tetrahedral)
B) CuCl₂F₂ (tetrahedral)
C) PtCl₂F₂ (square planar)
D) SCl₂F₂ (see-saw)


**Question 388**

Using only the elements Mg, Cl, and/or P, give the formula of a compound having largely polar covalent bonds.


**Question 389**

Which of the following indicates the most basic solution?

A) [H⁺] = 1 x 10⁻¹⁰ M
B) pOH = 6.7
C) [OH⁻] = 7 x 10⁻⁵ M
D) pH = 4.2


**Question 390**

Which element has the ground-state electron configuration [Xe]6s²5f⁴?

A) Pr
B) Nd
C) Pm
D) Sm


**Question 391**

Aluminum is an example of

A) a compound.
B) an element.
Question 392

The critical temperature of a substance is the
A) highest temperature at which the liquid phase can exist in equilibrium with the gas phase.
B) temperature above which the compound decomposes.
C) temperature at which all three phases can exist in equilibrium.
D) temperature at which sublimation occurs.

Question 393

What are the three most abundant elements in the Earth's crust?
A) H, O, Al
B) O, Al, Si
C) O, Si, Ca
D) Al, C, Fe

Question 394

Which one of the following elements can form more than four chemical bonds with other elements?
A) N
B) O
C) F
D) S

Question 395

Which one of the following salts, when dissolved in water, produces the solution with a pH closest to 7.00?
A) NH4Cl
B) BaO
C) NaHSO4
D) RbI

Question 396

When a narrow diameter glass tube is inserted into a body of water, water rises in the tube and its surface inside is concave upwards. Which statement, concerning the strength of the intermolecular forces between glass and water molecules compared to those between water molecules, is accurate?
A) The forces of attraction between the glass and water are weaker than those in water.
B) The forces of attraction between the glass and water are stronger than those in water.
C) The forces of attraction between the glass and water are the same as those in water.
D) Intermolecular forces are irrelevant to this situation.

Question 397

The nuclear transformation potassium-40 argon-40 + ? is classified as
A) alpha emission.
B) beta emission.
C) electron capture.
D) positron emission.

Question 398

According to the Heisenberg uncertainty principle,
A) the position of a particle cannot be measured precisely.
B) the momentum of a particle cannot be measured precisely.
C) neither the position nor the momentum of a particle can be measured precisely.
D) the position and momentum of a particle can be measured precisely, but not at the same time.
### Question 399
What is the mass of one atom of the element hydrogen?

A) 2.0 g  
B) 1.0 g  
C) $3.4 \times 10^{-24}$ g  
D) $1.7 \times 10^{-24}$ g

**Answer:** [Link](https://biology-forums.com/index.php?topic=288908)

### Question 400
The intensity of a beam of light is related to its

A) frequency.  
B) relative number of photons.  
C) speed.  
D) wavelength.

**Answer:** [Link](https://biology-forums.com/index.php?topic=289363)

### Question 401
Tin exists in two forms: gray tin and white tin. The electrical conductivity of gray tin increases with an increase in temperature, whereas the electrical conductivity of white tin decreases with an increase in temperature. The form of tin that is a semiconductor is ________ tin.

**Answer:** [Link](https://biology-forums.com/index.php?topic=291693)

### Question 402
Elements with ________ atomic mass are best possible candidates for a fusion reaction.

A) very low  
B) moderate  
C) moderate to heavy  
D) very heavy

**Answer:** [Link](https://biology-forums.com/index.php?topic=291379)

### Question 403
Which one of the following contains 38.7% carbon by mass?

A) C2H2  
B) CH4  
C) CH3NH2  
D) CO2

**Answer:** [Link](https://biology-forums.com/index.php?topic=289110)

### Question 404
A certain metal can exist in two different cubic cells, body-centered and face-centered cubic. Which unit cell will have the greater density?

**Answer:** [Link](https://biology-forums.com/index.php?topic=290181)

### Question 405
Name the product obtained from the addition of chlorine to 3-methyl-1-octene.

A) 1, 1-dichlorooctane  
B) 1, 2-dichloro-3-methylbutane  
C) 1, 2-dichlorononane  
D) trans-1, 2-dichlorooctene

**Answer:** [Link](https://biology-forums.com/index.php?topic=292010)

### Question 406
If the melting point of titanium metal is 1672°C, what is its melting point in Kelvin?

A) 897 K  
B) 1399 K  
C) 1945 K  
D) 3042 K

**Answer:** [Link](https://biology-forums.com/index.php?topic=288748)
Question 407
What is the ground-state electron configuration for Cr in Cr2O72-?
A) [Ar] 4s1 3d5
B) [Ar] 4s2 3d6
C) [Ar] 3d4
D) [Ar] 3d0

Question 408
Which of the following underlined items is not an intensive property?
A) the amount of gold.
B) the color of copper hydroxide
C) the density of argon
D) the melting point of iron metal

Question 409
Which one of the following compounds behaves as an acid when dissolved in water?
A) SrO
B) C3H8
C) HCl
D) LiO

Question 410
What is the pH of a buffer system prepared by dissolving 10.70 grams of NH4Cl and 30.00 mL of 12 M NH3 in enough water to make 1.000 L of solution? Kb = 1.80 x 10^-5 for NH3.
A) 9.00
B) 9.26
C) 9.51
D) 11.32

Question 411
Which of the following molecules will readily form hydrogen bonds with H2O?
A) H2
B) C3H8
C) CH4
D) CH3OH

Question 412
Which of the three laws of thermodynamics states the criterion for spontaneity?
A) the first law of thermodynamics
B) the second law of thermodynamics
C) the third law of thermodynamics
D) both the second and third laws of thermodynamics

Question 413
Which of the following is not a use of aluminum?
A) soda cans
B) cooking pots
C) cooking utensils
D) plastic bottles

Question 414
What structural features appear necessary for superconductivity in the 1-2-3 YBa2Cu3O7 superconductor?
A) high metallic character
B) infinite extended layers of Cu and O atoms and a fractional oxidation state for Cu
C) presence of an inner transition element
D) All of these are necessary.

Question 415

The average mass of an oxygen atom is 5.3 × 10^-26 kg. Calculate the kinetic energy of a mole of oxygen atoms, all moving at a speed of 400 m/s (1000 mph).
A) 8.2 × 10^-21 J
B) 2600 J
C) 5200 J
D) 13,000 J

Question 416

What is the mole fraction of I2 in a solution made by dissolving 139 g of I2 in 245 g of hexane, C6H14?
A) 0.161
B) 0.193
C) 0.278
D) 0.385

Question 417

What is the freezing point of a solution of 8.00 g MgCl2 in 100 g of water? Kf for water is 1.86°C/m for water.
A) 1.56°C
B) -1.56°C
C) 4.69°C
D) -4.69°C

Question 418

If the mass of one neutron is 1.00866 amu, the mass of one proton is 1.00728 amu, and the mass of 12C nucleus is 11.99671 amu, calculate the binding energy for the 12C nucleus.
A) 8.90 × 10^9 kJ/mol
B) 8.90 × 10^12 kJ/mol
C) 1.10 × 10^15 kJ/mol
D) 1.10 × 10^18 kJ/mol

Question 419

The oxidation number of chromium in Ag2Cr2O7 is ________.

Question 420

Which of the following is an example of a qualitative measurement?
A) blue crystal
B) 10 g of salt
C) 2 moles of carbon atoms
D) 12 dl of water

Question 421

What is the element symbol for an atom that has 33 protons and 41 neutrons?
A) As
B) Nb
C) O
D) W
Question 422

A greenhouse gas is a gas that can experience a change in dipole moment. Which of the following can be greenhouse gases?
A) O2
B) H2
C) N2
D) CH3F

Question 423

Which ionic compound would be expected to have the highest lattice energy?
A) Li2O
B) Na2O2
C) KO2
D) RbO2

Question 424

In which will the O—O bond be made stronger by removing an electron?
A) only O2
B) only O2-
C) only O22-
D) all of these

Question 425

Which one of the following metals is expected to have the highest melting point?
A) Au
B) Fe
C) Hg
D) Zn

Question 426

A nanoparticle that exhibits a yellow color is (larger/smaller) ________ than a nanoparticle that exhibits a red color.

Question 427

How many electrons are in the ion, S2-?
A) 14
B) 18
C) 30
D) 34

Question 428

Which molecule contains the most polar bonds?
A) CF4
B) TeO2
C) NO-
D) CCl4

Question 429

The alkane, 3-ethyl-3-methylhexane contains ________ carbon atoms and ________ hydrogen atoms.

Question 430

Consider the reaction
HCO₃⁻ (aq) + H₂O (l) ⇌ CO₃²⁻ (aq) + H₃O⁺ (aq)

The Keq for this reaction is 5.6 × 10⁻¹¹. Describe what will happen to the reaction if the concentration of each reactant is

[HCO₃⁻] = 5.6 × 10⁻¹¹
[H₃O⁺] = 1.2 × 10⁻¹¹
[CO₃²⁻] = 5.6 × 10⁻¹¹

A) Reaction will shift right, concentration of products will increase.
B) Reaction will shift left, concentration of reactants will increase.
C) Reaction will not change, it is at equilibrium.
D) Not enough information to determine the answer.


Question 431

A solution with a hydroxide ion concentration of 4.15 × 10⁻⁷ M is ________ and has a hydrogen ion concentration of ________.
A) acidic, 2.41 × 10⁻⁷ M
B) acidic, 2.41 × 10⁻⁸ M
C) basic, 2.41 × 10⁻⁷ M
D) basic, 2.41 × 10⁻⁸ M


Question 432

Which law does the equation, \( k \) represent?
A) Avogadro’s law
B) Boyle’s law
C) Charles’ law
D) Graham’s law


Question 433

Which of the following is not true?
A) The sp³ hybrid orbitals are degenerate.
B) An sp³ hybrid orbital may hold a lone pair of electrons.
C) An sp³ hybrid orbital may form a sigma bond by overlap with an orbital on another atom.
D) An sp³ hybrid orbital may form a pi bond by overlap with an orbital on another atom.


Question 434

Molecules of a liquid can pass into the vapor phase only if the
A) liquid has little surface tension.
B) molecules have sufficient kinetic energy to overcome the intermolecular forces in the liquid.
C) temperature of the liquid is near its boiling point.
D) vapor pressure of the liquid is high.


Question 435

Phosphorus pentachloride decomposes to phosphorus trichloride at high temperatures according to the reaction:

\[
\text{PCl}_5(g) \rightleftharpoons \text{PCl}_3(g) + \text{Cl}_2(g)
\]

At 250°C, 0.250 M PCl₅ is added to a flask. If Kc = 1.80, what are the equilibrium concentrations of each gas?
A) [PCl₅] = 0.0280 M, [PCl₃] = 0.222 M, [Cl₂] = 0.222 M
B) [PCl₅] = 1.25 M, [PCl₃] = 0.474 M, [Cl₂] = 0.474 M
C) [PCl₅] = 1.80 M, [PCl₃] = 1.80 M, [Cl₂] = 1.80 M
D) [PCl₅] = 2.27 M, [PCl₃] = 2.02 M, [Cl₂] = 2.02 M


Question 436

Arrange the following in order of increasing boiling point.

CH₃CH₂OH, CH₃CH₂CH₂CH₃, H₃C-O-CH₂CH₃, CH₃CH₂NH₂

A) IV < III < II < I
B) II < III < IV < I
C) I < IV < III < II
D) II < III < I < IV

Question 437

Which change in the system will drive equilibrium to the left in the reaction below?
N2O5(g) <-- --> NO2(g) + NO3(g)
A) decrease the amount of NO3
B) increase the amount of N2O5
C) decrease the volume
D) increase the volume

Question 438

Calculate the kinetic energy of a 150-g baseball moving at a speed of 40. m/s (89 mph).
A) 6.0 J
B) 1.2 × 102 J
C) 6.0 × 103 J
D) 1.2 × 105 J

Question 439

Which group 6A element is naturally radioactive?
A) S
B) U
C) Dy
D) Po

Question 440

What is the pH of the solution formed when 50 mL of 0.250 M NaOH is added to 50 mL of 0.120 M HCl?

Question 441

Phosphorus pentachloride decomposes to phosphorus trichloride and chlorine gas at elevated temperatures by the following reaction:
PCl5(g) <-- --> PCl3(g) + Cl2(g). If Kc = 1.8 at 250°C.
What is the value of Kp at the same temperature?
A) 4.2 × 10-2
B) 8.8 × 10-2
C) 65
D) 77

Question 442

Assume that the vapor at point c is condensed and reboiled. What is the vapor composition during reboiling?
A) 100% decane
B) composition at point b
C) composition at point c
D) composition at point e

Question 443

The third-row element having a less negative electron affinity than the elements on either side of it on the periodic table is ________.

Question 444

The B—H—B bond in B2H6 is a three-_______, two-_______ bond.

Question 445

What is the strongest oxidizing agent of the following set: MnCl2, Mn(OH)3, MnO2, KMnO4?
A) MnCl2
Question 446

Which element can accommodate more than eight electrons in its valence shell?

A) N
B) O
C) Ga
D) Ne


Question 447

For a process at constant pressure, 24,800 calories of heat are released. This quantity of heat is equivalent to

A) 9.64 × 10^{-6} J.
B) 5.92 × 10^{3} J.
C) 2.48 × 10^{4} J.
D) 1.04 × 10^{5} J.


Question 448

Biological reactions are catalyzed by

A) sugar.
B) enzymes.
C) fats.
D) water.


Question 449

The temperature scales of Kelvin, Celsius, and Fahrenheit use different ways to define scale. Which of the following correctly ranks the temperature from smallest to largest?

0°C, 0°F, 0K

A) 0K < 0°C < 0°F
B) 0°C < 0K < 0°F
C) 0K < 0°F < 0°C
D) 0°C = 0K = 0°F


Question 450

What is geometry around the carbon atom labeled C3?

A) bent
B) tetrahedral
C) trigonal planar
D) trigonal pyramidal


Question 451

Lead has a radius of 154 pm and crystallizes in a face-centered cubic unit cell. What is the edge length of the unit cell?

A) 35 pm
B) 54 pm
C) 1232 pm
D) 436 pm


Question 452

Group 2A metals tend to be somewhat less reactive than alkali metals, and the order of their reactivity is

A) Ba > Sr > Ca > Mg > Be.
B) Be > Mg > Ca > Sr > Ba.
C) Ca > Mg > Be > Ba > Sr.

### Question 453

D) Sr > Ca > Mg > Be > Ba.

**Answer:** https://biology-forums.com/index.php?topic=291733

### Question 454

A reaction has the rate law \( \text{Rate} = k[\text{NO}]^2[\text{H}_2] \). If the concentration of \( \text{NO} \) is reduced by \( \frac{1}{3} \), the rate of reaction will be ________ (increased, decreased) by ________.

**Answer:** https://biology-forums.com/index.php?topic=290465

### Question 455

How many electrons are in the ion, \( \text{P}_3^- \)?

A) 12  
B) 18  
C) 28  
D) 34  

**Answer:** https://biology-forums.com/index.php?topic=288912

### Question 456

If an equal number of moles of the weak acid HF and the strong base KOH are added to water, is the resulting solution acidic, basic, or neutral?

A) acidic  
B) basic  
C) neutral  
D) There is insufficient information provided to answer this question.

**Answer:** https://biology-forums.com/index.php?topic=290787

### Question 457

At 80.0°C heptane, \( \text{C}_7\text{H}_{16} \), has a vapor pressure of 428 mm Hg and octane, \( \text{C}_8\text{H}_{18} \), has a vapor pressure of 175 mm Hg. What is the vapor pressure of a solution that contains 20.0 g \( \text{C}_7\text{H}_{16} \) and 11.4 g \( \text{C}_8\text{H}_{18} \)?

**Answer:** https://biology-forums.com/index.php?topic=290339

### Question 458

Which of the following is a correct name for an alkyne?

A) 3-methyl-2-octyne  
B) 8-methyl-3-octyne  
C) 2, 2-dimethyl-4-pentyne  
D) 3, 3-dimethyl-1-heptyne  

**Answer:** https://biology-forums.com/index.php?topic=292009

### Question 459

The product of the reaction of lithium with nitrogen is ________.

**Answer:** https://biology-forums.com/index.php?topic=291904

### Question 460

The monosaccharide shown below is a(n)

A) aldohexose.  
B) aldopentose.  
C) ketohexose.  
D) ketopentose.  

**Answer:** https://biology-forums.com/index.php?topic=291950

### Question 461

Which statement below is not true?
A) The cell reactants in a fuel cell are continuously supplied from an external source.
B) A fuel cell is a galvanic cell.
C) Modern fuel cells can be easily regenerated using household current.
D) One of the reactants in a fuel cell is a traditional fuel.


Question 462

Compare the energies of molecular orbitals of homonuclear diatomic molecules with the energies of the atomic orbitals with which they correlate.
A) Both bonding and antibonding molecular orbitals lie lower in energy than the atomic orbitals.
B) Bonding orbitals are lower and antibonding orbitals are higher in energy than the atomic orbitals.
C) Bonding orbitals are higher and antibonding orbitals are lower in energy than the atomic orbitals.
D) Both bonding and antibonding molecular orbitals are higher in energy than the atomic orbitals.


Question 463

Identify the compound that is an ester.
A) propyl propanoate
B) 3-hexanone
C) ethanoic acid
D) dimethyl ether


Question 464

The compound, Cu(I O3 )2, is named
A) copper iodate(II).
B) copper(I) iodate.
C) copper(I) iodate(II).
D) copper(II) iodate.


Question 465

The oxidation state of palladium in K2[PdCl4] is ________.


Question 466

The nitrogen-nitrogen bond in :N N: has a bond order of
A) 3
B) 1
C) 2
D) 6


Question 467

Which of these neutralization reactions has a pH = 7 when equal molar amounts of acid and base are mixed?
A) CH3CO2H(aq) + LiOH(aq) <-- --> H2O(l) + LiCH3CO2(aq)
B) HI(aq) + C5H5N(aq) <-- --> C5H5NHI(aq)
C) HI(aq) + KOH(aq) <-- --> H2O(l) + KI(aq)
D) HNO2(aq) + NH3(aq) <-- --> NH4NO2(aq)


Question 468

The meter is closest in length to the English system unit the ________.


Question 469

For the reaction shown below, N2O4 and NO2 have equilibrium concentrations, [N2O4]eq = 2.160 × 10-4 and [NO2]eq = 1.001 × 10-3, respectively. The equilibrium constant, Kc, for this reaction equals ________.

N2O4(g) <-- --> 2 NO2(g)

Question 470

Which of the following elements is a solid at room temperature?
A) fluorine
B) chlorine
C) bromine
D) iodine

Question 471

Which statement below regarding fatty acids is not correct? Fatty acids
A) are always liquids.
B) are long chain carboxylic acids.
C) are usually unbranched chains.
D) usually have an even number of carbon atoms.

Question 472

The molecule believed to be most responsible for global warming is ________.

Question 473

What is the pH of a solution prepared by mixing 100.00 mL of 0.20 M HCl with 50.00 mL of 0.30 M HCl? Assume that the volumes are additive.
A) 0.25
B) 0.30
C) 0.63
D) 1.70

Question 474

What is the empirical formula for perfluoropropane if the compound contains 81% fluorine and 19% carbon by mass?
A) CF3
B) C2F4
C) C3F8
D) C6F10

Question 475

What is the binding energy (kJ/mol) for an element that has a mass defect of 3.33 × 10^-26 g? Remember that the unit for a joule is kg m^-2 s^-2.
A) 6.02 × 10^3 kJ/mole
B) 6.02 × 10^12 kJ/mole
C) 1.80 × 10^9 kJ/mole
D) 5.41 × 10^14 kJ/mole

Question 476

When 110 mL of 0.12 M NaF is added to 110 mL of 0.12 M HF, relative to the pH of the 0.10 M HF solution the pH of the resulting solution will
A) become 7.
B) decrease.
C) increase.
D) remain the same.

Question 477

The bonds in the polyatomic ion NO3- are classified as ________.

Question 478

Which of the following compounds is an Arrhenius base?
A) C6H12O6  
B) HOCl  
C) H2SO4  
D) CH3NH2  

**Question 479**

How many lone pairs in the correct electron dot structure of O3?
A) 2  
B) 3  
C) 4  
D) 6  

**Question 480**

What is the weight percent of vitamin C in a solution made by dissolving 8.00 g of vitamin C, C6H8O6, in 55.0 g of water?
A) 87.3%  
B) 14.5%  
C) 12.7%  
D) 85.5%  

**Question 481**

The oxidation of sulfur dioxide by oxygen to sulfur trioxide has been implicated as an important step in the formation of acid rain: 2 SO2(g) + O2(g) ⇌ 2 SO3(g). If the equilibrium partial pressures of SO2, O2, and SO3 are 0.564 atm, 0.102 atm, and 0.333 atm respectively at 1000 K, what is Kp at that temperature?
A) 0.292  
B) 3.42  
C) 5.79  
D) 8.11  

**Question 482**

For acid solutions of the same molarity acid strength is proportional to the equilibrium concentration of H3O+. For equimolar solutions of acids, which equilibrium expression below corresponds to the strongest acid?
A) $K_c = 3.5 \times 10^{-4}$  
B) $K_c = 3.5 \times 10^{-8}$  
C) $K_c = 4.5 \times 10^{-4}$  
D) $K_c = 4.9 \times 10^{-10}$  

**Question 483**

Which of the following ionic compounds would be expected to have the highest lattice energy?
A) Li F  
B) Na F  
C) K F  
D) Rb F  

**Question 484**

Which ion has the same electron configuration as Kr?
A) Rb+  
B) Br-  
C) Se2-  
D) All of these  

**Question 485**

Given three cylinders containing O2 gas at the same volume and pressure. Cylinder A is at -35°F, cylinder B is at -15°C, cylinder C is at 250 K. Which cylinder contains the largest mass of oxygen?
Question 486

What is the general valence-electron ground-state electron configuration for neutral alkaline earth metals?
A) ns1
B) ns2
C) 1s22s22p4
D) 1s22s2

Question 487

At 55° the decomposition of N2O5 is first order, having a rate constant, k = 1.7 × 10⁻³ s⁻¹. If the initial concentration of N2O5 is 6.4 × 10⁻³ M, the number of half-lives that are required for the N2O5 concentration to fall to 2.0 × 10⁻⁴ M is _______, and the amount of time required is ________ minutes.

Question 488

When dissolved in water, which of the following compounds is an Arrhenius base?
A) CH₃OH
B) HOCl
C) NaOH
D) CsF

Question 489

The diameter of an atom is approximately 1 × 10⁻¹⁰ m. What is the diameter in centimeters?
A) 1 × 10⁻¹³ cm
B) 1 × 10⁻¹₂ cm
C) 1 × 10⁻⁸ cm
D) 1 × 10⁻⁷ cm

Question 490

Which group of elements are found as diatomic molecules?
A) alkali metals
B) alkaline earth metals
C) halogens
D) noble gases

Question 491

A consistent explanation of known observations is called
A) an experiment.
B) a hypothesis.
C) a prediction.
D) a theory.

Question 492

When 30.0 g of zinc metal reacts with excess HCl, how many liters of H₂ gas are produced at STP?
A) 0.229 L
B) 0.458 L
C) 5.14 L
D) 10.3 L
Question 493
Which contains ionic bonds?
A) CH4
B) CaCl2
C) Cl2
D) NCl3

Question 494
NaNO3(aq) is employed in the salt bridge. Give the direction of electron flow and the direction of ion flow from the salt bridge.
A) Electrons flow from a to c; Na+ flows into b and NO3- flows into d.
B) Electrons flow from a to c; NO3- flows into b and Na+ flows into d.
C) Electrons flow from c to a; Na+ flows into b and NO3- flows into d.
D) Electrons flow from c to a; NO3- flows into b and Na+ flows into d.

Question 495
The element Al can be found in period _______ and group _______ of the periodic table.

Question 496
Which horizontal row of the periodic table contains the most elements?
A) row 4
B) row 5
C) row 6
D) They all contain the same number of elements.

Question 497
Which of the following is true? The probability density
A) for all s orbitals is independent of direction from the nucleus.
B) for all s orbitals is independent of distance from the nucleus.
C) is independent of direction from the nucleus for 1s orbitals only.
D) is independent of distance from the nucleus for 1s orbitals only.

Question 498
Which is most often used in the laboratory to measure pH?
A) a standard hydrogen electrode
B) a glass electrode
C) a Daniell cell
D) a conductivity cell

Question 499
The sugar fructose has an empirical formula of CH2O. The mass spectrum shows a molecular ion peak at a mass of 179.9. What is the molecular formula of fructose?
A) CH2O
B) C2H4O4
C) C6H11O6
D) C6H12O6

Question 500
According to Table 17.1, which will reduce water but not Mg2+?
A) Al3+(aq)
B) Al(s)
C) Na+(aq)
Question 501

If the cell reaction involves ions in solution, as the cell reaction in a galvanic cell continues,
A) $E$ for the cell increases.
B) $E$ for the cell decreases.
C) $E^\circ$ for the cell increases.
D) $E^\circ$ for the cell decreases.


Question 502

Calculate the hydroxide ion concentration in an aqueous solution that contains $\text{3.50} \times 10^{-3} \text{ M}$ in hydronium ion.
A) $2.86 \times 10^{-4} \text{ M}$
B) $2.86 \times 10^{-11} \text{ M}$
C) $2.86 \times 10^{-12} \text{ M}$
D) $3.50 \times 10^{-12} \text{ M}$


Question 503

Which name is not correct?
A) 1, 1-dimethylcyclopentane
B) 1, 2-dimethylcyclopentane
C) 1, 3-dimethylcyclooctane
D) 1, 4-dimethylcyclopentane


Question 504

Bromothymol blue indicator changes color from yellow at a pH of 6.0 to blue at a pH of 7.6. Phenol red indicator changes color from yellow at a pH of 6.8 to red at a pH of 8.4. A sample of pancreatic fluid having $[\text{OH}^-] = 1.258 \times 10^{-6}$ would impart a ________ color to bromothymol blue and a ________ color to phenol red.


Question 505

At an atmospheric pressure of 745 mm Hg, what is the pressure of He gas inside a cylinder that is attached to an open-end manometer in which the level of mercury in the open side of the manometer is 25 mm Hg higher than the side that is attached to the gas cylinder?


Question 506

What is the most acidic oxide of phosphorus?
A) PO2
B) PO3
C) P4O6
D) P4O10


Question 507

In which of the following sets do all species have the same number of protons?
A) Br-, Kr, Rb2+
B) C, N3-, O2-
C) Mg2+, Ca2+, Ba2+
D) O, O2-, O2+


Question 508

How many moles are there in 4.00 g of ethanol, CH3CH2OH?
A) 0.00543 mol
B) 0.0870 mol
C) 11.5 mol

**Question 509**

One way to prepare a solution with a pH of 10.00 is to dissolve ________ grams of CaO in enough water to make 500 mL of solution.


**Question 510**

At 298 K, $K_p = 2.1 \times 10^4$ for the reaction $CO(g) + 2 H_2(g) \leftrightarrow CH_3OH(g)$. What is the value of $K_c$ at this temperature?


**Question 511**

The strongest reducing agent in the group 3A is

A) B.
B) Al.
C) Ga.
D) Tl.


**Question 512**

Which orbitals do not have a node at the nucleus?

A) all beyond the second shell
B) s and d
C) d
D) s


**Question 513**

Which of the following chromium species is the strongest acid?

A) Cr(OH)$_2$
B) Cr(OH)$_3$
C) CrO$_2$(OH)$_2$
D) CrO$_4^{2-}$


**Question 514**

The mass number of an atom is equal to the number of

A) electrons.
B) neutrons.
C) protons.
D) protons plus neutrons.


**Question 515**

Which elements of group 6A are oxidizing agents and which are reducing agents?

A) O and S are oxidizing agents while Se and Te are reducing agents.
B) O and Se are oxidizing agents while S and Te are reducing agents.
C) O and S are reducing agents while Se and Te are oxidizing agents.
D) O and Se are reducing agents while S and Te are reducing agents.


**Question 516**

What are the basic oxides of the following set Cs$_2$O, CaO, P$_4$O$_{10}$, SO$_3$, and I$_2$O$_7$?

A) Cs$_2$O and CaO
B) Cs$_2$O, CaO, and P$_4$O$_{10}$
C) P$_4$O$_{10}$, SO$_3$, and I$_2$O$_7$
D) SO$_3$ and I$_2$O$_7$

Question 517
Which of the following terms can be used to describe an electrochemical cell in which a spontaneous chemical reaction generates an electric current?
I. an electrolytic cell
II. a galvanic cell
III. a voltaic cell
A) only I
B) only II
C) only III
D) II and III

Question 518
Which of the following processes are spontaneous?
I. dissolving more solute in an unsaturated solution
II. dissolving more solute in a saturated solution
III. dissolving more solute in a supersaturated solution
A) none of these
B) I
C) I and II
D) I, II, and III

Question 519
To two significant figures, by what factor will the pressure of an ideal gas change if the temperature of the gas is changed from 100°C to 200°C?

Question 520
Which of the following forms an ionic solid?
A) Au
B) CH₃NH₂
C) NH₄Cl
D) NH₃

Question 521
What is the molecular geometry of CH₃⁻?
A) T-shaped
B) tetrahedral
C) trigonal planar
D) trigonal pyramidal

Question 522
Analysis of a 1.000-g sample of the oral hypoglycemic agent metforminTM yielded 0.3720 g of carbon, 0.0858 g of hydrogen, and 0.5422 g of nitrogen. MetforminTM has a molar mass of 129.16 g/mol. What is the molecular formula of MetforminTM?

Question 523
Which ionic compound would be expected to have the highest lattice energy?
A) Cs₂O
B) BaO
C) Ga₂O₃
D) CO₂

Question 524
According to the Bohr model, when a hydrogen electron makes a transition from n=4 to n=2, which of the following statements is true?
I. Energy is emitted.
II. Energy is absorbed.
III. Electrons lose energy.
IV. Electrons gain energy.
A) I only
B) I and III
C) I and IV
D) II and IV

Question 525

Which of the following compounds forms a covalent network solid?
A) Na
B) diamond
C) N2
D) CS2

Question 526

Identify the compounds that have at least one sp2 hybridized carbon.
A) 1-pentyne
B) propane
C) 2-butene
D) 3-chloropentane

Question 527

Compared to the terminal B–H bonds the bridging H–B bonds in B2H6 are
A) longer and stronger.
B) longer and weaker.
C) shorter and stronger.
D) shorter and weaker.

Question 528

The coolant in automobiles is often a 50/50 % by volume mixture of ethylene glycol, HOCH2CH2OH, and water. At 20°C, the density of ethylene glycol is 1.1088 g/mL and the density of water is 0.9982 g/mL. Assuming that the volumes are additive, what is the expected freezing point of a 50/50(v/v)% ethylene glycol/water solution? Kf = 1.86°C/m for water.
A) -16°C
B) -17°C
C) -30°C
D) -33°C

Question 529

Which of the following species will have the highest ionization energy?
A) Rb+
B) Kr
C) Br-
D) Se2-

Question 530

How many lone pairs of electrons are on the P atom in PF3?
A) 0
B) 1
C) 2
D) 3

Question 531
Which of the following represent electron configurations that violate the Pauli exclusion principle?
(A) [Ne]3s13p5
(B) [Kr]4d125s25p6
(C) [Ar]3d104s24p2
A) only (A)
B) only (B)
C) (A) and (B)
D) (B) and (C)

Question 532

A person is considered legally intoxicated with a blood alcohol level of 80 mg/dL. Assuming that blood plasma has a density of 1.025 g/mL, what is this concentration expressed in parts per million?

Question 533

Determine the number of water molecules necessary to balance the reduction half reaction of \( \text{O}_2 \) that occurs in an acidic solution.
A) 2
B) 4
C) 5
D) 7

Question 534

What fraction of collisions will have sufficient energy to react for a gas whose activation energy is 68 kJ/mol at 25°C?
A) 1.2 \times 10^{-12}
B) 2.7 \times 10^{-2}
C) 27
D) 8.3 \times 10^{11}

Question 535

Which molecule contains a triple bond?
A) O2
B) O3
C) HCCH
D) Br2SO

Question 536

Which of the following compounds exhibits hydrogen bonding?
A) CH3I
B) HI
C) CH3OCH3
D) CH3NH2

Question 537

Which statement about the equilibrium constant is true? The value of Kc
A) changes as product concentration changes.
B) changes as reactant concentration changes.
C) changes as temperature changes.
D) never changes.

Question 538

Which of the following volumes is equal to 50 mL?
A) 50 cm3
B) 50 dm3
C) 0.50 L
D) 0.00050 kL
Question 539
Which of the following can be interpreted as a measure of randomness?
A) enthalpy
B) entropy
C) free energy
D) temperature

Question 540
Convert 55 m3 to liters.
A) 5.5 × 10-2 L
B) 5.5 L
C) 5.5 × 102 L
D) 5.5 × 104 L

Question 541
Cocaine, C17H21NO4, in urine can be confirmed by mass spectroscopy at a concentration of 150 ng/mL. Assuming a urine density of 1.025 g/mL, what is this concentration expressed as molality?

Question 542
The standard cell potential for the following galvanic cell is 0.71 V.
Pb(s)|Pb2+(aq)||Al3+(aq)|Al
This reaction has an equilibrium constant, K = ________.

Question 543
Radiation is detected by its ________ properties.
A) gravitational
B) ionizing
C) kinetic
D) thermal

Question 544
Which of the following gases has the highest average speed at 400K?
A) HCN
B) O2
C) Xe
D) BF3

Question 545
Calcium belongs to the ________ group of the periodic table.
A) alkali metal
B) alkaline earth metal
C) halogen
D) noble gas

Question 546
The equilibrium constant, Kp, equals 3.40 for the isomerization reaction:
cis-2-butene ⇌ trans-2-butene.
If a flask initially contains 0.250 atm of cis-2-butene and 0.125 atm of trans-2-butene, what is the equilibrium pressure of each gas?
A) P(cis-2-butene) = 0.037 atm, P(trans-2-butene) = 0.125 atm
B) P(cis-2-butene) = 0.048 atm, P(trans-2-butene) = 0.165 atm
C) P(cis-2-butene) = 0.074 atm, P(trans-2-butene) = 0.250 atm
| Question 547 | The property of a liquid that measure the liquid's resistance to spread out and increase its surface area is  
A) sublimation point.  
B) heat of deposition.  
C) dipole-dipole forces.  
D) surface tension.  
Answer: [link](https://biology-forums.com/index.php?topic=290133) |
|---|---|
| Question 548 | In which set do all elements tend to form anions in binary ionic compounds?  
A) C, S, Pb  
B) K, Fe, F  
C) Na, Ba, Al  
D) N, O, Cl  
Answer: [link](https://biology-forums.com/index.php?topic=289021) |
| Question 549 | Which is not a hydrate of a proton?  
A) H3O+  
B) H17O8+  
C) H19O8+  
D) H43O21+  
Answer: [link](https://biology-forums.com/index.php?topic=290742) |
| Question 550 | In a flask containing 2.00 mol of Ar, 3.00 mol of HCN, and 5.00 mol of N2 at STP the partial pressure of He is ________ mm Hg.  
Answer: [link](https://biology-forums.com/index.php?topic=290060) |
| Question 551 | Why is H3PO4 a weak triprotic acid whereas H3PO3 is a weak diprotic acid?  
Answer: [link](https://biology-forums.com/index.php?topic=291923) |
| Question 552 | Because of the high heat and low humidity in the summer in Death Valley, California, a visitor requires about one quart of water for every two miles traveled on foot. If the density of water is 0.990 g/mL at 45°C, how many kilograms of water are required for a person to walk 30 kilometers in Death Valley?  
A) 8.7 kg  
B) 70 kg  
C) 3.5 x 102 kg  
D) 7.0 x 102 kg  
Answer: [link](https://biology-forums.com/index.php?topic=288762) |
| Question 553 | From the following list of observations, choose the one that most clearly supports the following conclusion by de Broglie: "Electrons have wave properties."  
A) Line emission spectrum of hydrogen  
B) The photoelectric effect  
C) Xray diffraction  
D) Sodium chloride produces sodium solid and chlorine gas  
Answer: [link](https://biology-forums.com/index.php?topic=289377) |
| Question 554 | Which metal sulfides can be precipitated from a solution that is 0.01 M in Mn2+, Zn2+, Pb2+ and Cu2+ and 0.10 M in H2S at a pH of 0.50?  
A) MnS  
B) CuS  
Answer: [link](https://biology-forums.com/index.php?topic=290539) |
C) PbS, CuS
D) ZnS, PbS, CuS

Question 555
Which of the following elements has chemical properties similar to oxygen?
A) neon
B) hydrogen
C) nitrogen
D) tellerium

Question 556
The combustion of methane has a standard enthalpy of combustion \( H^\circ = -802 \text{ kJ per mole of methane burned.} \) How many kilojoules of heat are released if 1.28 grams of oxygen are consumed in the reaction?

Question 557
Which unit of radiation describes the amount of radiation emitted by a radioactive substance?
A) becquerel
B) gray
C) rad
D) rem

Question 558
Transition elements are located in the ________ block of the periodic table.

Question 559
A methane molecule contains 1 atom of carbon. The number 1 represents how many significant figures?
A) one
B) two
C) three
D) infinite

Question 560
An ionic compound crystallizes in a unit cell having a face-centered cubic array of metal ions, Mn+, and all of the tetrahedral holes occupied by anions, X-. The empirical formula of this ionic compound is
A) MX.
B) MX2.
C) M2X.
D) M7X4.

Question 561
Which of the following is not a state function?
A) depth
B) heat
C) internal energy
D) gas

Question 562
A container filled with gas is connected to an open-end U-tube manometer that is filled with mineral oil. The pressure in the gas container is 770 mm Hg and atmospheric pressure is 754 mm Hg. What will be the difference in the levels of mineral oil in the two arms of the manometer if the densities of Hg and mineral oil are 13.6 g/mL and 0.822 g/mL respectively?
A) 1.15 mm
Question 563

What is the oxidation number of the sulfur atom in SO2?
A) -2
B) +2
C) -4
D) +4

Question 564

How many unpaired electrons are present in the high spin form of the [CoF6]3- complex and what metal orbitals are used in bonding?
A) 0 unpaired electrons and 4s, 4p and 4d orbitals to give sp3d2
B) 4 unpaired electrons and 4s, 4p and 4d orbitals to give sp3d2
C) 0 unpaired electrons and 3d, 4s, and 4p orbitals to give d2sp3
D) 4 unpaired electrons and 3d, 4s, and 4p orbitals to give d2sp3

Question 565

Which has the smallest atomic radius?
A) La
B) W
C) Os
D) Hg

Question 566

What is the pH of a 0.040 M HClO4 solution?
A) 0.040
B) 0.080
C) 1.40
D) 12.60

Question 567

Of NH4+ and NH4- the one with the smaller bond angles is ________.

Question 568

Which transition could occur if a solid is heated at a pressure below the triple point pressure?
A) condensation
B) deposition
C) melting
D) sublimation

Question 569

What statement is not characteristic about group 6A elements?
A) Oxygen, sulfur, and selenium are typical nonmetals while tellurium is a semi-metal.
B) Oxygen is a powerful oxidizing agent but H2Se and H2Te are good reducing agents.
C) S, Se, and Te are much less electronegative than oxygen and commonly have positive oxidation states.
D) The favored oxidation state of Te and Po is +2.

Question 570

What is the Meissner effect associated with superconductors? It is
A) when the temperature above which the superconductor fails to work.
B) when the temperature at which the superconductors become perfect insulators.
C) when the net magnetic field within the bulk of the superconductor is zero.
D) when the net magnetic field within the bulk of the superconductor becomes nearly infinite.

**Question 571**

What is the strongest acid of the following?
A) HOI
B) HOBr
C) HOCl
D) All are equivalent.

**Question 572**

Calculate the pH of a 0.20 M H2SO3 solution that has the stepwise dissociation constants Ka1 = 1.5 × 10^{-2} and Ka2 = 6.3 × 10^{-8}.
A) 1.26
B) 1.32
C) 1.82
D) 2.52

**Question 573**

Which alkali metal reacts with nitrogen to form a nitride?
A) Li
B) Na
C) K
D) All of these

**Question 574**

Which has the lowest melting point?
A) Sc
B) V
C) Mn
D) Zn

**Question 575**

What is the molality of a glucose solution prepared by dissolving 27.0 g of glucose, C6H12O6, in 125.9 g of water?
A) 1.19 × 10^{-3} m
B) 0.214 m
C) 0.981 m
D) 1.19 m

**Question 576**

In order for a photovoltaic cell to convert light to electricity, the band gap must be less than or equal to the energy of the light absorbed. If light of 955 nm is to be absorbed, the band gap of the photovoltaic cell must be less than or equal to ________ kJ/mol.

**Question 577**

For a homogeneous equilibrium of gases, which of the following changes in reaction conditions will not alter the equilibrium concentrations?
A) addition of an inert gas to the reaction mixture
B) addition of products
C) increasing the volumee
D) increasing the temperature
Question 578
In an open end manometer, one end of a U-tube filled with mercury is attached to a gas-filled container and the other end is open to the atmosphere. If the gas pressure in the container is less than atmospheric pressure
A) Hg will be forced out of the open end of the U-tube.
B) the difference between the Hg levels in the two arms will be greater than 76 cm.
C) the Hg level will be higher in the arm connected to the container.
D) the Hg level will be higher in the arm open to the atmosphere.

Question 579
Elements that can accommodate more than eight electrons in their valence shell occur only in periodic table row
A) 2 or lower.
B) 3 or lower.
C) 4 or lower.
D) 5 or lower.

Question 580
The pressure in a container of gas connected to an open-end mercury manometer in which the mercury level is 22 cm lower in the side open to the atmosphere and the atmospheric pressure is 734 mm Hg is __________ mm Hg.

Question 581
Iodine, I2(s), is more soluble in dichloromethane, CH2Cl2(l), than in water because
A) both iodine and dichloromethane have strong ion-dipole interactions.
B) the dipole-dipole forces in dichloromethane are much stronger than the dispersion forces in iodine.
C) the intermolecular forces are similar in both iodine and dichloromethane.
D) iodine is polar and dichloromethane has a large number of hydrogen bonds.

Question 582
The esterification of acetic acid and ethanol is given by the reaction below:
C2H5OH(aq) + CH3COOH(aq) <-- --> CH3COOC2H5(aq) + H2O(l)
When 1.00 mol of ethanol was mixed with 2.00 mol of acid in a 1.00 L flask, 0.86 mol of ester was formed at room temperature. What is the value of the equilibrium constant, Kc?
A) 0.43
B) 2.3
C) 4.6
D) 5.4

Question 583
A weak base ionizes in water as follows:
B(aq) + H2O(l) <-- --> BH+(aq) + OH-(aq)
A 0.150 M solution of B is 2.500 % ionized at 25°C. What is the pH of this solution?
A) 0.40
B) 2.43
C) 11.57
D) 13.60

Question 584
Which of the following is the lowest temperature?
A) 35°C
B) 57°F
C) 313 K
D) All of these temperatures are all equal.
Question 585

C₂H₆O is the empirical formula for both ethyl alcohol, CH₃CH₂OH and dimethyl ether, CH₃OCH₃. In order to boil CH₃CH₂OH the strongest intermolecular forces that must be overcome are (London dispersion, dipole-dipole, hydrogen bonding) forces. In order to boil CH₃OCH₃ the strongest intermolecular forces that must be overcome are (London dispersion, dipole-dipole, hydrogen bonding) forces. Which compound is expected to have the higher boiling point?


Question 586

Which one of the following is a pseudohalide?

A) CO₃²⁻
B) OH⁻
C) CN⁻
D) SO₄²⁻


Question 587

Peptide bonds that link amino acids together in proteins contain the _______ functional group.

A) amine
B) amide
C) ester
D) ketone


Question 588

What are the products of the reaction of chlorine gas with hot aqueous sodium hydroxide?

A) Cl⁻ and H₂O
B) ClO₃⁻ and H₂O
C) Cl⁻ and ClO₃⁻
D) Cl⁻, ClO₃⁻ and H₂O


Question 589

In which set are all compounds considered to be covalent binary hydrides?

A) CsH, KH, CaH₂, BaH₂
B) CaH₂, SiH₂, AlH₃, SiH₄
C) BeH₂, B₂H₆, GeH₄, PH₃
D) CaH₂, AlH₃, SiH₄, H₂S


Question 590

Which of the following statements about helium is inconsistent with its chemistry?

A) A helium oxygen mixture is used as a deep-sea diving gas instead of compressed air.
B) In its liquid form it is used as a cryogenic coolant for superconductors.
C) It is one of the more reactive elements of its group.
D) Its melting point is -272.2°C and its boiling point is -268.9°C.


Question 591

The cycloalkane represented by a square is called _______ and has the molecular formula _______.

A) cyclopropane, C₃H₆
B) cyclopropane, C₃H₈
C) cyclobutane, C₄H₄
D) cyclobutane, C₄H₈


Question 592

Which one of the following amino acids contains a basic side chain?

A) proline
B) cytosine
C) glutamic acid
D) arginine

Question 593
A small block of wood or heavy clothing can form an effective shield against what type of radiation?
A) beta particles
B) cosmic rays
C) gamma rays
D) neutrons

Question 594
How many grams of nickel metal are plated out when a constant current of 15.0 A is passed through aqueous NiCl2 for 80.0 minutes?
A) 14.7 g
B) 21.9 g
C) 43.8 g
D) 48.4 g

Question 595
How many mL of a 0.175 M FeCl3 solution are needed to make 550 mL of a solution that is 0.300 M in Cl- ion?
A) 0.943 mL
B) 314 mL
C) 943 mL
D) It is not possible to make a more concentrated solution from a less concentrated solution.

Question 596
Which one of the following elements forms the most acidic binary oxide?
A) K
B) Si
C) P
D) As

Question 597
At a certain temperature, bromine and nitric oxide react to form nitrosyl bromide:
Br2(g) + 2 NO(g) <-- --> 2 NOBr(g).
When 0.010 mol Br2 is mixed with 0.025 mol NO and 0.015 mol NOBr in a 2.50 L flask, the concentration of NOBr decreases. Which statement below is true?
A) Kc < 36
B) Kc > 36
C) Kc < 90
D) Kc > 90

Question 598
How many resonance structures are required in the electron-dot structure of CO32-?
A) two
B) three
C) four
D) five

Question 599
Using principles discussed in chapters 15 and 19, determine which of the following is the strongest acid.
A) HClO2
B) HClO3
Question 600

Molarity is defined as
A) moles of solute per liter of solution.
B) moles of solute per liter of solvent.
C) moles of solvent per liter of solution.
D) moles of solvent per liter of solvent.


Question 601

How many kilograms of copper sulfide must be reduced to produce $3.20 \times 10^{10}$ kg of Cu? The reduction of copper proceeds via the following reaction.

$\text{Cu}_2\text{S} (l) + \text{O}_2 (g) \rightarrow 2\text{Cu} (l) + \text{SO}_2 (g)$

A) $3.20 \times 10^{13}$ kg
B) $4.0 \times 10^{12}$ kg
C) $6.4 \times 10^{10}$ kg
D) $1.3 \times 10^{11}$ kg


Question 602

At 300°C decomposition of NO$_2$(g) occurs with a rate law: 

$\text{Rate} = -k[\text{NO}_2]^x$

If the initial rate of decomposition is $3.2 \times 10^{-5}$ M/s when $[\text{NO}_2]^o = 8.0 \times 10^{-3}$ M and the initial rate of decomposition is $8.0 \times 10^{-6}$ M/s when $[\text{NO}_2]^o = 4.0 \times 10^{-3}$ M, then the order of reaction with respect to NO$_2$, $x =$ _______.


Question 603

Which of the following elements forms the most ionic binary hydride?
A) Fr
B) Ba
C) Po
D) At


Question 604

How many lone pairs of electrons are on the I atom in IF$_5$?
A) 0
B) 1
C) 2
D) 3


Question 605

Which part of the Arrhenius equation contains a term which measures the number of molecules that have the correct orientation for reaction?
A) activation energy
B) $e^{-E_a/RT}$
C) frequency factor
D) none of these


Question 606

When melting $\text{S}_8$, _______ forces must be overcome and $\text{S}_8$ is expected to have a _______ melting point than MgS.
A) covalent bonding, higher
B) covalent bonding, lower
C) intermolecular, higher
D) intermolecular, lower

 Question 607

What is the pH of a buffer system made by dissolving 10.70 grams of NH4Cl and 20.00 mL of 12.0 M NH3 in enough water to make 1.000 L of solution? Kb = 1.8 \times 10^{-5} for NH3.

A) 9.18
B) 9.26
C) 9.34
D) 11.03


 Question 608

What is the \([\text{CH}_3\text{CO}_2-]/[\text{CH}_3\text{CO}_2\text{H}]\) ratio necessary to make a buffer solution with a pH of 4.24? Ka = 1.8 \times 10^{-5} for \text{CH}_3\text{CO}_2\text{H}.

A) 0.31:1
B) 0.89:1
C) 1.1:1
D) 3.2:1


 Question 609

To make a 0.125 m solution, one could take 0.125 moles of solute and add

A) 1.00 L of solvent.
B) 1.00 kg of solvent.
C) enough solvent to make 1.00 L of solution.
D) enough solvent to make 1.00 kg of solution.


 Question 610

For the reaction \(\text{A}_2 + 2 \text{B}_3 \rightleftharpoons 2 \text{A}\text{B}_3\), the rate of the forward reaction is 0.25 M/s and the rate of the reverse reaction is 0.75 M/s. The reaction is not at equilibrium. In order to attain equilibrium the reaction must proceed in the ________ (forward, reverse) direction in order to achieve equilibrium.


 Question 611

The dissociation equilibrium constants for the protonated form of alanine (a diprotic amino acid \(\text{H}_2\text{X}^+\)) are \(\text{Ka}_1 = 4.6 \times 10^{-3}\) and \(\text{Ka}_2 = 2.0 \times 10^{-10}\). What is the pH of 50.00 mL of a 0.100 M solution of alanine after 100.00 mL of 0.100 M NaOH has been added?

A) 9.70
B) 10.69
C) 11.11
D) 12.70


 Question 612

A solution is prepared by dissolving 17.75 g sulfuric acid, \(\text{H}_2\text{SO}_4\), in enough water to make 100.0 mL of solution. If the density of the solution is 1.1094 g/mL, what is the mole fraction \(\text{H}_2\text{SO}_4\) in the solution?

A) 0.0181
B) 0.0338
C) 0.0350
D) 19.0


 Question 613

Which has the greatest density?

A) Sc
B) V
C) Cu
D) Zn


 Question 614

Why are ceramics superior to metals as structural materials?
<table>
<thead>
<tr>
<th>Question 615</th>
</tr>
</thead>
<tbody>
<tr>
<td>Which are isotopes? An atom that has an atomic number of 35 and a mass number of 76 is an isotope of an atom that has</td>
</tr>
<tr>
<td>A) an atomic number of 31 and a mass number of 76.</td>
</tr>
<tr>
<td>B) an atomic number of 35 and a mass number of 80.</td>
</tr>
<tr>
<td>C) 41 neutrons and 35 protons.</td>
</tr>
<tr>
<td>D) 41 protons and 35 neutrons.</td>
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<table>
<thead>
<tr>
<th>Question 616</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iodine is an example of</td>
</tr>
<tr>
<td>A) a compound.</td>
</tr>
<tr>
<td>B) an element.</td>
</tr>
<tr>
<td>C) a mixture.</td>
</tr>
<tr>
<td>D) an ion.</td>
</tr>
</tbody>
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<tr>
<th>Question 617</th>
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<tbody>
<tr>
<td>Mendeleev arranged the elements according to</td>
</tr>
<tr>
<td>A) atomic number and atomic weight.</td>
</tr>
<tr>
<td>B) atomic weight and chemical reactivity.</td>
</tr>
<tr>
<td>C) electron configuration and atomic weight.</td>
</tr>
<tr>
<td>D) physical state and relative abundance.</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th>Question 618</th>
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<tbody>
<tr>
<td>What is the name of the oxide ceramic BeO?</td>
</tr>
<tr>
<td>A) beryllia.</td>
</tr>
<tr>
<td>B) beryllic</td>
</tr>
<tr>
<td>C) beryllium ceramic</td>
</tr>
<tr>
<td>D) beryllium oxide</td>
</tr>
</tbody>
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<thead>
<tr>
<th>Question 619</th>
</tr>
</thead>
<tbody>
<tr>
<td>To which family does this organic compound belong?</td>
</tr>
<tr>
<td>A) alcohol</td>
</tr>
<tr>
<td>B) aldehyde</td>
</tr>
<tr>
<td>C) ether</td>
</tr>
<tr>
<td>D) ketone</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Question 620</th>
</tr>
</thead>
<tbody>
<tr>
<td>Which one of the following statements about balanced equations is false? In a balanced reaction</td>
</tr>
<tr>
<td>A) atoms must be balanced on both sides of the reaction arrow.</td>
</tr>
<tr>
<td>B) mass must be conserved.</td>
</tr>
<tr>
<td>C) molecules must be balanced on both sides of the reaction arrow.</td>
</tr>
<tr>
<td>D) net charge must be balanced on both sides of the reaction arrow.</td>
</tr>
</tbody>
</table>

<table>
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<tr>
<th>Question 621</th>
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<tbody>
<tr>
<td>In the galvanic cell represented by the shorthand notation shown below,</td>
</tr>
<tr>
<td>Cd(aq)</td>
</tr>
<tr>
<td>the inert electrode is ________, and the balanced cathode half-reaction reaction is ________.</td>
</tr>
</tbody>
</table>
Question 622

Phosphate ion has the formula ________.

Question 623

At a certain temperature the equilibrium constant, Kc, equals 0.11 for the reaction:
2 ICl(g) ⇌ I2(g) + Cl2(g).
What is the equilibrium concentration of ICl if 0.65 mol of I2 and 0.65 mol of Cl2 are initially mixed in a 2.0-L flask?
A) 0.20 M
B) 0.24 M
C) 0.39 M
D) 0.49 M

Question 624

For a system at constant pressure, 19,400 calories of heat are released. This quantity of heat is equivalent to
A) 6.92 × 10^{-5} J.
B) 8.12 × 10^{3} J.
C) 1.94 × 10^{4} J.
D) 8.12 × 10^{4} J.

Question 625

Carbon dioxide is a gas which causes environmental concern because of the greenhouse effect. What is the approximate percentage (by volume) of CO2 in the atmosphere?
A) 0.040%
B) about 3%
C) about 8%
D) more than 15%

Question 626

Which of the following statements about a catalyst is true?
A) A catalyst decreases the position of the equilibrium in a reaction.
B) A catalyst increases the pressure of a reaction.
C) A catalyst is consumed in a chemical reaction.
D) A catalyst provides a lower energy pathway for a reaction.

Question 627

For which of the following will the entropy of the system increase?
A) condensation of steam
B) reaction of zinc with oxygen to form zinc oxide
C) reaction of nitrogen and hydrogen to form ammonia
D) sublimation of dry ice

Question 628

The property of a liquid that is a measure of the liquid's resistance to increase its surface area is ________.

Question 629

Compared to Si, Cl has a ________ effective nuclear charge, Z_{eff}, and a ________ atomic radius.

Question 630

For which one of the following reactions will Kc = Kp?
A) CO(g) + 2 H2(g) ⇌ CH3OH(g)
B) \( \text{NiO(s)} + \text{CO(g)} \rightleftharpoons \text{Ni(s)} + \text{CO}_2(g) \)
C) \( 2 \text{O}_3(g) \rightleftharpoons 3 \text{O}_2(g) \)
D) \( \text{COF}_2(g) \rightleftharpoons \text{CO(g)} + \text{F}_2(g) \)

**Question 631**

What is the density of chlorine gas at STP?
A) 0.316 g/L
B) 1.58 g/L
C) 2.90 g/L
D) 3.16 g/L

**Question 632**

A steel bottle contains argon gas at STP. What is the final pressure if the temperature is changed to 125°C?
A) 0.686 atm
B) 0.748 atm
C) 1.34 atm
D) 1.46 atm

**Question 633**

How many d electrons are there on the Fe metal atom in \( \text{Li}_3[\text{Fe(OH)}_6] \)?
A) 1
B) 3
C) 5
D) 6

**Question 634**

What is the mass of 0.0500 mol of dichlorodifluoromethane, \( \text{CF}_2\text{Cl}_2 \)?
A) \( 4.14 \times 10^{-4} \) g
B) 6.05 g
C) 12.1 g
D) 24.2 g

**Question 635**

Which of the following gases has the lowest average speed at 25°C?
A) \( \text{C}_2\text{H}_6 \)
B) \( \text{H}_2\text{Se} \)
C) \( \text{PH}_3 \)
D) \( \text{F}_2 \)

**Question 636**

Three identical flasks contain three different gases at standard temperature and pressure. Flask A contains \( \text{He} \), flask B contains \( \text{SO}_2 \), and flask C contains \( \text{He} \). Which flask contains the largest number of molecules?
A) flask A
B) flask B
C) flask C
D) All contain same number of molecules.

**Question 637**

Covalent hydrides of the type \( \text{MH}_3 \) are likely to form with elements of what group?
A) 3A
B) 4A
C) 5A
D) 6A
Question 638
Which of the following statements is false concerning the formula of a compound?
A) The empirical formula is the simplest whole numbered ratio of atoms in a compound.
B) The molecular formula is the true ratio of atoms in a compound.
C) The molecular formula and empirical formula can be identical.
D) The number of atoms in a molecular formula is always greater than the number of atoms in an empirical formula.

Question 639
First-order diffraction of X-rays with d = 154.2 pm at an angle of 32.5° is caused by layers of atoms in a crystalline solid with a spacing of ________ pm.

Question 640
The sum of the potential and kinetic energies for every molecule or ion in a system is the ________ energy of the system and is given the symbol ________.

Question 641
Which of the following phase changes has a positive value for its entropy change?
A) creating steam
B) formation of snow from a cloud
C) sublimation of gaseous CO2
D) making ice cubes from liquid water

Question 642
Which one of the following molecules can rotate freely around its carbon-carbon bond?
A) benzene
B) cyclopropane
C) pentane
D) ethene

Question 643
At what temperature will sulfur hexafluoride molecules have the same average speed as argon atoms at 20°C?
A) -22.0°C
B) 73.2°C
C) 381°C
D) 799°C

Question 644
The amount of data that can be stored in an optical disc storage medium is related to the wavelength of the laser employed. Blu-Ray discs that are read by a laser having a wavelength of 405 nm have a much greater storage capacity than a DVD that is read by a 650 nm laser. The color of the 405 nm laser beam is ________, whereas the color of the 650 nm laser is ________.

Question 645
When Na₂CrO₄(aq) and AgNO₃(aq) are mixed, a red colored precipitate forms which is
A) Ag.
B) Ag₂CrO₄.
C) AgNO₂.
D) NaNO₃.

Question 646
Ionization energy of main-group elements generally
A) increases from left to right across a period and increases down a group.
B) increases from left to right across a period and decreases down a group.
C) decreases from left to right across a period and increases down a group.
D) decreases from left to right across a period and decreases down a group.

Question 647
An Arrhenius base is best defined as a
A) electron pair donor.
B) hydroxide acceptor.
C) substance that dissociates in water to produce aqueous hydrogen ions.
D) substance that dissociates in water to produce aqueous hydroxide ions.

Question 648
A diode has a positive bias when the p-type semiconductor is attached to the ________ (negative, positive) battery terminal, which ________ (inhibits, permits) electron flow.

Question 649
When 1.0 gram of hydrogen reacts with 8.0 grams of oxygen 9.0 grams of water are produced and 142 kJ of heat are released. How many grams of hydrogen and how many grams of oxygen must react to produce 250 kJ of heat?
A) 0.57 g H₂ and 4.5 g O₂
B) 0.57 g H₂ and 14 g O₂
C) 1.8 g H₂ and 4.5 g O₂
D) 1.8 g H₂ and 14 g O₂

Question 650
Which of the following elements is a good conductor of heat and electricity?
A) silicon
B) iodine
C) radon
D) lead

Question 651
Which element will react rapidly with aqueous H⁺ ions and also with liquid H₂O?
A) Pt
B) Co
C) Zn
D) Ca

Question 652
The density of lead is 11.3 g/cm³. The volume occupied by 227 g of lead is ________ cm³.

Question 653
During perspiration,
A) the entropy of the water evaporated decreases and the entropy of the body decreases.
B) the entropy of the water evaporated decreases and the entropy of the body increases.
C) the entropy of the water evaporated increases and the entropy of the body decreases.
D) the entropy of the water evaporated increases and the entropy of the body increases.

Question 654
The neutral atom with the electron configuration [Ar]4s²3d⁶ is ________. 
Question 655

Of the following, which element has the highest first ionization energy?
A) P
B) N
C) Sb
D) As

Question 656

What is the total pressure in a 8.00-L flask which contains 0.127 mol of H2(g) and 0.288 mol of N2(g) at 20.0°C?
A) 0.382 atm
B) 0.681 atm
C) 0.866 atm
D) 1.25 atm

Question 657

Which of the following ionic compounds would be expected to have the highest lattice energy?
A) RbF
B) RbCl
C) RbBr
D) Rbl

Question 658

Which of the following salts are acidic?
A) LiCl, NaCl, KCl
B) NH4Cl, CuCl2, AlCl3
C) NaCH3CO2, LiCH3CO2, RbCH3CO2
D) KCl, NH4Cl, Na2CO3

Question 659

The dissociation equilibrium constants for the protonated form of alanine (a diprotic amino acid, H2X+) are Ka1 = 4.6 × 10^-3 and Ka2 = 2.0 × 10^-10. What is the pH of 50.00 mL of a 0.050 M solution of alanine after 37.50 mL of 0.100 M NaOH has been added?
A) 4.85
B) 6.02
C) 7.39
D) 9.70

Question 660

Identify the ether.
A) CH3CH2OCH3
B) CH3CH2CH=CH2
C) CH3CH2OH
D) CH3CH2NHCH3

Question 661

The smallest alkyne is called
A) ethene.
B) propene.
C) 1-butyne.
D) acetylene.
Question 662
What percentage of a radioactive substance remains after 6.00 half-lives have elapsed?
A) 0.78%
B) 1.56%
C) 3.31%
D) 6.25%

Question 663
What is the most metallic element of group 5A?
A) P
B) As
C) Sb
D) Bi

Question 664
The winner of the men's 1500-meter speed skating event at a recent Winter Olympics had a time of 1:45.57. Assuming that the distance was measured accurately to five significant figures, what was the skater's average speed in miles per hour?
A) 31.790 mi/hr
B) 38.418 mi/hr
C) 51.151 mi/hr
D) 61.826 mi/hr

Question 665
In which of the following sets do all species have the same number of electrons?
A) Cl-, Ar, Ca2+
B) N, O2-, F-
C) Sc3+, Y3+, La3+
D) Cr, Cr2+, Cr3+

Question 666
According to history, the concept that all matter is composed of atoms was first proposed by
A) the Greek philosopher Democritus, but not widely accepted until modern times.
B) Dalton, but not widely accepted until the work of Mendeleev.
C) Dalton, but not widely accepted until the work of Einstein.
D) Dalton, and widely accepted within a few decades.

Question 667
Binary oxides can be classified as acidic, amphoteric, or basic. MgO, Al2O3, and SO3 are classified as ________, ________, and ________ oxides, respectively.

Question 668
If Kc is the equilibrium constant for a forward reaction what is Kc' for the reverse reaction?
A) - Kc
B) Kc
C) (Kc)-1
D) none of these

Question 669
The number of atoms in 1 g of H is ________ (greater than, less than, the same as) the number of atoms in 12 g of C.
Question 670

The cubic closest-packed arrangement of atoms is the same as which cubic unit cell?

Question 671

Of the following elements, which has the highest electronegativity?
A) Si
B) N
C) Ga
D) Cd

Question 672

What is the resulting pH when 0.005 moles of KOH is added to 0.100 L of a buffer solution that is 0.100 M in H2PO4- and 0.100 M HPO42- and the
Ka2 = 6.2 × 10-8?
A) 5.21
B) 5.61
C) 6.73
D) 7.69

Question 673

Electrical conductivity in graphite is maximized
A) parallel to the pi framework and parallel to the planar C atom framework.
B) perpendicular to the pi framework and parallel to the planar C atom framework.
C) parallel to the pi framework and perpendicular to the planar C atom framework.
D) perpendicular to the pi framework and perpendicular to the planar C atom framework.

Question 674

During an electrochemical reaction, electrons move through the external circuit toward the ________ and positive ions in the cell move toward the
_______.
A) anode, anode
B) anode, cathode
C) cathode, anode
D) cathode, cathode

Question 675

When 220. mL of 1.50 × 10-4 M hydrochloric acid is added to 125 mL of 1.75 × 10-4 M Mg(OH)2, the resulting solution will be
A) acidic.
B) basic.
C) neutral.
D) It is impossible to tell from the information given.

Question 676

The cycloalkane represented by a heptagon is named ________ and has the molecular formula ________.

Question 677

When 70 mL of 0.18 M NH4Cl is added to 70 mL of 0.18 M NH3, relative to the pH of the 0.10 M NH3 solution the pH of the resulting solution will
A) become 7.
B) decrease.
C) increase.
D) remain the same.
Question 678

What is the pH of a buffer solution made by mixing 50.0 mL of 0.100 M potassium hydrogen phthalate with 13.6 mL of 0.100 M NaOH and diluting the mixture to 100.0 mL with water? The Ka2 for hydrogen phthalate is 3.1 \times 10^{-6}.

A) 3.25  
B) 5.08  
C) 5.51  
D) 5.94  

Question 679

Which has the lowest melting point?

A) La  
B) W  
C) Os  
D) Hg  

Question 680

According to Graham's law, the rate of effusion of a gas is inversely proportional to the ________.


Question 681

A researcher needs 5.00 mg of 128Ba for an experiment. If the half-life of 128Ba is 2.43 days, how many milligrams of 128BaCl2 must she order from the manufacturer if it takes 4.50 days to ship the material from the manufacturer to the university? (Assume the molar mass of 128Ba is 128 g/mol.)

A) 11.6 mg  
B) 18.0 mg  
C) 21.5 mg  
D) 44.9 mg  

Question 682

What are the conjugate acid-base pairs in the following chemical reaction?

\[ \text{NH}_3(\text{aq}) + \text{H}_2\text{O}(l) \rightleftharpoons \text{NH}_4^+(\text{aq}) + \text{OH}^-(\text{aq}) \]

A) \text{NH}_3, \text{H}_2\text{O} and \text{NH}_4^+, \text{OH}^-  
B) \text{NH}_3, \text{NH}_4^+ and \text{H}_2\text{O}, \text{OH}^-  
C) \text{NH}_3, \text{OH}^- and \text{H}_2\text{O}, \text{NH}_4^+  
D) \text{NH}_3 and \text{NH}_4^+  

Question 683

Phenobarbital has a pKa = 7.4. Compared to a 1.0 \times 10^{-3} M solution, 1.0 \times 10^{-4} M phenobarbital will have a ________ (higher, lower) pH and a ________ (higher, lower) percent ionization.


Question 684

Which metal is not found in nature in uncombined form?

A) Mn  
B) Au  
C) Os  
D) Ir  

Question 685

Rubber is classified as an ________ solid, whereas diamond is classified as a ________ solid.


Question 686

Which one of the following statements does not describe the equilibrium state?
A) Equilibrium is dynamic and there is no net conversion to reactants and products.
B) The concentration of the reactants is equal to the concentration of the products.
C) The concentration of the reactants and products reach a constant level.
D) The rate of the forward reaction is equal to the rate of the reverse reaction.

Question 687

If the reaction of phosphate ion with water is ignored, what is the total concentration of ions in a solution prepared by dissolving 7.00 g of K3PO4 in enough water to make 350. mL of solution?
A) 0.0236 M 
B) 0.0943 M 
C) 0.377 M 
D) 0.754 M

Question 688

Which is classified as an ionic binary oxide?
A) BaO 
B) CO2 
C) N2O5 
D) SO3

Question 689

Which of the following statements are true about reaction mechanisms?
I. A rate law can be written from the molecularity of the slowest elementary step.
II. The final rate law can include intermediates.
III. The rate of the reaction is dependent on the fastest step in the mechanism.
IV. A mechanism can never be proven to be the correct pathway for a reaction.
A) I, II, III 
B) II, IV 
C) I, III 
D) I, IV

Question 690

In which blocks of the periodic table are the transition series and inner transition series elements found?
A) d, p 
B) d, f 
C) s, d 
D) s, p

Question 691

One source of titanium is pyrophanite, MnTiO3. The oxidation states of manganese and titanium in pyrophanite are ________ and ________, respectively.

Question 692

Which of the following is expected to have the greatest viscosity?
A) C5H12 
B) C6H14 
C) C5H11OH 
D) CH4

Question 693

The number of electrons in the ion Zn2+ is ________.
### Question 694

Approximately what mass percent of a body’s dry weight consists of proteins?

- A) 5%
- B) 40%
- C) 50%
- D) 70%


### Question 695

Para-Aminobenzoic acid (PABA), p-\(\text{H}_2\text{NCO}_6\text{H}_4(\text{COOH})\), is used in some sunscreens and hair conditioning products. Calculate the pH of an aqueous solution with \([\text{PABA}] = 0.030 \text{ M}\) and \(K_a = 2.2 \times 10^{-5}\).

- A) 1.52
- B) 3.09
- C) 4.66
- D) 6.18


### Question 696

Which of the following statements is not correct when balancing a nuclear equation?

I. The mass numbers must be conserved on both sides of the reaction arrow.
II. The ionic charges must be conserved on both sides of the reaction arrow.
III. The atomic numbers must be conserved on both sides of the reaction arrow.
IV. The elements must be the same on both sides of the reaction arrow.

- A) II only
- B) II and III
- C) I and III
- D) II and IV


### Question 697

Identify the compound that contains a carbon-carbon double bond.

- A) 2-pentyne
- B) 1-pentene
- C) methyl propanoate
- D) methanol


### Question 698

To reach a noble gas electron configuration how many electrons would tellerium have to adopt?

- A) 1
- B) 2
- C) 7
- D) 4


### Question 699

Water has an unusually high

- A) electrical conductivity.
- B) heat of combustion.
- C) heat of formation.
- D) specific heat.


### Question 700

What is the first ionization energy for a hydrogen atom in the ground state? The Rydberg constant is .

- A) 7.27 \times 10^{-36} \text{ J}
- B) 1.63 \times 10^{-27} \text{ J}
- C) 2.18 \times 10^{-18} \text{ J}
- D) 0.00823 \text{ J}
Question 701

An aqueous solution has a normal boiling point of 105.0°C. What is the freezing point of this solution? For water $K_b = 0.51°C/m$ and $K_f = 1.86°C/m$.

A) 14.7°C  
B) -14.7°C  
C) 18.2°C  
D) -18.2°C  

Question 702

Predict the product(s) when the reactants Mg(s) + Cl2(l) are mixed.

A) MgCl(s)  
B) MgCl2(s)  
C) Mg2Cl(s)  
D) MgCl3(s)  

Question 703

What reagent would distinguish between Ba2+ and Pb2+?

A) KCl  
B) LiNO3  
C) K2SO4  
D) Li2S2O3  

Question 704

The Cl—Cl bond energy is 199 kJ/mol. Therefore the formation of a single bond between atoms

A) should require the absorption of 199 kJ per mole of Cl—Cl formed.  
B) should require the absorption of 398 kJ per mole of Cl—Cl formed.  
C) should result in the release of 199 kJ per mole of Cl—Cl formed.  
D) should result in the release of 398 kJ per mole of Cl—Cl formed.  

Question 705

Which period 2 element has successive first through seventh ionization energies (kJ/mol) of

$E_{i1} = 1,402; E_{i2} = 2,856; E_{i3} = 4,578; E_{i4} = 7,475; E_{i5} = 9,445; E_{i6} = 53,267;$ and $E_{i7} = 64,360$?

A) B  
B) C  
C) N  
D) O  

Question 706

The total binding energies for 3He, 4He, and 6He are 7.72 MeV, 28.29 MeV, and 29.26 MeV respectively. Arrange the 3 isotopes in increasing order of binding energy per nucleon.

A) 3He < 4He < 6He  
B) 6He < 4He < 3He  
C) 4He < 3He < 6He  
D) 3He < 6He < 4He  

Question 707

The formula for tetraamminediiodochromium(III) bromide is ________.


Question 708

In the galvanic cell represented by the shorthand notation

\[ \text{Al}(s)|\text{Al}^3+(aq)||\text{Fe}^3+(aq)|\text{Fe}(s) \]
the anode is ________ and the cathode is ________.

### Question 709
Calculate the concentration of bicarbonate ion, HCO$_3^-$, in a 0.050 M H$_2$CO$_3$ solution that has the stepwise dissociation constants $K_a1 = 4.3 \times 10^{-7}$ and $K_a2 = 5.6 \times 10^{-11}$.
A) $1.5 \times 10^{-4}$ M
B) $4.3 \times 10^{-7}$ M
C) $2.2 \times 10^{-8}$ M
D) $5.6 \times 10^{-11}$ M

### Question 710
Fuel cells
A) produce carbon dioxide and hydrogen.
B) emit sulfur oxides.
C) are environmentally clean.
D) cannot be used in vehicles.

### Question 711
At 1 atm pressure, the heat of sublimation of gallium is 277 kJ/mol and the heat of vaporization is 271 kJ/mol. To the correct number of significant figures, how much heat is required to melt 1.50 mol of gallium at 1 atm pressure?
A) 6 kJ
B) 9 kJ
C) 268 kJ
D) 271 kJ

### Question 712
Some assumptions from the kinetic molecular theory are listed below. Which one is most frequently cited to explain compressibility of a gas?
A) The average kinetic energy of gas particles is proportional to the Kelvin temperature.
B) Collisions of gas particles are elastic and total kinetic energy of the gas is constant.
C) A gas consist of tiny particles moving in random straight line motion.
D) The volume of the particles is negligible compared to the volume of the gas.

### Question 713
Aqueous solutions of 30.0% (by weight) hydrogen peroxide, H$_2$O$_2$, are used to oxidize metals or organic molecules in chemical reactions. Calculate the molality of this solution.
A) 0.974 m
B) 6.78 m
C) 9.79 m
D) 12.6 m

### Question 714
What is the percent dissociation of ascorbic acid if the solution has a pH = 5.50 and a $pK_a = 4.10$?
A) 96%
B) 10%
C) 5%
D) 1%

### Question 715
Which one of the following carbides is not a correct formula?
A) CaC$_2$
B) Fe$_3$C
C) SiC
D) None of these
Question 716

At an elevated temperature, K_p = 4.2 \times 10^{-9} for the reaction 2 \text{HBr}(g) \rightleftharpoons \text{H}_2(g) + \text{Br}_2(g). If the initial partial pressures of \text{HBr}, \text{H}_2, and \text{Br}_2 are 1.0 \times 10^{-2} \text{ atm}, 2.0 \times 10^{-4} \text{ atm}, and 2.0 \times 10^{-4} \text{ atm}, respectively, what is the equilibrium partial pressure of \text{H}_2?


Question 717

An atom can be seen by
A) an atomic force microscope.
B) a nucleon microscope.
C) an optical microscope.
D) a telescope.


Question 718

The density of copper is 8.96 g/cm^3. What is the mass in mg of a cube of copper that measures 2.31 mm on each side?

A) 0.0207 g
B) 0.110 g
C) 2.07 g
D) 110 g


Question 719

Combustion of hydrogen releases 142 kJ per gram of hydrogen reacted. How many kilocalories of energy are released by the combustion of 16.0 ounces of hydrogen?

A) 1.31 kcal
B) 19.2 kcal
C) 1.54 \times 10^4 kcal
D) 2.69 \times 10^5 kcal


Question 720

Which of the following isotopes is the most stable?
A) ^{6}\text{He}, 4.89 \text{ MeV/nucleon}
B) ^{20}\text{Ne}, 8.03 \text{ MeV/nucleon}
C) ^{94}\text{Zr}, 8.67 \text{ MeV/nucleon}
D) ^{240}\text{Pu}, 7.26 \text{ MeV/nucleon}


Question 721

Which of the following statements about gamma radiation is false?
A) It almost always accompanies alpha or beta emission.
B) It is a mechanism to release excess energy in the nucleus.
C) Gamma rays are high energy photons.
D) The mass number decreases by one with each gamma emitted.


Question 722

How many H^+ ions can the acid CH_3CO_2H donate per molecule?
A) 1
B) 2
C) 3
D) 4


Question 723

Which of the following atoms is expected to be sp^2 hybridized?
A) C in C_2H_6
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<table>
<thead>
<tr>
<th>Question 724</th>
<th>What is the percent dissociation of acetic acid if the solution has a pH = 4.74 and a pKa = 4.74?</th>
</tr>
</thead>
<tbody>
<tr>
<td>A) 100%</td>
<td>B) 50%</td>
</tr>
<tr>
<td>C) 10%</td>
<td>D) 1%</td>
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<th>Question 725</th>
<th>Of the following elements, which has the highest electronegativity?</th>
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<tbody>
<tr>
<td>A) As</td>
<td>B) Se</td>
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<tr>
<td>C) Y</td>
<td>D) Sb</td>
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<tr>
<th>Question 726</th>
<th>Kc = 57.0 at 700 K for the reaction shown below. H2(g) + I2(g) ←→ 2 HI(g)</th>
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<tr>
<td>If [H2(g)] = [I2(g)] = 0.200 M at equilibrium, the molar concentration [HI(g)] = _______ at equilibrium.</td>
<td>Answer: <a href="https://biology-forums.com/index.php?topic=290613">https://biology-forums.com/index.php?topic=290613</a></td>
</tr>
</tbody>
</table>

<table>
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<tr>
<th>Question 727</th>
<th>How many H+ ions can the acid H3PO4 donate per molecule?</th>
</tr>
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<tbody>
<tr>
<td>A) 0</td>
<td>B) 1</td>
</tr>
<tr>
<td>C) 2</td>
<td>D) 3</td>
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<table>
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<tr>
<th>Question 728</th>
<th>In the process of dissolving ionic compounds, the cations and anions are separated from the crystal lattice and surrounded by an ordered shell of solvent molecules. If the solvent is water, the dissolved ions are said to be</th>
</tr>
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<tbody>
<tr>
<td>A) ionized.</td>
<td>B) homogenized.</td>
</tr>
<tr>
<td>C) hybridized.</td>
<td>D) hydrated.</td>
</tr>
</tbody>
</table>

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<thead>
<tr>
<th>Question 729</th>
<th>What is the hydronium ion concentration of a 0.300 M acetic acid solution with Ka = 1.8 × 10^-5? The equation for the dissociation of acetic acid is: CH3CO2H(aq) + H2O(l) ←→ H3O+(aq) + CH3CO2-(aq).</th>
</tr>
</thead>
<tbody>
<tr>
<td>A) 2.3 × 10-2 M</td>
<td>B) 4.2 × 10-2 M</td>
</tr>
<tr>
<td>C) 2.3 × 10-3 M</td>
<td>D) 4.2 × 10-3 M</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Question 730</th>
<th>What is the molality of a glucose solution prepared by dissolving 9.00 g of glucose, C6H12O6, in 125.9 g of water?</th>
</tr>
</thead>
<tbody>
<tr>
<td>A) 2.38 × 10-4 m</td>
<td>B) 0.0715 m</td>
</tr>
<tr>
<td>C) 0.347 m</td>
<td>D) 0.397 m</td>
</tr>
</tbody>
</table>
### Question 731
Calculate the pH of a 0.100 M CH₃NH₃Cl solution. Kb for methylamine, CH₃NH₂, is 3.7 × 10⁻⁴.

A) 2.22  
B) 5.78  
C) 8.22  
D) 11.78  

### Question 732
A 0.050 M solution of hydroxylamine, NH₂OH, having Kb = 9.1 × 10⁻⁹ has a pH of _______.


### Question 733
The group 4A element that always obeys the octet rule in its stable compounds is _______.


### Question 734
A peptide bond links  
A) an alcohol and a ketone.  
B) an amine and an aldehyde.  
C) an amine and a carboxylic acid.  
D) an ester and a carboxylic acid.  

### Question 735
What is the identity of the element with 6 protons, 7 neutrons, and 6 electrons?  
A) C  
B) N  
C) Al  
D) Mg  

### Question 736
What is the edge length of a face-centered cubic unit cell made up of atoms having a radius of 139 pm?  
A) 197 pm  
B) 393 pm  
C) 556 pm  
D) 1110 pm  

### Question 737
Which of the following is the principal cause of global warming?  
A) acid rain  
B) air pollution  
C) greenhouse effect  
D) ozone depletion  

### Question 738
Which of the following processes is spontaneous?  
A) a mixture of two liquids separating into pure compounds  
B) reaction of sodium with oxygen  
C) precipitation of solute from a unsaturated solution  
D) water flowing uphill  

### Question 739
Which has the greatest density?
Question 740

Cr³⁺ has ________ valence electrons.

Question 741

How many Br⁻ ions are around each K⁺ ion in KBr, which has a cubic unit cell with Br⁻ ions on each corner and each face?
A) 1
B) 4
C) 6
D) 8

Question 742

What volume of a 0.540 M KOH solution contains 15.5 g of KOH?
A) 0.54 L
B) 0.51 L
C) 1.95 L
D) 8.47 L

Question 743

Which has the least kinetic energy?
A) a 1200 kg object moving at 90 km/hr
B) a 1400 kg object moving at 85 km/hr
C) a 1600 kg object moving at 80 km/hr
D) a 1800 kg object moving at 75 km/hr

Question 744

What statement is inconsistent with the chemistry of copper?
A) It has a high electrical conductivity and is widely used to make electrical wiring.
B) It is commonly found in the elemental state.
C) It is a reddish colored metal that accounts for only 0.0068% of the earth's crust by mass.
D) It is used to make corrosion-resistant water pipes because it has a positive oxidation potential.

Question 745

Addition of 0.0125 mol HCl to 150 mL of a 0.150 M formic acid/0.100 M sodium formate buffer results in a pH = ________. The Ka of formic acid is 1.8 x 10⁻⁴.

Question 746

A gas molecule at 298 K and 1 atm pressure undergoes a collision with another gas molecule approximately every ________ seconds.
A) 10⁻¹⁵
B) 10⁻⁹
C) 10⁻⁶
D) 10⁻³

Question 747

A 2.00 M solution of CaCl₂ in water has a density of 1.17 g/mL. What is the mole fraction of CaCl₂?
A) 0.0348
B) 0.0360
Question 748

Which of the following amino acids is acidic?
A) alanine
B) aspartic acid
C) glutamine
D) histidine

Question 749

Which of the following compounds forms an ionic solid?
A) water
B) carbon dioxide
C) potassium bromide
D) zince

Question 750

Which contains Avogadro's number of formula units?
A) 36.5 g of Cl
B) 36.5 g of Cl2
C) 36.5 g of HCl
D) All of these

Question 751

A gas occupies 22.4 L at STP and 16.5 L at 100°C and 1.75 atm pressure. How many moles of gas did the system gain or lose?
A) 0.06 moles gained
B) 0.03 moles gained
C) 0.03 moles lost
D) 0.06 moles lost

Question 752

Which ionic compound would be expected to have the highest lattice energy?
A) AlH3
B) Al2S3
C) AlCl3
D) AlN

Question 753

Which of the following is not quantized?
A) the charge on a monatomic ion
B) the distance between two objects
C) the population of the United States
D) the static charge on a balloon rubbed with wool

Question 754

At a certain temperature the equilibrium constant, Kc, equals 0.11 for the reaction:
2 ICl(g) <-- --> I2(g) + Cl2(g).
What is the equilibrium concentration of ICl if 0.75 mol of I2 and 0.75 mol of Cl2 are initially mixed in a 2.0-L flask?
A) 0.23 M
B) 0.28 M
C) 0.45 M
D) 0.56
Question 755

What is the strongest base among the following?
A) IO-
B) IO2-
C) IO3-
D) IO4-

Question 756

In the most acceptable electron-dot structure for carbonyl fluoride, COF2 the central atom is
A) C, which is singly-bonded to O.
B) C, which is doubly-bonded to O.
C) O, which is singly-bonded to C.
D) O, which is doubly-bonded to C.

Question 757

Which of the following has the smallest mass?
A) 1.40 × 10²⁴ molecules of I₂
B) 340. g of Cl₂
C) 10.0 mol of F₂
D) 0.200 kg of Br₂

Question 758

Which of the following have the same number of valence electrons?
A) Cs, Bi, At
B) In, Pb, Bi
C) N, P, As
D) Xe, Rn, At

Question 759

The SI unit for pressure is the
A) atmosphere.
B) MM Hg.
C) newton.
D) pascal.

Question 760

What is a cermet?
A) boron nitride/epoxy
B) ceramic-metal composite
C) ceramic-polymer composite
D) silicon carbide/graphite

Question 761

If the units for rate are M s⁻¹, what are the units for the rate constant, k, for a zeroth-order reaction?
A) s⁻¹
B) M
C) M s⁻¹
D) M⁻¹ s⁻¹

Question 762
The number of waters of hydration in the hydrate proton H\textsubscript{11}O\textsubscript{5+} is ________.

**Question 763**

Elements A and Q form two compounds. The ratio (mass Q)/(mass A) for compound one is 0.271 and ratio (mass Q)/(mass A) for compound two is 0.362. If compound one has the chemical formula AQ, what is the chemical formula for compound two?

A) A\textsubscript{3}Q\textsubscript{4}
B) A\textsubscript{2}Q\textsubscript{3}
C) AQ\textsubscript{2}
D) AQ\textsubscript{3}


**Question 764**

Which element has the chemical symbol, Pb?

A) tin
B) lead
C) mercury
D) potassium


**Question 765**

What is the temperature of N\textsubscript{2} gas if the average speed (actually the root-mean-square speed) of the molecules is 750 m/s?

A) 0.842 K
B) 6.31 \times 10^2 K
C) 3.16 \times 10^2 K
D) 0.421 K


**Question 766**

Which has a dipole moment?

A) CF\textsubscript{4}
B) SiO\textsubscript{3}\textsuperscript{2-}
C) SO\textsubscript{2}
D) SO\textsubscript{4}\textsuperscript{2-}


**Question 767**

Which type of bonding does Ca form upon solidification?

A) covalent network
B) ionic
C) metallic
D) molecular


**Question 768**

Which compound is most likely to exist as a gas or liquid at room temperature?

A) Al\textsubscript{4}C\textsubscript{3}
B) CBr\textsubscript{4}
C) CaBr\textsubscript{2}
D) WC


**Question 769**

What is the hydronium ion concentration and the pH for an aqueous solution of NH\textsubscript{3} that has a hydroxide ion concentration of 2.25 \times 10^{-3} M?

A) 4.44 \times 10^{-11} M, 3.65
B) 4.44 \times 10^{-11} M, 10.35
C) 4.44 \times 10^{-12} M, 2.65
D) 4.44 \times 10^{-12} M, 11.35

Question 770

Sodium hypochlorite, NaOCl, is the active ingredient in household bleach. What is the concentration of hypochlorite ion if 20.00 mL of bleach requires 31.00 mL of 0.500 M HCl to reach the equivalence point?
A) 0.275 M
B) 0.333 M
C) 0.775 M
D) 1.28 M

Question 771

Of the following, which element has the highest first ionization energy?
A) indium
B) rubidium
C) tin
D) strontium

Question 772

In the reaction between NO2 and H2O that produces HNO3, the Lewis acid is ________ and the Lewis base is ________.

Question 773

What statement is most consistent for an acid with a pH = 1?
A) one one-hundredth as strong as an acid with a pH of 3
B) half as strong as an acid with a pH = 3
C) twice as strong as an acid with a pH of 3
D) one hundred times as strong as an acid with a pH = 3

Question 774

Of the following, which element has the highest first ionization energy?
A) Ra
B) Fr
C) K
D) Sr

Question 775

Orange juice is an example of
A) a compound.
B) an element.
C) an ion.
D) a mixture.

Question 776

Which statement is true for the general rate law: Rate = k[A]^m[B]^n?
A) It can be written from the stoichiometry of the first step.
B) The overall order of the reaction is equal to m times n.
C) The values for the exponents must be determined by experiment.
D) The exponents in the rate law must be positive integers.

Question 777

Consider Li+, F-, and O2-. Which ratio should be the largest?
A) (radius Li+)/ (radius F-)
B) (radius Li+)/ (radius O2-)
C) (radius F-)/ (radius Li+)

<table>
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<tr>
<th>Question 778</th>
<th>What is the pH at the equivalence point of a weak acid-strong base titration?</th>
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<tbody>
<tr>
<td>A) pH &lt; 7</td>
<td>B) pH = 7</td>
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<tr>
<td>C) pH &gt; 7</td>
<td>D) pH = 14.00</td>
</tr>
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<table>
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<tr>
<th>Question 779</th>
<th>A solution is prepared by dissolving 50.0 g of sucrose, C_{12}H_{22}O_{11}, in 250.0 g of water at 25°C. What is the vapor pressure of the solution if the vapor pressure of water at 25°C is 23.76 mm Hg?</th>
</tr>
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<tbody>
<tr>
<td>A) 0.247 mm Hg</td>
<td>B) 19.8 mm Hg</td>
</tr>
<tr>
<td>C) 23.5 mm Hg</td>
<td>D) 24.0 mm Hg</td>
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<tr>
<th>Question 780</th>
<th>Which of the following can function as a chelating agent?</th>
</tr>
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<tbody>
<tr>
<td>A) CN-</td>
<td>B) CO</td>
</tr>
<tr>
<td>C) H_{2}NCH_{2}CH_{2}NH_{2}</td>
<td>D) NCS-</td>
</tr>
</tbody>
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<thead>
<tr>
<th>Question 781</th>
<th>Of C_{2}H_{5}OH and C_{3}H_{5}(OH)_{3} the one expected to have the higher vapor pressure is ________, and the one expected to have the higher boiling point is ________.</th>
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<tr>
<th>Question 782</th>
<th>The pH of 0.255 M HCN is 4.95. What is the value of Ka for hydrocyanic acid?</th>
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<tbody>
<tr>
<td>A) 1.3 \times 10^{-10}</td>
<td>B) 4.9 \times 10^{-10}</td>
</tr>
<tr>
<td>C) 1.1 \times 10^{-5}</td>
<td>D) 4.4 \times 10^{-5}</td>
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<th>Question 783</th>
<th>What is the standard isotope that is used to define the number of atoms in a mole?</th>
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<tbody>
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<td>A) 14N</td>
<td>B) 12C</td>
</tr>
<tr>
<td>C) 9Be</td>
<td>D) 31P</td>
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<th>Question 784</th>
<th>How many lone pairs are on the central Br atom in Br\textsubscript{3}?</th>
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<td>A) 0</td>
<td>B) 1</td>
</tr>
<tr>
<td>C) 2</td>
<td>D) 3</td>
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</table>

| Question 785 | Zinc occurs in sulfide ores. How many liters of SO\textsubscript{2}(g) are produced at STP for each kilogram of roasted ore that is 70% zinc sulfide? |
A) 160 L
B) 230 L
C) 460 L
D) 660 L

**Question 786**

Which of the following is not a strong acid?
A) HF
B) HCl
C) HBr
D) HI

**Question 787**

A 1.75-L container filled with CO2 gas at 25°C and 225 kPa pressure springs a leak. When the container is re-sealed, the pressure is 185 kPa and the temperature is 10°C. How many moles of gas were lost?
A) 0.0213 mol
B) 0.463 mol
C) 0.561 mol
D) 2.16 mol

**Question 788**

Which of the following species is diamagnetic?
A) an isolated, gas-phase V3+ ion
B) a high-spin octahedral Fe2+ complex
C) an isolated, gas-phase Cu2+ ion
D) a low-spin octahedral Co3+ complex

**Question 789**

Which is not a solution?
A) sterling silver
B) fog
C) hydrochloric acid
D) coffee

**Question 790**

A zeroth order reaction is one whose
A) rate is zero.
B) rate is independent of reactant concentration.
C) rate can be found where \([A] = -kt + ln[A]_0\).
D) rate is dependent on none of the reactants.

**Question 791**

If one mole of each is dissolved in 1.00 L of water, which will lower the vapor pressure the most?
A) C12H22O11
B) KNO3
C) C3H7OH
D) MgCl2

**Question 792**

How many geometrical and structural isomers are there of butene?
A) 3
B) 4
C) 5
Question 793

The artist's pigment cadmium yellow, CdS, has a water solubility of 0.13 g/L. The solubility product of CdS, K\text{sp} = ________.


Question 794

KBr crystallizes in a cubic unit cell with Br- ions on each corner and each face. How many K+ ions and Br- ions are in each unit cell of KBr?
A) 1 K+ ion and 1 Br- ion
B) 2 K+ ions and 2 Br- ions
C) 4 K+ ions and 4 Br- ions
D) 8 K+ ions and 8 Br- ions


Question 795

What is the oxidation number of H in H2?
A) 0
B) -2
C) +3
D) +1


Question 796

What are two of the major components of stainless steel?
A) iron and carbon
B) iron and chromium
C) iron and titanium
D) iron and tungsten


Question 797

What is the name of the complex ion [AuBrCl(CN)2]-?
A) bromochlorodicyanogold(I) ion
B) bromochlorodicyanoaurate(III) ion
C) bromochlorodicyanoargentate(III) ion
D) bromochlorodicyanoaurate(IV) ion


Question 798

Which is paramagnetic?
A) N22+
B) N22-
C) O22+
D) O22-


Question 799

As a liquid evaporates at a temperature below its boiling point, the temperature of the liquid
A) decreases.
B) decreases at low temperatures, but increases at high temperatures.
C) increases.
D) remains unchanged.


Question 800

A 55.0-L steel tank at 20.0°C contains acetylene gas, C2H2, at a pressure of 1.39 atm. Assuming ideal behavior, how many grams of acetylene are in the tank?
A) 3.17 g
Question 801

What is the molar mass of iodine?
A) 126.9 g/mol
B) 253.8 g/mol
C) 6.02 × 10^{23} g/mol
D) 1.20 × 10^{24} g/mol

Question 802

"Isotopes" are atoms with the same number of ________ but different number of ________.
A) electrons, neutrons
B) neutrons, protons
C) protons, electrons
D) protons, neutrons

Question 803

Oxygen-16 (15.994915 amu) is synthesized in the sun by fusion of 12C (12.000000 amu) and 4He (4.00260 amu). How much energy is released in this nuclear reaction?
A) 2.48 × 10^3 kJ/mol
B) 2.30 × 10^6 kJ/mol
C) 6.92 × 10^8 kJ/mol
D) 7.20 × 10^{11} kJ/mol

Question 804

What is the approximate value of the equilibrium constant, K_n, for the neutralization of acetic acid with potassium hydroxide, shown in the equation below? The Ka for acetic acid is 1.8 × 10^{-5}.
\[
\text{CH}_3\text{CO}_2\text{H(aq)} + \text{KOH(aq)} \rightarrow \text{H}_2\text{O(l)} + \text{NaCH}_3\text{CO}_2(aq)
\]
A) 1.8 × 10^{-19}
B) 5.6 × 10^{-10}
C) 1.8 × 10^{-8}
D) 1.8 × 10^{9}

Question 805

To make a 3.00 m solution, one could take 3.00 moles of solute and add
A) 1.00 L of solvent.
B) 1.00 kg of solvent.
C) enough solvent to make 1.00 L of solution.
D) enough solvent to make 1.00 kg of solution.

Question 806

Which of the following would have a density of 1.89 g/L at 7.0°C and 0.987 atm?
A) Ar
B) CO_2
C) CO
D) O_2

Question 807

Which element has the least favorable (least negative) electron affinity?
A) Cl
B) S
C) Mg
D) As

Question 808

Carbon-14 has a half-life of 5715 years. Currently living organisms decay at a rate of 15.3 disintegrations/ min per gram of carbon. If an archeological artifact has a carbon-14 decay rate of 12.0 disintegrations/ min per gram of carbon, the approximate age of the artifact is ________ years old.

Question 809

The fraction of collisions with sufficient energy to react is equal to
A) A.
B) Ea.
C) e-Ea/RT.
D) p.

Question 810

According to the rule of thumb "like dissolves like" ionic solids like LiF or polar substances like glucose are more soluble in ________ solvents, whereas nonpolar substances like I2 are more soluble in ________ solvents.

Question 811

The greater the electronegativity difference between two bonded atoms, the
A) greater the bond order.
B) greater the covalent character of the bond.
C) greater the ionic character of the bond.
D) more unstable the bond.

Question 812

Which element of group 5A has the highest melting point?
A) nitrogen
B) white phosphorus
C) antimony
D) bismuth

Question 813

The volume of a well is 40.0 ft3. How many kilograms of concrete will it take to fill the well if the density of concrete is 2.85 g/cm3?
A) 3.47 kg
B) 3.23 × 103 kg
C) 3.47 × 103 kg
D) 3.23 × 106 kg

Question 814

The number of electrons in the ion K+ is ________.

Question 815

An old copper penny has a mass 3 × 1022 times that of a copper atom. Compare the de Broglie wavelength of a penny moving at 0.5 m/s to that of a copper atom moving 104 times as fast. The wavelength for the
A) copper atom is 3 × 1018 times that of the penny.
B) copper atom is 3 × 1026 times that of the penny.
C) penny is 3 × 1018 times that of the copper atom.
D) penny is 3 × 1026 times that of the copper atom.
Question 816
What is the molar solubility of AgCl in 0.50 M NaCN if the colorless complex ion Ag(CN)2- forms? Ksp for AgCl is 1.8 × 10^-10 and Kf for Ag(CN)2- is 1.0 × 1021.
A) 0.25 M
B) 0.50 M
C) 1.0 M
D) 2.0 M

Question 817
The ratio of oxygen atoms to silicon atoms in orthosilicate, single-strand silicates, double-strand silicates, and cyclic silicates is ________, ________, ________, and ________, respectively.

Question 818
A proton hydrated by ten water molecules has the formula ________.

Question 819
The decomposition of ammonia is: 2 NH3(g) = N2(g) + 3 H2(g). If Kp is 1.5 × 10^3 at 400°C, what is the partial pressure of ammonia at equilibrium when N2 is 0.40 atm and H2 is 0.15 atm?
A) 9.0 × 10^-7 atm
B) 9.5 × 10^-4 atm
C) 1.1 × 10^3 atm
D) 1.1 × 10^6 atm

Question 820
An acidic solution at 25°C has
A) [H3O+] > [OH-] > 1 × 10^-7 M.
B) [H3O+] > 1 × 10^-7 M > [OH-].
C) [H3O+] = [OH-] > 1 × 10^-7 M.
D) [H3O+] < 1 × 10^-7 M > [OH-].

Question 821
Which one of the following gases will have the lowest rate of effusion?
A) Ne
B) NO2
C) Ar
D) SO2

Question 822
You are given two flasks of equal volume. One contains H2 at 0°C and 1 atm while the other contains CO2 at 25°C and 2 atm. Which of the following quantities will be the same for both flasks?
A) average molecular kinetic energy
B) average molecular speed
C) density
D) number of molecules present

Question 823
How much energy is released for alpha decay of 236U? The masses of 4He, 232Th, and 236U are 4.002604, 232.038124, and 236.045637 amu, respectively.
A) 1.473 × 108 kJ/mol
B) 4.418 × 108 kJ/mol
C) 4.909 × 108 kJ/mol
Question 824

If the reaction of phosphate ion with water is ignored, what is the total concentration of ions in a solution prepared by dissolving 3.00 g of Na₃PO₄ in enough water to make 350. mL of solution?

A) 0.0183 M  
B) 0.209 M  
C) 0.0523 M  
D) 0.323 M


Question 825

A balloon filled with helium gas at 20°C occupies 2.91 L at 1.00 atm. The balloon is immersed in liquid nitrogen at -180°C, raising the pressure to 5.20 atm. What is the volume of the balloon in the liquid nitrogen?

A) 0.178 L  
B) 5.62 L  
C) 5.04 L  
D) 0.199 L


Question 826

Which of the compounds H₃PO₄, Mg(OH)₂, LiOH, and HCl, behave as bases when they are dissolved in water?

A) Mg(OH)₂ and LiOH  
B) H₃PO₄ and HCl  
C) only HCl  
D) only LiOH


Question 827

Which of the following gases has the lowest average speed at 25°C?

A) He  
B) BF₃  
C) H₂  
D) NH₃


Question 828

What is the mass of a single astatine molecule, At₂?

A) 3.49 × 10⁻²² g  
B) 6.97 × 10⁻²² g  
C) 210 g  
D) 420 g


Question 829

A light emitting diode with a band gap of 181 kJ/mol emits light in what region of the electromagnetic radiation spectrum?

A) infrared  
B) ultraviolet  
C) visible - blue  
D) visible - red


Question 830

At some temperature, a 4.0 L flask is found to contain 10.0 mol of CO₂, 8.0 mol of C, and 10.0 mol of CO, at equilibrium. What is the value of the equilibrium constant, K_c, for this reaction?

A) 1.25  
B) 0.50  
C) 0.40  
D) 2.50
Question 831

The volume of 350. mL of gas at 25°C is decreased to 125 mL at constant pressure. What is the final temperature of the gas?
A) -167°C  
B) 8.9°C  
C) 70°C  
D) 561°C  

Question 832

Calculate the mass defect for the formation of phosphorus-31. The mass of a phosphorus-31 nucleus is 30.973765 amu. The masses of a proton and a neutron are 1.00728 and 1.00866 amu, respectively.
A) 0.13015 amu  
B) 0.15404 amu  
C) 0.27261 amu  
D) 0.27399 amu  

Question 833

The burning of sulfur-containing coal can lead to the formation of ________ which is emitted into the atmosphere.

Question 834

Some assumptions from the kinetic molecular theory are listed below. Which one is most frequently cited to explain Charles' law?
A) The average kinetic energy of gas particles is proportional to the Kelvin temperature.  
B) Collisions of gas particles are elastic and total kinetic energy of the gas is constant.  
C) A gas consists of tiny particles moving in random straight line motion.  
D) The volume of the particles is negligible compared to the volume of the gas.  

Question 835

A piece of metal ore weighs 8.50 g. When a student places it into a graduated cylinder containing water, the liquid level rises from 21.25 mL to 26.47 mL. What is the density of the ore?
A) 0.321 g/mL  
B) 0.614 g/mL  
C) 1.63 g/mL  
D) 3.11 g/mL  

Question 836

The number of neutrons in Fe2+ is
A) 26.  
B) 36.  
C) 60.  
D) 62.  

Question 837

What is the density of carbon monoxide gas at STP?
A) 0.510 g/L  
B) 0.800 g/L  
C) 1.96 g/L  
D) 1.25 g/L  

Question 838

Which of the following three sets consist of atoms or ions with the same electron configuration in the ground state?
s (I) O2-, Ne, and Mg2+
Question 839
Assume that you start with a mixture containing 0.80 mol of decane and 0.20 mol of octane, what is the vapor composition at the boiling point?
A) 100% decane
B) composition at point b
C) composition at point c
D) composition at point e

Question 840
What is the geometric shape of the hydrated proton; that is, the hydronium ion H3O+?
A) angular
B) trigonal pyramidal
C) trigonal planar
D) tetrahedral

Question 841
The reaction CaCO3(s) <-- --> CaO(s) + O2(g) is endothermic 298 K. The effect of increasing the total volume of the system at equilibrium will ______ (decrease, increase, have no effect on) the total quantity of CaCO3 once equilibrium is reestablished.

Question 842
The decomposition of nitrosyl bromide is exothermic: 2 NOBr(g) <-- --> 2 NO(g) + Br2(g). Which of the following changes in reaction condition will shift the reaction to the left?
A) remove NO
B) decrease the temperature
C) decrease the pressure
D) None of these

Question 843
When 12.0 g of zinc metal reacts with excess HCl, how many liters of H2 gas are produced at STP?
A) 0.243 L
B) 0.486 L
C) 4.11 L
D) 8.23 L

Question 844
Naproxen is a commercially important anti-inflammatory agent that can be isolated from the thyroid gland. A solution of 1.138 g of naproxen in 25.00 g benzene has an osmotic pressure of 4.00 atm at 20°C. The density of benzene is 0.8787 g/mL at this temperature. Calculate the molar mass of naproxen, assuming it remains intact upon dissolution and the density of the solution equals the density of pure benzene.
A) 176 g/mol
B) 230 g/mol
C) 307 g/mol
D) 3.80 × 105 g/mol

Question 845
What is the name of the complex [Ni(en)3][Cr(CN)6]? 
A) ethylenediaminenickel(III) hexacyanochromate(II)
B) tris(ethylenediamine)nickel(III) hexacyanochromate(II)
Question 846

Which of the following gases has the highest average speed at 400K?
A) NO2
B) SO2
C) OF2
D) SF6


Question 847

A sample of pure lithium chloride contains 16% lithium by mass. What is the % lithium by mass in a sample of pure lithium carbonate that has twice the mass of the first sample?
A) 8.20%
B) 16.4%
C) 32.8%
D) 65.6%


Question 848

Keratin is found in
A) cells.
B) bird feathers.
C) muscles.
D) DNA.


Question 849

Which one of the following binary oxides is the most covalent?
A) Li2O
B) BaO
C) SiO2
D) Br2O5


Question 850

Which one of the following contains 52% carbon by mass?
A) C2H2
B) CH4
C) CH3OCH3
D) CO2


Question 851

Rank the following elements in order of increasing effective nuclear charge: Na, Mg, Cl, and S.
A) S < Cl < Mg < Na
B) Cl < Mg < Na < S
C) Mg < Na < Cl < S
D) Na < Mg < Cl < S


Question 852

Which compound has carbon with a negative oxidation number?
A) CO2
B) CaC2
C) HCN
D) Li2CO3

Question 853

What is the pH of a solution made by mixing 30.00 mL of 0.10 M acetic acid with 45.00 mL of 0.100 M KOH? Assume that the volumes of the solutions are additive. Ka = 1.8 × 10⁻⁵ for CH₃CO₂H.

A) 8.26  
B) 9.26  
C) 11.13  
D) 12.30  

Question 854

Na₂O is named

A) sodium dioxide.  
B) sodium oxide.  
C) sodium(II) oxide.  
D) sodium oxygen.  

Question 855

The ion NO₂⁻ is named

A) nitrate ion.  
B) nitrite ion.  
C) nitrogen dioxide ion.  
D) nitrogen(II) oxide ion.  

Question 856

Who discovered the phenomenon of superconductivity in 1911?

A) J. G. Bednorz  
B) R. B. Fuller  
C) K. A. Müller  
D) H. K. Onnes  

Question 857

Which one of the following amino acids contains a hydrophobic side chain?

A) leucine  
B) cysteine  
C) glutamine  
D) lysine  

Question 858

What reagent would distinguish between Ag⁺ and Fe³⁺?

A) NaClO₃  
B) NaI  
C) NaNO₃  
D) NaOH  

Question 859

If Kc = 7.04 × 10⁻² for the reaction: 2 HBr(g) ⇌ H₂(g) + Br₂(g), what is the value of Kc for the reaction: ?

A) 3.52 × 10⁻²  
B) 0.265  
C) 3.77  
D) 28.4  

Question 860
If additional SCN⁻ is added to the equilibrium system shown below, Le Châtelier's principle predicts a net reaction from ________ to ________, causing the red color to become ________.

\[ \text{Fe}^{3+} (aq) + \text{SCN}^- (aq) \rightleftharpoons \text{Fe}^{2+}(aq) \]

*Answer: yellow to colorless and red*  Question 861

What is the pH of a solution made by mixing 5.00 mL of 0.10 M acetic acid with 5.00 mL of 0.10 M KOH? Assume that the volumes of the solutions are additive. \( K_a = 1.8 \times 10^{-5} \) for \( \text{CH}_3\text{CO}_2\text{H} \).

- A) 5.28
- B) 7.00
- C) 8.72
- D) 10.02


When baking soda is heated it decomposes according to the following reaction:

\[ 2 \text{NaHCO}_3(s) \rightleftharpoons \text{Na}_2\text{CO}_3(s) + \text{H}_2\text{O}(g) + \text{CO}_2(g) \]

If sufficient baking soda is placed in a container and heated to 90°C, the total pressure of the gases is 0.5451 atm. What is the value of \( K_p \) at that temperature?

- A) 0.07428
- B) 0.2973
- C) 0.4228
- D) 1.091


A 0.50 m solution of which solute has the largest van’t Hoff factor?

- A) CaF₂
- B) Li₃PO₄
- C) K₂CO₃
- D) NaNO₃


What is the molar concentration of sodium ions in a 0.350 M Na₃PO₄ solution?

- A) 0.117 M
- B) 0.350 M
- C) 1.05 M
- D) 1.40 M


Which one of the following salts, when dissolved in water, produces the solution with the highest pH?

- A) KHSO₄
- B) RbClO₄
- C) BaO
- D) CH₃CH₃NH₃Br


Lithium reacts with oxygen to form an oxide with the formula ________.


What is the ground state valence shell electron configuration of a group 4A element?

- A) ns0 np4
- B) ns1 np3
- C) ns2 np2
- D) ns2 np4
Question 868

What is the pH of a solution prepared by mixing 100.00 mL of 0.025 M Ca(OH)₂ with 50.00 mL of 0.080 M LiOH? Assume that the volumes are additive.
A) 12.67  
B) 12.78  
C) 12.95  
D) 13.25

Question 869

A binding energy curve is a plot of binding energy per nucleon versus atomic number. In what region of the binding curve are the most stable elements found?
A) in the lower left region (low atomic mass)  
B) in the central top region (moderate atomic mass)  
C) in the lower right region (heavy atomic mass)  
D) binding energy is not dependent on atomic mass

Question 870

Using exponential notation, there are ________ g in 1.5 mg.

Question 871

Which element of group 4A has the highest melting point?
A) C  
B) Si  
C) Sn  
D) Pb

Question 872

What is the highest possible oxidation state for vanadium?
A) +2  
B) +3  
C) +4  
D) +5

Question 873

What is the approximate value of the equilibrium constant, Kᵢ, for the neutralization of pyridine with hydrochloric acid, shown in the equation below?
The Kb for pyridine is 1.8 × 10⁻⁹.
HCl(aq) + C₅H₅N(aq) ⇌ C₅H₅NHCl(aq)
A) 5.6 × 10⁻¹₀  
B) 5.6 × 10⁻⁶  
C) 1.8 × 10⁵  
D) 5.6 × 10⁸

Question 874

What statement is not consistent with the chemistry of lead?
A) It has the highest density of the group 4A elements.  
B) It is commonly used as a fuel additive in gasoline to boost the octane rating.  
C) It is obtained from its ore galena (PbS) by roasting in air and then by reduction with carbon monoxide.  
D) It is used in making pipes, cables, paint pigments and electrodes for storage batteries.

Question 875
None of the listed compounds contains a ring. Which could have one carbon-carbon double bond?

A) C9H20
B) C2H2
C) C3H6
D) All of these


Question 876

Which one of the following is a p-type of semiconductor?

A) germanium doped with antimony
B) germanium doped with boron
C) tellurium
D) YBa2Cu3O7


Question 877

What is the pH of a buffered system made by dissolving 17.42 g of KH2PO4 and 20.41 g of K2HPO4 in water to give a volume of 200.0 mL? The Ka2 for dihydrogen phosphate is 6.2 × 10^-8 and the equilibrium reaction of interest is:

\[ \text{H}_2\text{PO}_4^-(aq) + \text{H}_2\text{O}(l) \leftrightarrow \text{H}_3\text{O}^+(aq) + \text{HPO}_4^{2-}(aq). \]

A) 7.03
B) 7.17
C) 7.38
D) 7.58


Question 878

What is an example of the proper number of bonds to carbon?

A) two double bonds
B) one double bond + one triple bond
C) three single bonds
D) five single bonds


Question 879

The partial pressures of CH4, N2, and O2 in a sample of gas were found to be 143 mmHg, 469 mmHg, and 251 mmHg, respectively. Calculate the mole fraction of oxygen.

A) 0.410
B) 0.291
C) 2.44
D) 22.4


Question 880

Which of the following is a peroxide?

A) Li2O
B) K2O2
C) CaO
D) CsO2


Question 881

The number of cm in 1.0 in is closest to

A) 1.0
B) 1.5
C) 2.0
D) 2.5


Question 882

The number of sp2 hybrid orbitals on the carbon atom in CO32- is
Question 883

The alkali metals K, Rb, and Cs are commercially produced by
A) chemical reduction of their molten salts.
B) electrolysis of their molten salts.
C) thermal decomposition of their molten metal halides.
D) thermal decomposition of their molten metal oxides.

Question 884

Which of the following molecules does not have a dipole moment?
A) CBr2=CBr2
B) NCl3
C) CH3NH2
D) HCl

Question 885

How many electrons can a single orbital hold?
A) 2n
B) 2
C) 2l + 1
D) 8

Question 886

Which is not true about elemental oxygen?
A) Oxygen exists in two allotopic forms.
B) Oxygen has a double bond.
C) Oxygen is a reducing agent.
D) Solid oxygen melts at -219 degrees Celsius.

Question 887

The oxidation numbers of nitrogen in NH4NO3 are ________ and ________.

Question 888

An interpretation of the results of many tests is called
A) an experiment.
B) a hypothesis.
C) a prediction.
D) a theory.

Question 889

What is the deBroglie wavelength in meters of a 1-ton (907 kg) vehicle having a velocity of 95 km/hr?

Question 890

When a cell reaction reaches equilibrium,
A) \( E^0 = 0 \).
B) \( E = 0 \).
C) both \( E^0 \) and \( E = 0 \).
Question 891

The solid compound, Na2CO3, contains
A) Na+, C4+, and O2- ions.
B) Na+ ions and CO32- ions.
C) Na2+ and CO32- ions.
D) Na2CO3 molecules.

Question 892

A solution with a hydroxide ion concentration of 4.15 × 10^-4 M is ________ and has a hydrogen ion concentration of ________.
A) acidic, 2.41 × 10^-10 M
B) acidic, 2.41 × 10^-11 M
C) basic, 2.41 × 10^-10 M
D) basic, 2.41 × 10^-11 M

Question 893

Combustion analysis of an unknown compound containing only carbon and hydrogen produced 2.845 g of CO2 and 1.744 g of H2O. What is the empirical formula of the compound?
A) CH2
B) CH3
C) C4H10
D) C5H2

Question 894

An equilibrium mixture of CO, O2 and CO2 at a certain temperature contains 0.0010 M CO2 and 0.0020 M O2. At this temperature, Kc equals 1.4 × 10^2 for the reaction:
2 CO(g) + O2(g) <-- --> 2 CO2(g).
What is the equilibrium concentration of CO?
A) 3.6 × 10^-6 M
B) 1.9 × 10^-3 M
C) 7.0 × 10^-2 M
D) 2.6 × 10^-1 M

Question 895

Atomic radius of main-group elements generally
A) increases from left to right across a period and increases down a group.
B) increases from left to right across a period and decreases down a group.
C) decreases from left to right across a period and increases down a group.
D) decreases from left to right across a period and decreases down a group.

Question 896

Which substance is the best conductor of electricity?
A) diamond
B) germanium
C) gold
D) phosphorus

Question 897

________ does not combine with any other element.
A) Chlorine
B) Nitrogen
C) Helium
### Question 898

Which element of group 5\(\text{A}\) has the most basic oxide?

- A) N
- B) P
- C) As
- D) Bi


### Question 899

The best oxidizing agents are found at the ________ of the activity series.


### Question 900

Classify bonds in BeS as largely ionic, nonpolar covalent, or polar covalent.


### Question 901

An unknown gas contains 83\% C and 17\% H by mass. If effuses at 0.87 times the rate of CO\(_2\) gas under the same conditions. What is the molecular formula of the unknown gas?

- A) C\(_2\)H\(_5\)
- B) C\(_3\)H\(_3\)
- C) C\(_4\)H\(_{10}\)
- D) C\(_7\)H\(_{17}\)


### Question 902

Neptunium-239 has a half-life of 2.35 days. How many days must elapse for a sample of 239Np to decay to 3.00\% of its original quantity?

- A) 0.0841 days
- B) 0.967 days
- C) 1.03 days
- D) 11.9 days


### Question 903

In a periodic table rows are called ________ and columns are called ________.


### Question 904

Which of the following is a part of Dalton's atomic theory?

- A) Atoms are rearranged but not changed during a chemical reaction.
- B) Atoms break down during radioactive decay.
- C) Atoms contain protons, neutrons, and electrons.
- D) Isotopes of the same element have different masses.


### Question 905

What substance has a rating of 10 on the Mohs hardness scale?

- A) beryllia
- B) silicon carbide
- C) diamond
- D) aluminum


### Question 906

The horizontal rows of the periodic table are called

- A) groups.
Question 907

Gaseous elements characterized by low reactivity are found in group ______ of the periodic table.
A) 5A
B) 6A
C) 7A
D) 8A

Question 908

A reaction is second order in NO and first order in O2 has a rate constant, k = 1.4 × 104 M⁻²s⁻¹. What is the initial rate of reaction when the concentrations of NO and O2 are 0.015 M and 0.030 M, respectively?

Question 909

Calculate the concentration of bicarbonate ion, HCO₃⁻, in a 0.010 M H₂CO₃ solution that has the stepwise dissociation constants Ka₁ = 4.3 × 10⁻⁷ and Ka₂ = 5.6 × 10⁻¹¹.
A) 6.6 × 10⁻⁵ M
B) 4.3 × 10⁻⁷ M
C) 4.3 × 10⁻⁹ M
D) 5.6 × 10⁻¹¹ M

Question 910

The increased viscosity of molten sulfur at 160-195°C is due to the
A) melting of S₈ to give discrete S₈ units.
B) merging of the S₈ rings to give interlocking S₈ rings.
C) opening of the S₈ rings to give smaller S units.
D) opening of the S₈ rings which then polymerize into long chains.

Question 911

The effects of ionizing radiation depend on
A) length of exposure to radiation.
B) location of source (internal or external).
C) type and energy of radiation.
D) All of these

Question 912

The number of electrons that half fill a composite s-d band is ________.

Question 913

Nonoxide ceramics include silicon nitride, the formula of which is ________.

Question 914

The electronegativity value of C is 2.5 while the electronegativity value of F is 3.98. What is the expected electronegativity value for the C-F bond?
A) 0
B) 6.48
C) 1.48
D) -1.48
Question 915

Which of the compounds of H NO₂, Ra(OH)₂, FrOH, and HI, behave as acids when they are dissolved in water?
A) Ra(OH)₂ and FrOH
B) H NO₂ and HI
C) only HI
D) only FrOH

Question 916

When methane, CH₄, undergoes combustion with oxygen, the usual products are carbon dioxide and water. Carbon monoxide is formed when the limiting reactant is
A) carbon dioxide.
B) methane.
C) oxygen.
D) water.

Question 917

At 25°C the vapor pressures of benzene and toluene are 96.0 mm Hg and 30.5 mm Hg, respectively. When a 1:1 molar mixture of benzene and toluene is fractionally distilled, the first fraction will have a mole fraction of benzene that is ________ (equal to, greater than, less than) 0.50.

Question 918

What is the mole fraction of ethanol in a solution made by dissolving 25.0 g of ethanol, C₂H₅OH, in 53.6 g of water?
A) 0.154
B) 0.846
C) 0.214
D) 0.272

Question 919

Which of the following changes in reaction conditions will alter the composition of an equilibrium mixture of gases for a reaction having unequal moles of gaseous products and gaseous reactants?
A) adding of products
B) decreasing the volume
C) increasing the temperature
D) All of these will alter the equilibrium concentrations.

Question 920

What oxidation state(s) is(are) exhibited by all first row transition elements except scandium?
A) +2
B) +3
C) +2 and +3
D) +2, +3 and +4

Question 921

The element that forms a 2+ ion with the electron configuration [Xe] 4f¹⁴ 5d⁸ is ________.

Question 922

Acids donate protons to water according to the general equation:
HA(aq) + H₂O(l) ←→ H₃O⁺(aq) + A⁻(aq)
Consider the following acids and their equilibrium constants for reaction with water at 25°C. If all the acids have the same initial concentration, which is the strongest acid (i.e. which donates the most protons to water)?
A) HBrO, Kc = 2.0 × 10⁻⁹
B) HNO₂, Kc = 4.5 × 10⁻⁴
C) HF, \( K_c = 3.5 \times 10^{-4} \)
D) HIO₃, \( K_c = 1.7 \times 10^{-1} \)

**Question 923**

The pH of a 0.055 M KOH solution is ________.

**Question 924**

Determine the acid dissociation constant for a 0.010 M nitrous acid solution that has a pH of 2.70. Nitrous acid is a weak monoprotic acid and the equilibrium equation of interest is

\[ \text{HNO}_2(aq) + \text{H}_2\text{O}(l) \rightleftharpoons \text{H}_3\text{O}^+(aq) + \text{NO}_2^-(aq). \]

A) \( 8.0 \times 10^{-3} \)
B) \( 2.0 \times 10^{-3} \)
C) \( 5.0 \times 10^{-4} \)
D) \( 4.0 \times 10^{-4} \)

**Question 925**

In an acid-base neutralization reaction 23.74 mL of 0.400 M sodium hydroxide reacts with 50.00 mL of sulfuric acid solution. What is the concentration of the H₂SO₄ solution?

A) 0.0950 M
B) 0.190 M
C) 0.380 M
D) 0.760 M

**Question 926**

Assume that the vapor at point c is condensed and reboiled. What is the boiling point?
A) temperature at point b
B) temperature at point c
C) temperature at point d
D) temperature at point f

**Question 927**

Formaldehyde is a carcinogenic volatile organic compound with a permissible exposure level of 0.75 ppm. At this level, how many grams of formaldehyde are permissible in a 6.0-L breath of air having a density of 1.2 kg/m³?

A) \( 3.8 \times 10^{-2} \) g formaldehyde
B) \( 5.4 \times 10^{-6} \) g formaldehyde
C) 3.8 g formaldehyde
D) 5.4 g formaldehyde

**Question 928**

What is the pH at the equivalence point of a weak base-strong acid titration if 20.00 mL of NaOCl requires 28.30 mL of 0.50 M HCl? \( Ka = 3.0 \times 10^{-8} \) for HOCl.

A) 0.30
B) 3.18
C) 3.76
D) 4.03

**Question 929**

Which compound contains a nitrogen and a C=O?
A) ether
B) amide
C) carboxylic acid
D) alkene
Question 930
Convert 10,000 cm³ to m³.
A) 1 × 10⁻² m³
B) 1 × 10² m³
C) 1 × 10⁶ m³
D) 1 × 10¹⁰ m³

Question 931
Which has the highest standard molar entropy at 25°C?
A) P(s)
B) P(l)
C) P(g)
D) All three should have a standard molar entropy of zero.

Question 932
A positron is
A) n.
B) p.
C) e.
D) e.

Question 933
What is the strongest acid among the following?
A) H₂SO₃
B) H₂SO₄
C) H₂SeO₂
D) H₂TeO₄

Question 934
Under which of the following conditions would one mole of Ne have the highest entropy, S?
A) 29°C and 26 L
B) 135°C and 26 L
C) 29°C and 34 L
D) 135°C and 34 L

Question 935
What mass of carbon monoxide, CO, contains the same number of molecules as 3.00 g of trichlorofluoromethane, CCl₃F?
A) 3.00 g
B) 0.612 g
C) 1.63 g
D) 9.33 g

Question 936
The electronegativity for both sulfur and carbon is 2.5. Therefore the compound CS₂ would be expected to
A) be ionic with C as the anion.
B) be ionic with C as the cation.
C) have nonpolar covalent bonds between C and S.
D) have polar covalent bonds between C and S.

Question 937
Of the following, which atom has the largest atomic radius?
Question 938
What statement is not representative of the chemistry of H2S?
A) It has a tetrahedral geometry.
B) It is an extremely toxic substance.
C) It is a weak diprotic acid.
D) It is a weak reducing agent.

Question 939
In the shorthand notation for a galvanic cell, a single vertical line (|) represents a ________, and a double vertical line (|| ) represents a ________.

Question 940
For a galvanic cell, the cathode has a ________ sign and is the site of ________.
A) negative, oxidation
B) negative, reduction
C) positive, oxidation
D) positive, reduction

Question 941
Which acid solution has the lowest pH?
A) HX
B) HY
C) HZ
D) All have the same pH.

Question 942
What is the molecular geometry of SCl4?
A) seesaw
B) square planar
C) square pyramidal
D) tetrahedral

Question 943
Some assumptions from the kinetic molecular theory are listed below. Which one is most frequently cited to explain diffusion of a gas?
A) The average kinetic energy of gas particles is proportional to the Kelvin temperature.
B) Collisions of gas particles are elastic and total kinetic energy of the gas is constant.
C) A gas consist of tiny particles moving in random straight line motion.
D) The volume of the particles is negligible compared to the volume of the gas.

Question 944
What type of substances exhibit an increase in conductivity with an increase in temperature?
A) both metals and semiconductors
B) only insulators
C) only metals
D) only semiconductors

Question 945
Which is a third transition series element?
A) B
B) Mg
C) Y
D) Ta

Question 946

What is the percent dissociation of glycine if the solution has a pH = 8.60 and a pKa = 9.60?
A) 50%
B) 9%
C) 5%
D) 1%

Question 947

What is the pH of a solution prepared by mixing 25.00 mL of 0.10 M methylamine, CH₃NH₂, with 25.00 mL of 0.10 M methylammonium chloride, CH₃NH₃Cl? Assume that the volume of the solutions are additive and that Kb = 3.70 x 10⁻⁴ for methylamine.
A) 10.27
B) 10.57
C) 10.87
D) 11.78

Question 948

List the elements Na, Ca, Rb, Cl, He in order of decreasing first ionization energy.
A) He > Cl > Ca > Na > Rb
B) He > Na > Ca > Cl > Rb
C) He > Na > Cl > Ca > Rb
D) Rb > Ca > Cl > Na > He

Question 949

In order for a cell potential to be a standard cell potential, the concentration of all ions in solution must be ________ M, the partial pressures of all gaseous species must be ________ atm, and the temperature must be ________ K.

Question 950

In the protein, Asn-Phe-Cys-Lys, which amino acid contains the C-terminal group?
A) asparagine
B) cysteine
C) lysine
D) phenylalanine

Question 951

Which is the strongest oxidizing agent under acidic conditions?
A) Cr²⁺
B) Cr³⁺
C) CrO₄²⁻
D) Cr₂O₇²⁻

Question 952

Chlorine belongs to the ________ group of the periodic table.
A) alkali metal
B) alkaline earth metal
C) halogen
D) noble gas
| Question 953 | The number of electrons in the ion C\(^{-}\) is \[\_\_\_\_\_\_\_\].

| Question 954 | If the entropy of a collection of molecules in 5000 boxes is \(1.76 \times 10^{-20}\) J/K, how many molecules are there?

| Question 955 | Which one of the following compounds that contains a Group 5A element is least likely to exist?
| A) NBr3
| B) NBr5
| C) PBr3
| D) PBr5

| Question 956 | What is the molarity of chloride ions when 10.4 grams of MgCl\(_2\) is dissolved in 753 mL of water?
| A) 0.00 M
| B) 0.145 M
| C) 0.000290 M
| D) 0.290 M

| Question 957 | For a reaction that follows the general rate law, Rate = \(k[A][B]^2\), what will happen to the rate of reaction if the concentration of B is increased by a factor of 2.00? The rate will
| A) decrease by a factor of 1/4.00.
| B) decrease by a factor of 1/2.00.
| C) increase by a factor of 2.00.
| D) increase by a factor of 4.00.

| Question 958 | If NO\(_2\) and NH\(_3\) are allowed to effuse through a porous membrane under identical conditions, the rate of effusion for NH\(_3\) will be \[\_\_\_\_\_\_\_\_] times that of CO\(_2\).
| A) 0.37
| B) 0.61
| C) 1.6
| D) 2.7

| Question 959 | What is the molecular geometry of TeBr\(_4\)?
| A) seesaw
| B) square planar
| C) square pyramidal
| D) tetrahedral

| Question 960 | When silver nitrate reacts with barium chloride, silver chloride and barium nitrate are formed. How many grams of silver chloride are formed when 8.0 g of silver nitrate reacts with 15.0 g of barium chloride?
| A) 6.752 g
| B) 9.40 g
| C) 11.9 g
| D) 18.8 g
Question 961

Which of the following elements has the least tendency to form an ion?
A) Be  
B) H  
C) He  
D) O  

Question 962

When 2.36 g of a nonvolatile solute is dissolved in 100 g of solvent, the largest change in freezing point will be achieved when the solvent is
A) paradichlorobenzene, K_f = 7.10.  
B) tert-butanol, K_f = 9.1.  
C) water, K_f = 1.86.  
D) All are expected to have the same freezing point.  

Question 963

The reaction CaCO_3(s) <-> CaO(s) + O_2(g) is endothermic at 298 K. The effect of increasing the partial pressure of O_2 in the system at equilibrium will ______ (decrease, increase, have no effect on) the total quantity of CaCO_3 once equilibrium is reestablished.  

Question 964

In a solution that is 75% ethyl alcohol and 25% water, the solute is ______ and the solvent is ______.  

Question 965

Potassium hydrogen phthalate (molar mass = 204.2 g/mol) is one of the most commonly used acids for standardizing solutions containing bases. KHP is a monoprotic weak acid with  
Calculate the pH of the solution that results when 0.40 g of KHP is dissolved in enough water to produce 25.0 mL of solution.  
A) 2.10  
B) 3.26  
C) 4.30  
D) 5.41  

Question 966

What is the number of moles of 5.00 × 10^{22} molecules of NaBr?  
A) 0.037 moles  
B) 1.0 moles  
C) 0.083 moles  
D) 1.2046 moles  

Question 967

_______ energy is the kinetic energy of molecular motion.  

Question 968

What is the IUPAC name for the continuous carbon chain of C_4H_{10}?  
A) butane  
B) methane  
C) butene  
D) octyne  

Question 969

Three atoms have the following properties.  
ProtonNeutronElectron
Atom X: 119
Atom Y: 118
Atom Z: 118

The elements X and Y are best described as:
A) isotopes.
B) cations.
C) different elements.
D) anions.

Question 970
What is the O—S—O bond angle in SO3?
A) less than 109.5°
B) 109.5°
C) 120°
D) greater than 120°

Question 971
Which substance is the best conductor of electricity?
A) bromine
B) diamond
C) tungsten
D) xenon

Question 972
Which of the following represent electron configurations that are allowed but do not represent ground-state configurations?
(A) [Ne]3s13p5
(B) [Kr]4d125s25p5
(C) [Ar]3d104s24p2
A) only (A)
B) only (B)
C) (A) and (B)
D) (B) and (C)

Question 973
A solution is prepared by dissolving 20.0 g of sucrose, C12H22O11, in 250. g of water at 25°C. What is the vapor pressure of the solution if the vapor pressure of water at 25°C is 23.76 mm Hg?
A) 0.198 mm Hg
B) 20.5 mm Hg
C) 23.7 mm Hg
D) 24.0 mm Hg

Question 974
According to the Bohr model of the atom, when an electron goes from a higher-energy orbit to a lower-energy orbit, it ________ electromagnetic energy with an energy that is equal to the ________ between the two orbits.

Question 975
What is the chemical formula for the superoxide ion?
A) O-
B) O2-
C) O2-
D) O22-

Question 976
What two transition elements have the highest electrical conductivity of any elements at room temperature?
A) copper and zinc
Question 977

Platinum in the catalytic converter of an automobile catalyzes the conversion of CO to CO2 is an example of a ________ catalyst.
A) heterogeneous
B) homogeneous

Question 978

For Cu2+ and CO2, which will behave as a Lewis acid toward OH- in water?
A) only Cu2+
B) only CO2
C) Cu2+ and CO2
D) neither Cu2+ nor CO2

Question 979

The octet rule is most likely to fail occasionally for which of the following elements?
A) C
B) Ca
C) Li
D) P

Question 980

Bromothymol blue indicator changes color from yellow at a pH of 6.0 to blue at a pH of 7.6. Methyl red indicator changes color from red at a pH of 4.4 to yellow at a pH of 6.2. A sample of saliva having [H3O+] = 6.3 × 10⁻⁷ would impart a ________ color to bromothymol blue and a ________ color to methyl red.

Question 981

Which element can form more than one kind of monatomic ion?
A) Sr
B) Al
C) Sn
D) O

Question 982

What is the overall reaction order for the reaction that has the rate law: Rate = k[H2][NO]2?
A) zero order
B) first order
C) second order
D) third order

Question 983

Which compound exhibits pi bonding?
A) I2
B) C2
C) P4
D) S8

Question 984

How many anions are there in 4.50 g of MgBr2?
A) 1.47 × 10²² anions

Question 985

Which element can form more than one kind of monatomic ion?
A) Sr
B) Al
C) Sn
D) O

Question 986

What is the overall reaction order for the reaction that has the rate law: Rate = k[H2][NO]²?
A) zero order
B) first order
C) second order
D) third order

Question 987

Which compound exhibits pi bonding?
A) I₂
B) C₂
C) P₄
D) S₈

Question 988

How many anions are there in 4.50 g of MgBr₂?
A) 1.47 × 10²² anions
Question 985
What are the most abundant mineral in the earth’s crust?
A) silicates
B) iodides
C) sulfates
D) oxides

Question 986
The difference between the boiling point and freezing point of water is 100°C, which is ________ kelvins.

Question 987
Compounds that have the same formula but different molecular structures are called
A) isoelectronic.
B) isomers.
C) isotones.
D) isotopes.

Question 988
What is the coordination number of Si in SiC that has a diamond-like structure?
A) 1
B) 2
C) 4
D) 6

Question 989
Wollastonite, CaSiO3, is an example of a(n) ________ silicate.

Question 990
What is a principal commercial ore for the element aluminum?
A) bauxite
B) chalcopyrite
C) galena
D) rutile

Question 991
Which of the following elements would you expect to have the largest number of stable isotopes? Element number:
A) 48
B) 49
C) 50
D) 51

Question 992
Which electrostatic forces hold atoms together in a molecule?
A) electron-electron forces
B) electron-nucleus forces
C) nucleus-nucleus forces
D) all three forces
Question 993
If CO2 and NH3 are allowed to effuse through a porous membrane under identical conditions, the rate of effusion for NH3 will be ________ times that of CO2.
A) 0.39
B) 0.62
C) 1.6
D) 2.6

Question 994
Calculate the freezing point of a solution of 30.0 g methyl salicylate, C_7H_6O_2, dissolved in 800. g of benzene, C_6H_6. K_f for benzene is 5.10°C/m and the freezing point is 5.50°C for benzene.
A) -1.56°C
B) 1.56°C
C) 3.93°C
D) 7.06°C

Question 995
Copper has the anomalous electron configuration ________.

Question 996
What does the term "alpha" amino acid mean?
A) The amino group attaches to the carbon in the carboxyl group.
B) The amino group attaches to the carbon next to the carboxylic acid group.
C) The amino acid contains only one carbon atom.
D) The amino acid contains only one carboxylic acid group.

Question 997
At 20°C and 0.28 atm pressure Xenon has a solubility in water of 1.4 mmol/L. What is the Henry’s Law-constant in mol/ L•atm at 20°C?

Question 998
A tortoise moves at a speed of 454 cm/min. How fast is the tortoise in mph?
A) 0.17 mph
B) 0.34 mph
C) 17 mph
D) 0.0017 mph

Question 999
How many isomers exist for C_5H_12? Of these isomers, how many are straight-chain isomers and how many are branched isomers?

Question 1000
The equilibrium constant is equal to 5.00 at 1300 K for the reaction:
2 SO_2(g) + O_2(g) <-- --> 2 SO_3(g).
If initial concentrations are [SO_2] = 3.60 M, [O_2] = 0.45 M, and [SO_3] = 5.40 M, the system is
A) at equilibrium.
B) not at equilibrium and will remain in an unequilibrated state.
C) not at equilibrium and will shift to the left to achieve an equilibrium state.
D) not at equilibrium and will shift to the right to achieve an equilibrium state.

Question 1001
How many electrons are in the outermost shell of the Al³⁺ ion in its ground state?
A) 2
B) 3
C) 6
D) 8

Question 1002

Which of the following elements has the highest density?
A) Cr
B) Cu
C) Os
D) Re

Question 1003

Which metal ions can be precipitated out of solution as chlorides?
A) Ag⁺, Hg²⁺, Zn²⁺
B) Cu²⁺, Cd²⁺, Bi³⁺
C) Ag⁺, Hg²⁺, Pb²⁺
D) Na⁺, Li⁺, Ca²⁺

Question 1004

The molecules CH₃CH₂CH₂CH₂CH₃ and CH₃CH₂CH₂CH₂CH=CH₂, respectively, belong to the ________ family and the ________ family of organic molecules.

Question 1005

The number of neutrons in a neutral atom of uranium-238 is ________.

Question 1006

From the phase diagram above, the minimum pressure at which this substance can exist in the liquid phase is
A) 0.25 atm.
B) 0.45 atm.
C) 1.0 atm.
D) 1.2 atm.

Question 1007

What is the bond order of the O—O bond in O₂?
A) 0
B) 1
C) 2
D) 3

Question 1008

Which ligand when bonded to a metal would be incorrectly named?
A) H₂O, aqua
B) NH₃, carbonyl
C) CO, carbonyl
D) I⁻, iodo

Question 1009

Which element of group 6A has the highest boiling point?
A) Al
Question 1010

A steel bottle contains argon gas at STP. What is the final pressure if the temperature is changed to 85°C?

A) 0.666 atm
B) 0.762 atm
C) 0.850 atm
D) 1.31 atm


Question 1011

________ are used as a battery electrode material.
A) Buckyballs
B) Graphite
C) Carbon
D) Sucrose molecules


Question 1012

Another term for alkanes is
A) alkenes.
B) alkynes.
C) saturated hydrocarbons.
D) unsaturated hydrocarbons.


Question 1013

Which of the following should have the largest dipole moment?
A) H2(g)
B) CO2(g)
C) KCl(g)
D) CH3F(g)


Question 1014

You have two samples of the same gas in the same size container, with the same pressure. The gas in the first container has a Kelvin temperature four times that of the gas in the other container. The ratio of the number of moles of gas in the first container compared to that in the second is
A) 1:1.
B) 1:2.
C) 1:4.
D) 4:1.


Question 1015

Sodium metal and water react to form hydrogen and sodium hydroxide. If 5.98 g of sodium react with water to form 0.26 g of hydrogen and 10.40 g of sodium hydroxide, what mass of water was consumed in the reaction?
A) 4.68 g
B) 5.98 g
C) 10.14 g
D) 10.66 g


Question 1016

The superconductor Tl2Ba2Ca2Cu3O10 has a critical temperature Tc = 125 K. In order for each of the atoms to have a whole-number oxidation number, the oxidation numbers of Tl, Ba, Ca, Cu, and O must be ________, ________, ________, ________, and ________ respectively.

Question 1017
What is the most likely charge on an ion of phosphorus, P?
A) 5-
B) 3-
C) 1+
D) 5+

Question 1018
A sailor circumnavigated the earth and covered 4,264,000 meters. Express this number in standard scientific notation.
A) 4.264 × 10^7 m
B) 4.264 × 10^6 m
C) 4.264 × 10^6 m
D) 4.264 × 10^7 m

Question 1019
The first law of thermodynamics
A) defines water energy.
B) defines energy.
C) is a statement of conservation of energy.
D) provides a criterion for the spontaneity of a reaction.

Question 1020
How many molecules of N2 are in a 300.0 mL container at 780 mm Hg and 135°C?
A) 5.26 × 10^{21} molecules
B) 5.54 × 10^{21} molecules
C) 1.59 × 10^{22} molecules
D) 1.67 × 10^{22} molecules

Question 1021
What are the common oxidation states of the Group 3A elements Al and Tl?
A) both are +3
B) +3 for Al and +1 for Tl
C) +3 for Al and both +1 and +3 for Tl
D) +3 for Al and +1, +3, and -5 for Tl

Question 1022
Calculate the solubility (in g/L) of silver carbonate in water at 25°C if the Ksp for Ag2CO3 is 8.4 × 10^{-12}.
A) 8.0 × 10^{-4} g/L
B) 3.5 × 10^{-2} g/L
C) 4.4 × 10^{-2} g/L
D) 5.6 × 10^{-2} g/L

Question 1023
If Kc = 0.600, and Kp = 359 for a hypothetical reaction, which of the equations below could represent the reaction at 25°C?
A) 4 A(g) + B(s) <-- --> 6 C(g)
B) A(l) + 2 B(g) <-- --> 2 C(g)
C) B(g) <-- --> C(l) + D(l)
D) A(g) <-- --> 2 C(s) + D(g)

Question 1024
The loss in mass that occurs when protons and neutrons combine to form a nucleus is called the _________ of the nucleus, and the corresponding
energy released during the formation of that nucleus is the ________ that holds the nucleus together.

**Question 1025**

The dissolution of calcium hydroxide is exothermic:
Ca(OH)₂(s) ↔ Ca²⁺(aq) + 2 OH⁻(aq)
What happens when the solution of Ca(OH)₂ is heated?
A) The amount of Ca(OH)₂(s) decreases.
B) The amount of Ca(OH)₂(s) increases.
C) The amount of Ca(OH)₂(s) remains unchanged.
D) The Ca(OH)₂(s) completely dissolves.

**Question 1026**

When suspected drunk drivers are tested with a Breathalyzer, the alcohol (ethanol) in the exhaled breath is oxidized to acetic acid with an acidic solution of potassium dichromate:
3CH₃CH₂OH(aq) + 2Cr²O₇⁻²(aq) + 16H⁺(aq) → 3CH₃CO₂H(aq) + 4Cr³⁺(aq) + 11H₂O(l)
If E° for this cell is 1.30V and the standard half-cell potential of Cr²O₇⁻²(aq) to Cr³⁺ is 1.358 V, what is the standard half-cell reduction potential for the conversion of acetic acid to ethanol?
A) 2.658 V
B) -2.658 V
C) +0.058 V
D) -0.058 V

**Question 1027**

Helium-3, an electron, a neutron, and a proton have masses of 3.016029 amu, 5.486 × 10⁻⁴ amu, 1.00866 amu, and 1.00728 amu, respectively. The mass defect for the formation of helium-3 is ________ amu or ________ g/mol.

**Question 1028**

Based on the variation in Z_eff, which M²⁺ ion should be the weakest reducing agent?
A) Ti
B) Cr
C) Fe
D) Zn

**Question 1029**

The chemical formula for rubidium peroxide is
A) RbOH
B) RbO₂
C) Rb₂O
D) Rb₂O₂

**Question 1030**

Which is not true?
A) Mendeleev ended each row in his periodic table with an inert gas.
B) Mendeleev left gaps in his periodic table for undiscovered elements.
C) Mendeleev ordered the elements in his periodic table by atomic weight.
D) Mendeleev’s periodic table predated the concept of electron configuration.

**Question 1031**

A 10.0-L flask containing He, 1.00 mole of Ar, and 3.00 mole of Ne has a total pressure of 24.5 atm at 25°C. How many moles of He are in the flask?
A) 6.00 mol
B) 10.0 mol
C) 10.0 mol
D) 119 mol
Question 1032

An acidic solution at 25°C will have a hydronium ion concentration ________ and a pH value ________.
A) \([H_3O^+] > 1 \times 10^{-7} \text{ M}, \text{pH} > 7.00\)
B) \([H_3O^+] > 1 \times 10^{-7} \text{ M}, \text{pH} < 7.00\)
C) \([H_3O^+] < 1 \times 10^{-7} \text{ M}, \text{pH} > 7.00\)
D) \([H_3O^+] < 1 \times 10^{-7} \text{ M}, \text{pH} < 7.00\)

Question 1033

Which of the following is most likely to have the highest viscosity at 25°C?
A) C6H14
B) HOCH2CH2OH
C) C3H7OH
D) C7H8

Question 1034

Which is the most acceptable electron dot structure for N2H2?
A) H — — — H
B) H — = — H
C) H — N — N — H
D) H — — H

Question 1035

Which amino acid has the simplest structure?
A) valine
B) glycine
C) asparagine
D) arginine

Question 1036

What mass of sulfur hexafluoride, SF6, has the same number of fluorine atoms as 50.0 g of oxygen difluoride, OF2?
A) 202.7 g
B) 8.33 g
C) 43.0 g
D) 135.1 g

Question 1037

Which is the largest amount of heat?
A) 547 cal
B) 8.32 \times 10^2 \text{ kcal}
C) 6.66 \times 10^2 \text{ J}
D) 4.33 \text{ kJ}

Question 1038

The amide bonds that form when two or more amino acids link together are called ________ bonds.

Question 1039

Which general rate law below corresponds to an elementary bimolecular reaction?
A) \(\text{Rate} = k[B]\)
B) \(\text{Rate} = k[A][B][C][D]\)
C) \(\text{Rate} = k[A][B]^2\)
D) Rate = k[A]^2

Question 1040

Volume is a derived unit having the unit length^x, where x = ________.

Question 1041

For the isomerization reaction:
butane ⇄ isobutane
K_p equals 25 at 500°C. If the initial pressures of butane and isobutane are 10. atm and 0.0 atm, respectively, what are the pressures of the two gases at equilibrium?
A) P(butane) = 0.38 atm and P(isobutane) = 9.6 atm
B) P(butane) = 0.40 atm and P(isobutane) = 10. atm
C) P(butane) = 9.6 atm and P(isobutane) = 0.38 atm
D) P(butane) = 10 atm and P(isobutane) = 0.40 atm

Question 1042

What is the molecular geometry of SeF_5^-?
A) octahedral
B) seesaw
C) square pyramidal
D) trigonal bipyramidal

Question 1043

Aluminum requires relatively little protection from corrosion because
A) aluminum has little tendency to react with oxygen.
B) the reduction potential for Al^{3+}/Al is very low.
C) the oxidation of aluminum produces a hard, relatively impenetrable film of Al_2O_3.
D) aluminum is protected by cathodic protection.

Question 1044

If the age of the Earth is 4.5 billion years and the half-life of 40K is 1.26 billion years, what percent of the Earth’s original amount of 40K remains today?
A) 4.2%
B) 8.4%
C) 12%
D) 16%

Question 1045

The Lewis electron-dot structure of H_2CO has _______ nonbonding electron pairs, _______ bonding electron pairs, and a carbon-oxygen bond order of _______.

Question 1046

What is the pH of a solution prepared by diluting 25.00 mL of 0.10 M HCl with enough water to produce a total volume of 100.00 mL?
A) 1.00
B) 1.60
C) 2.00
D) 3.20

Question 1047

Combustion analysis of an unknown compound containing only carbon and hydrogen produced 1.1385 g of CO_2 and 0.5805 g of H_2O. What is the empirical formula of the compound?
A) CH2
B) C2H5
C) C4H10
D) C5H2

**Question 1048**

The pressure in the eye of a hurricane is less than atmospheric pressure. Which one of the following pressure readings could not have been taken in the eye of a hurricane?

A) 16 lbs/in²
B) 66 cm Hg
C) 660 mm Hg
D) 9.45 × 10⁴ Pa


**Question 1049**

In general, at room temperature

A) ionic compounds are all solids and covalent compounds are all gases.
B) ionic compounds are all solids, but covalent compounds may be solids, liquids, or gases.
C) ionic compounds are all solids, and covalent compounds are liquids or gases.
D) covalent compounds are all gases, but ionic compounds may be solids, liquids, or gases.


**Question 1050**

Which one of the following compounds contains a three-center, two electron (3c-2e) bond?

A) B₂H₆
B) C₂H₄
C) N₂H₄
D) H₂O₂


**Question 1051**

Which element is most likely to have an anomalous electron configuration?

A) Zr
B) Mn
C) Au
D) Ca


**Question 1052**

A solution may contain the following ions Ag⁺, Cu²⁺, Cd²⁺, Mn²⁺, Ni²⁺ and Na⁺. A white precipitate formed when 0.10 M NaCl was added and after this was removed the solution was treated with H₂S gas under acidic conditions and no precipitate formed. When the solution was made basic and again treated with H₂S gas a dark colored precipitate formed. If no further tests were made then what conclusions can you draw?

A) possible ions present Ag⁺, Mn²⁺, Ni²⁺
B) possible ions present Ag⁺, Mn²⁺, Ni²⁺, Na⁺
C) possible ions present Ag⁺, Cu²⁺, Cd²⁺
D) possible ions present Ag⁺, Cu²⁺, Cd²⁺, Na⁺


**Question 1053**

Compound A is a solid with a melting point of 85°C, and compound B is a gas at 75°C and one atmosphere pressure. Based on these data, one would expect

A) both compounds to be covalent.
B) compound A to be ionic and compound B to be covalent.
C) compound A to be covalent and compound B to be ionic.
D) both compounds to be ionic.


**Question 1054**

Calculate the Ksp for silver sulfate if the solubility of Ag₂SO₄ in pure water is 4.5 g/L.
Question 1055

Which element of group 4A has the greatest electronegativity?
A) C
B) Si
C) Ge
D) Sn

Question 1056

Aqueous solutions of 30% (by weight) hydrogen peroxide, H2O2, are used to oxidize metals or organic molecules in chemical reactions. Given that the density of the solution is 1.11 g/mL, calculate the molarity.
A) 0.794 M
B) 6.78 M
C) 9.79 M
D) 12.6 M

Question 1057

Which one of the following contains a polar carbonyl group, C=O?
A) a carboxylic acid
B) an alkyne
C) an amine
D) an alkane

Question 1058

The balanced net ionic equation for the neutralization reaction involving equal molar amounts of HCl and CH3CH2NH2 is ________.

Question 1059

The sugar in RNA is ________.

Question 1060

Which element has the most favorable (most negative) electron affinity?
A) K
B) Be
C) I
D) Ne

Question 1061

How much water must be added to 36.0 g of CaCl2 to produce a solution that is 35.0 wt% CaCl2?
A) 48.6 g
B) 66.9 g
C) 97.2 g
D) 103 g

Question 1062

The wavelength of light emitted by the GaP0.40As0.60 LED, which has a band gap of 181 kJ/mol, is ________ nm.
Question 1063
Based on formal charges, the P—O bond order in POCl₃ is expected to be ________.

Question 1064
Which of the following species cannot act as a Lewis base?
A) O₂⁻
B) CH₄
C) H₂O
D) NH₃

Question 1065
Main-group elements are those elements in groups ________ through ________ of the periodic table.

Question 1066
What is a principal commercial ore for the element iron?
A) bauxite
B) pyrolusite
C) ilmenite
D) hematite

Question 1067
Most of the radiation to which people are exposed comes from
A) atmospheric testing of nuclear weapons.
B) emissions from nuclear power plants.
C) medical procedures.
D) natural sources.

Question 1068
Which of the following statements regarding nuclear stability is true?
A) A stable element always has an equal number of protons and neutrons.
B) The most abundant isotope of an element always has an equal number of protons and neutrons.
C) Very few elements have at least one radioactive isotope.
D) Hydrogen is the only element whose most abundant isotope contains more protons than neutrons.

Question 1069
What element was found to be the first superconductor of electricity at 4.2 K in 1911?
A) nickel
B) aluminum
C) gallium
D) mercury

Question 1070
Lipids are characterized by what property?
A) chemical reactivity
B) chemical structure
C) refractive index
D) solubility

Question 1071
Determine the number of water molecules necessary to balance the reduction half reaction of _______ that occurs in a basic solution.
Question 1072
Which element is likely to be a principal impurity in zinc ore?
A) lead
B) zinc
C) silver
D) cadmium

Question 1073
The ions ClO4-, ClO3-, ClO2-, and ClO- are named respectively
A) hypochlorate, chlorate, chlorite, perchlorite.
B) hypochlorite, chlorite, chlorate, perchlorate.
C) perchlorate, chlorate, chlorite, hypochlorite.
D) perchlorite, chlorite, chlorate, hypochlorate.

Question 1074
What is the concentration of 200. mL of 0.500 M LiF?
A) 0.500 M
B) 1.00 M
C) 0.250 M
D) 0.400 M

Question 1075
Chromium crystallizes in a body-centered cubic structure. What is the coordination number of each atom?
A) 4
B) 6
C) 8
D) 12

Question 1076
When KI is dissolved in water, the major forces overcome are ________ forces in the solute and ________ forces in the solvent, and the major forces created between solute and solvent particles are ________ forces.

Question 1077
Which is expected to have the largest dispersion forces?
A) C2H4
B) C18H36
C) NBr3
D) Ba

Question 1078
Two aqueous solutions, A and B, are separated by a semipermeable membrane. The osmotic pressure of solution A immediately begins to decrease. Which of the following statements is true?
A) Solvent molecules are moving from solution B into solution A.
B) The initial osmotic pressure of solution B is greater than that of solution A.
C) The solvent molecules are moving from the solution of higher osmotic pressure to that of lower osmotic pressure.
D) Both B and C are true statements.
Question 1079

Which metal ion is most likely to form a square planar complex ion with CN-?
A) Co2+
B) Cu2+
C) Ni2+
D) Zn2+

Question 1080

Identify the conjugate acid/base pairs present in an aqueous solution of hydrogen sulfate ion, HSO4-.
A) HSO4-/SO42- and H3O+/H2O
B) H2SO4/HSO4- and H2O/OH-
C) HSO4-/H2O and H3O+/SO42-
D) HSO4-/H2O and H2SO4/OH-

Question 1081

Addition of a small amount of As impurity in silicon results in a(n) ______--type semiconductor that has a conductivity that is ______ (greater, less) than silicon.

Question 1082

A reaction is performed in a water bath initially at 28°C which decreases to 10°C by the end of the reaction. For this reaction the sign of heat transfer is ______ and the reaction is classified as ______.

Question 1083

What is the empirical formula of a substance that contains 2.64 g of C, 0.444 g of H, and 3.52 g of O?
A) CH2O
B) C2H4O2
C) C2H4O3
D) C3H4O4

Question 1084

Which one of the following is expected to exhibit resonance?
A) NH4+
B) HCN
C) CS2
D) NO3-

Question 1085

Which orbitals have two nodal planes passing through the nucleus?
A) s
B) p
C) d
D) all in the third shell

Question 1086

An unknown gas effuses 1.73 times faster than krypton. What is the molar mass of the gas?
A) 28.0 g/mol
B) 48.4 g/mol
C) 110 g/mol
D) 251 g/mol
### Question 1087
The equilibrium constant is equal to 5.00 at 1300 K for the reaction:
\[ 2 \text{SO}_2(g) + \text{O}_2(g) \rightleftharpoons 2 \text{SO}_3(g) \].
If initial concentrations are \([\text{SO}_2] = 1.20 \text{ M}, [\text{O}_2] = 0.45 \text{ M}, \text{and} [\text{SO}_3] = 1.80 \text{ M}\), the system is
A) at equilibrium.
B) not at equilibrium and will remain in an unequilibrated state.
C) not at equilibrium and will shift to the left to achieve an equilibrium state.
D) not at equilibrium and will shift to the right to achieve an equilibrium state.

### Question 1088
Which one of the following elements can form more than four bonds with other elements?
A) C  
B) O  
C) F  
D) P

### Question 1089
Which is expected to have the highest surface tension at 25°C?
A) C\(_7\)H\(_{16}\)  
B) C\(_8\)H\(_{10}\)  
C) C\(_5\)H\(_{11}\)OH  
D) C\(_3\)H\(_5\)(OH)\(_3\)

### Question 1090
What is the magnitude of the change in pH when 0.005 moles of HCl is added to 0.100 L of a buffer solution that is 0.100 M in CH\(_3\)CO\(_2\)H and 0.100 M NaCH\(_3\)CO\(_2\)? The Ka for acetic acid is 1.8 \times 10^{-5}.
A) 0.00  
B) 0.20  
C) 0.47  
D) 1.30

### Question 1091
The factor 0.01 corresponds to which prefix?
A) deka  
B) deci  
C) centi  
D) milli

### Question 1092
C has a decay constant, \(k = 1.209 \times 10^{-4} \text{ yr}^{-1}\) and a half-life of ________ years.

### Question 1093
Which sphere most likely represents the S\(_2\)- ion?
A) A  
B) B  
C) A or B  
D) C or D

### Question 1094
KI does not dissolve well in nonpolar solvents because
A) solute-solute interactions are much larger than solvent-solvent or solute-solvent interactions.
B) solvent-solvent interactions are much larger than solute-solvent or solute-solute interactions.
C) solute-solvent interactions are much larger than solvent-solvent or solute-solute interactions.
D) solute-solvent interactions are similar to solvent-solvent and solute-solute interactions.

Question 1095
Which one of the following has the lowest standard molar entropy, S°, at 25°C?
A) C5H12(s)
B) C9H20(l)
C) C12H26(s)
D) C18H38(l)

Question 1096
The electronegativity is 2.1 for H and 3.0 for N. Based on these electronegativities, NH4+ would be expected to
A) be ionic and contain H- ions.
B) be ionic and contain H+ ions.
C) have polar covalent bonds with a partial negative charges on the H atoms.
D) have polar covalent bonds with a partial positive charges on the H atoms.

Question 1097
Vanadium ore contains two isotopes of vanadium, 50V and 51V. The least abundant isotope is radioactive and undergoes beta capture. What is the product of the beta decay?
A) 50Cr
B) 51Cr
C) 50Ti
D) 51Ti

Question 1098
Which alkali metal forms preferentially an oxide rather than a peroxide or superoxide?
A) Li
B) Na
C) K
D) Mg

Question 1099
The term "nucleons" refers to the number of ________ in the atom.
A) neutrons and electrons
B) electrons
C) protons and neutrons
D) protons and electrons

Question 1100
A 0.429-g sample of gas occupies 125 mL at 60. cm of Hg and 25°C. What is the molar mass of the gas?
A) 8.9 g/mol
B) 66 g/mol
C) 88 g/mol
D) 106 g/mol

Question 1101
Compared to ultraviolet radiation, infrared radiation occurs at ________ wavelengths, ________ frequencies, and ________ energies.

Question 1102
The compound K₂CO₃ is predicted to be soluble based on the solubility guideline that all ________ are soluble.


**Question 1103**

If the ionization constant of water, Kw, at 40°C is 2.92 × 10⁻¹⁴, then what is the hydronium ion concentration and pH for an acidic solution?

A) [H₃O⁺] > 1.71 × 10⁻⁷ M and pH > 6.77
B) [H₃O⁺] > 1.71 × 10⁻⁷ M and pH < 6.77
C) [H₃O⁺] < 1.71 × 10⁻⁷ M and pH > 6.77
D) [H₃O⁺] < 1.71 × 10⁻⁷ M and pH < 6.77


**Question 1104**

What is the approximate pH at the equivalence point of a weak acid-strong base titration if 25 mL of aqueous hydrofluoric acid requires 30.00 mL of 0.400 M NaOH? Ka = 6.76 × 10⁻⁴ for HF.

A) 1.74
B) 5.75
C) 8.25
D) 12.26


**Question 1105**

Alumina-titanium is a composite material used in hip replacements. Composite materials can be classified as ceramic-ceramic, ceramic-metal, or ceramic-polymer. Alumina-titanium is classified as ________.


**Question 1106**

The energy of motion is

A) electrical energy.
B) dam energy.
C) reserve energy.
D) kinetic energy.


**Question 1107**

A molecule with the formula XF₃ where the element X has the hybridization sp³. Which of the following elements could be Y?

A) C
B) P
C) B
D) Si


**Question 1108**

Concentrations of fluoride in drinking water greater than 4.0 mg/L can cause mottled teeth in children. What is 4.0 mg/L expressed as molality?


**Question 1109**

What are the three most abundant elements in the human body?

A) H, C, O
B) H, O, Fe
C) H, C, N
D) H, C, P


**Question 1110**

At 298 K, Kc = 1.7 × 10⁻⁵⁶ for the reaction 3 O₂(g) ⇌ 2 O₃(g). What is the value of Kp at this temperature?


**Question 1111**

Which has the highest Z_eff for its valence electrons?
A) Cs
B) W
C) Pb
D) At

**Question 1112**

Given that O₂ is paramagnetic and has a bond order of 2, and its highest occupied molecular orbital is antibonding, what would be the expected bond orders for O₂⁻ and O₂⁺?

A) 1 for O₂⁻ and 3 for O₂⁺
B) 3/2 for O₂⁻ and 5/2 for O₂⁺
C) 5/2 for O₂⁻ and 3/2 for O₂⁺
D) 3 for O₂⁻ and 1 for O₂⁺

**Question 1113**

What is the pH of a solution prepared by mixing 25.00 mL of 0.10 M CH₃CO₂H with 25.00 mL of 0.040 M CH₃CO₂Na? Assume that the volume of the solutions are additive and that Ka = 1.8 × 10⁻⁵ for CH₃CO₂H.

A) 2.87
B) 4.35
C) 4.75
D) 5.14

**Question 1114**

According to band theory, the element having all of its bonding molecular orbitals filled and all of its antibonding orbitals empty in the 4s-3d composite band is ________.


**Question 1115**

What are the major solute-solvent interactions created when HOCH₂CH₂OH dissolves in water?

A) dipole-dipole
B) dispersion
C) hydrogen bonding
D) ion-dipole

**Question 1116**

Write the chemical formula for aquabromobis(ethylenediamine)chromium(III) chloride.

A) [CrBr(H₂O)(en)]Cl
B) [CrBr₂(H₂O)(en)]Cl₂
C) [CrBr(H₂O)(en)₂]Cl₂
D) [CrBr(H₂O)(en)₂]Cl₃

**Question 1117**

The VSEPR model predicts the O—S—O bond angle in SO₂ to be

A) 90°.
B) 109.5°.
C) less than 120° but greater than 109.5°.
D) 120°.

**Question 1118**

The coordination number of chromium in [Cr(EDTA)]⁻ is ________.


**Question 1119**

What is least easily oxidized?

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Question 1120
How will the osmotic pressure of an aqueous solution change as evaporation occurs?
A) The osmotic pressure will increase.
B) The osmotic pressure will not change.
C) The osmotic pressure will decrease.
D) The osmotic pressure will increase or decrease until it equals the vapor pressure of water.

Question 1121
What is the ground-state electron configuration of the ion Hg2+?
A) [Xe]4f145d10
B) [Xe]4f145d86s2
C) [Xe]4f145d106s2
D) [Xe]4f145d106s26p2

Question 1122
Which of the following ionic compounds would be expected to have the highest lattice energy?
A) MgS
B) KBr
C) K2S
D) BeBr2

Question 1123
What is the energy of a wavelength of light of 550 nm?
A) 1.09 × 10^{-31} J
B) 3.61 × 10^{-37} J
C) 3.61 × 10^{-19} J
D) 1.09 × 10^{-22} J

Question 1124
When a person exhales through a straw into water, the water will have a(n) _______ pH due to the reaction _______.

Question 1125
What is the chemical symbol for platinum?
A) Pd
B) Pr
C) Pt
D) Au

Question 1126
Which of the following species has the electron configuration [Ar]3d3?
A) Sc
B) V3+
C) Cr3+
D) Fe3+

Question 1127
Which one of the amino acids contains a double ring structure?
A) alanine
B) serine
C) tryptophan
D) histidine

Question 1128

The practical limit for 14C dating occurs when its activity falls to 0.20% of its original value due to interference in detectors by natural background radiation. If the half-life is 5715 years, what is the maximum age of a sample that can be dated by 14C without interference?
A) 1.3 x 104 years
B) 2.9 x 104 years
C) 5.1 x 104 years
D) 2.9 x 106 years

Question 1129

If 100. mL of 0.200 M Na₂SO₄ is added to 200. mL of 0.300 M NaCl, what is the concentration of Na⁺ ions in the final solution? Assume that the volumes are additive.
A) 0.267 M
B) 0.333 M
C) 0.500 M
D) 0.700 M

Question 1130

Of the following, which element has the highest first ionization energy?
A) Li
B) F
C) Cs
D) At

Question 1131

In general, metallic character
A) increases down a column because the orbitals become more compact.
B) decreases down a column because the orbitals become more compact.
C) increases across a row because the effective nuclear charge increases.
D) increases down a column because the orbitals become more diffuse.

Question 1132

Write a balanced chemical equation for obtaining iron metal by the reduction of hematite, Fe₂O₃, by hydrogen gas.

Question 1133

An electrolytic cell is
A) a battery.
B) a cell in which the cell reaction is spontaneous.
C) a cell in which an electric current drives a nonspontaneous reaction.
D) a cell in which reactants are continuously supplied to the cell.

Question 1134

The oxidation number of sulfur in S O₂ is ________.

Question 1135

Which of the following can function as a bidentate ligand?
A) NH₃
B) CN⁻
C) N₃⁻
D) C₂O₄²⁻

**Question 1136**
The fundamental SI unit for measuring matter is the ________.

**Question 1137**
In the dark the reaction of 2-pentene with bromine will form how many different products?

**Question 1138**
Radiation is dangerous to organisms because
A) all radionuclides are poisonous.
B) it causes electrolysis of water in the cells.
C) it causes nuclear reactions in the cells.
D) it ionizes molecules in the cells.

**Question 1139**
A 1.0 m aqueous BaI₂ solution will have a ________ vapor pressure, ________ freezing point, and ________ boiling point than a 1.0 m aqueous solution of LiI.

**Question 1140**
How many moles and how many atoms of zinc are in a sample weighing 34.9 g?
A) 0.533 mol, 8.85 × atoms
B) 0.533 mol, 3.21 × atoms
C) 1.87 mol, 3.10 × atoms
D) 1.87 mol, 1.13 × atoms

**Question 1141**
What is the pH of a solution prepared by mixing 50.00 mL of 0.10 M NH₃ with 25.00 mL of 0.10 M NH₄Cl? Assume that the volume of the solutions are additive and that Kₐ = 1.8 × 10⁻⁵ for NH₃.
A) 8.95
B) 9.26
C) 9.56
D) 11.13

**Question 1142**
The sum of the masses of the protons and neutrons in a given nucleus minus the mass of that nucleus is always
A) negative.
B) positive.
C) temperature dependent.
D) zero.

**Question 1143**
Which ending on a ketone or aldehyde indicates a sugar?
A) -ene
B) -one
C) ether
D) -ose
Question 1144

The estimated mass of the planet Jupiter is $1.90 \times 10^{27}$ kg and the density is believed to be $1.34$ g/cm$^3$. If Jupiter were a perfect sphere, what would be its diameter?

A) $6.96 \times 10^6$ m  
B) $6.96 \times 10^7$ m  
C) $1.39 \times 10^7$ m  
D) $1.39 \times 10^8$ m


Question 1145

Which of the following is not a geometric (cis-trans) isomer?

A) 1, 1-dichloro-1-pentene  
B) 1, 2-dichloro-1-hexene  
C) 2-hexene  
D) 2-chloro-2-heptene


Question 1146

$KH_2PO_4$ is

A) hydropotassium phosphate.  
B) potassium dihydrogen phosphate.  
C) potassium diphosphate.  
D) potassium hydrogen(II) phosphate.


Question 1147

What are the names of the ions $Mn^{2+}$, $Sn^{2+}$, and $Se^{2-}$?

A) manganese, tin, and selenium  
B) manganese, tin(II), and selenide  
C) manganese(II), tin(II), and selenium(II-)  
D) manganous, stannous, and selenide


Question 1148

The rubbing alcohol sold in drug stores often is composed of 70% isopropyl alcohol and 30% water. In this solution

A) isopropyl alcohol is the solvent.  
B) water is the solvent.  
C) both water and isopropyl alcohol are solvents.  
D) neither water nor isopropyl alcohol is a solvent.


Question 1149

A process by which gas molecules escape through a tiny hole in a membrane into a vacuum without collisions is called

A) Boyle's law.  
B) diffusion.  
C) effusion.  
D) compressibility.


Question 1150

At 298 K which is larger rate of effusion or rate of diffusion?


Question 1151

The number of unpaired electrons in tetrahedral $NiBr_4^{2-}$ is ________.


Question 1152
One reason ionic compounds do not dissolve well in nonpolar solvents is that
A) ion-dipole interactions are too large for effective solvation to occur.
B) ion-solvent interactions are not strong enough to solvate the ions in solution.
C) not all cations and anions have the same magnitude of charge and therefore do not form neutral ion pairs.
D) there are no forces of attraction between ions and nonpolar molecules.

**Question 1153**

The heat of vaporization of water at 100°C is 40.66 kJ/mol. Calculate the quantity of heat that is absorbed/released when 7.00 g of steam condenses to liquid water at 100°C.
A) 15.8 kJ of heat are absorbed.
B) 15.8 kJ of heat are released.
C) 105 kJ of heat are absorbed.
D) 105 kJ of heat are released.

**Question 1154**

Which atom in each group (I and II) has the smallest atomic radius?
(I) K, Zn, Br
(II) Al, Ga, In
A) K; Al
B) K; In
C) Br; Al
D) Br; In

**Question 1155**

What is the quantitative change in the cell voltage on increasing the ion concentration in the cathode compartment by a factor of 10?
A) +0.06 V
B) +0.03 V
C) -0.03 V
D) -0.06 V

**Question 1156**

Which one of the following is not a main group element?
A) Rb
B) Ba
C) Fe
D) Ge

**Question 1157**

What is the silver ion concentration for a saturated solution of SrF2 if the Ksp for SrF2 is
A) 9.3 × 10^{-7} M
B) 1.4 × 10^{-3} M
C) 8.5 × 10^{-4} M
D) 4.06 × 10^{-4} M

**Question 1158**

An element M reacts with chlorine to form MCl2, with oxygen to form MO, and with nitrogen to form M3N2. The most likely candidate for the element is
A) Na
B) Sr
C) B
D) Ge

**Question 1159**

How many electrons are in the ground state of Ti⁺?
A) 2
Question 1160

Which element has the smallest energy band gap?
A) C (diamond)
B) Ge
C) Pb
D) Si

Question 1161

What is not a metallurgy process?
A) environmental reconstruction of the landscape
B) extraction of metals from their ores
C) making of alloys and metallic composites
D) reduction of the mineral to the free metal

Question 1162

What is the pH of a solution made by mixing 100.00 mL of 0.20 M HCl with 50.00 mL of 0.10 M HCl? Assume that the volumes are additive.
A) 0.15
B) 0.52
C) 0.78
D) 1.70

Question 1163

The balanced chemical equation for the production of silver by roasting of its sulfide is ________.

Question 1164

A proton is approximately
A) 600 times larger than an electron.
B) 2000 times larger than an electron.
C) 700 times smaller than an electron.
D) 3000 times smaller than an electron.

Question 1165

Which of the following is not a valence bond concept?
A) The greater the overlap between the orbitals on two atoms, the stronger the bond.
B) Lone pair electrons are in atomic orbitals or in hybrid atomic orbitals.
C) Atomic orbitals on two atoms may overlap to form antibonding orbitals.
D) A pair of electrons in a bond is shared by both atoms.

Question 1166

Within a given shell of a multielectron atom, the lower l for an orbital, the
A) higher the orbital energy and the higher Zeff for the electron.
B) higher the orbital energy and the lower Zeff for the electron.
C) lower the orbital energy and the higher Zeff for the electron.
D) lower the orbital energy and the lower Zeff for the electron.

Question 1167

What is the compound responsible for the green patina seen on bronze monuments?
A) CuCO₃
B) Cu₂(OH)₂CO₃
C) Cu(OH)₂
D) Cu₂(OH)₂SO₄

**Question 1168**

What are the C–C–C bond angles in cyclopropane and cyclohexane?

A) 60° in both molecules
B) 60° in cyclopropane and 109.5° in cyclohexane
C) 60° in cyclopropane and 120° in cyclohexane
D) 109.5° in both molecules

**Question 1169**

Calculate the pH of a 0.800 M KBrO solution. Ka for hypobromous acid, HBrO, is 2.0 × 10⁻⁹.

A) 2.70
B) 4.40
C) 9.60
D) 11.30

**Question 1170**

Which group 3A element has the highest electronegativity?

A) B
B) Al
C) Ga
D) Si

**Question 1171**

A neutral atom with atomic number 5 and mass number 11 contains ________ electrons.


**Question 1172**

Automobile tires are typically inflated to about 30 pounds of pressure per square inch. What is the typical air pressure of a tire in kPa?

A) 2.0 × 10⁻³ kPa
B) 2.0 kPa
C) 2.1 × 10² kPa
D) 2.1 × 10⁵ kPa

**Question 1173**

Ethyl chloride, C₂H₅Cl, is used as a local anesthetic. It works by cooling tissue as it vaporizes. The heat of vaporization is 26.4 kJ/mol. How much heat could be removed by 60.0 g of ethyl chloride?

A) 24.6 kJ
B) 1584 kJ
C) 2.28 kJ
D) 1703 kJ

**Question 1174**

What nuclide is formed when U undergoes a portion of the decay series: alpha, beta, beta, alpha, alpha, alpha.

A) Ra
B) Rn
C) Th
D) Pb
Question 1175

Which molecule has the weakest bonds?
A) CF₄
B) CCl₄
C) CBr₄
D) CI₄

Question 1176

Which is a net ionic equation for the neutralization of a strong acid with a strong base?
A) HI(aq) + NaOH(aq) <-- --> H₂O(l) + NaI(aq)
B) H₃O⁺(aq) + OH⁻(aq) <-- --> 2 H₂O(l)
C) HF(aq) + NaOH(aq) <-- --> H₂O(l) + NaF(aq)
D) HCl(aq) + OH⁻(aq) <-- --> H₂O(l) + Cl⁻(aq)

Question 1177

Which of the following regions of the earth’s atmosphere contains the ozone layer?
A) mesosphere
B) stratosphere
C) thermosphere
D) troposphere

Question 1178

Historical records of greenhouse gases can be found in
A) polar ice caps.
B) oil from the ground.
C) the Alps.
D) the Dead Sea Scrolls.

Question 1179

Phosphorus pentachloride decomposes to phosphorus trichloride at high temperatures according to the equation:

\[ \text{PCl}_5(g) \rightleftharpoons \text{PCl}_3(g) + \text{Cl}_2(g) \]

At 250° C, 0.250 M PCl₅ is added to the flask. If Kc = 1.80, what are the equilibrium concentrations of each gas?
A) [PCl₅] = 0.0280 M, [PCl₃] = 0.222 M, and [Cl₂] = 0.222 M
B) [PCl₅] = 0.125 M, [PCl₃] = 0.474 M, and [Cl₂] = 0.474 M
C) [PCl₅] = 1.80 M, [PCl₃] = 1.80 M, and [Cl₂] = 1.80 M
D) [PCl₅] = 2.27 M, [PCl₃] = 2.02 M, and [Cl₂] = 2.02 M

Question 1180

What is the approximate pH at the equivalence point of a weak acid-strong base titration if 25 mL of aqueous formic acid requires 29.80 mL of 0.0567 M NaOH? Ka = 1.8 × 10⁻⁴ for formic acid.
A) 2.46
B) 5.88
C) 8.12
D) 11.54

Question 1181

In which of the following solutions would solid PbBr₂ be expected to be the least soluble at 25°C?
A) 0.1 M HBr
B) 0.1 M LiBr
C) 0.1 M CaBr₂
D) 0.1 M LiNO₃
Question 1182
What is the average speed (actually the root-mean-square speed) of a xenon atom at 27°C?
A) 2.27 m/s
B) 7.57 m/s
C) 71.7 m/s
D) 239 m/s

Question 1183
What is the pH of a 0.020 M RbOH solution?
A) 0.020
B) 0.040
C) 1.70
D) 12.30

Question 1184
The bonding in NaI is ________, whereas the bonding in NH₃ is ________.

Question 1185
Of the following, which element has the highest first ionization energy?
A) argon
B) neon
C) helium
D) krypton

Question 1186
If the quantum number ms had possible values +1/2, -1/2, what would be the maximum number of electrons that be placed in a single orbital?
A) one
B) two
C) three
D) four

Question 1187
Which of the following is not a valid set of quantum numbers?
A) n = 2, l = 1, ml = 0, and ms = +1/2
B) n = 2, l = 1, ml = -1, and ms = +1/2
C) n = 3, l = 0, ml = 0, and ms = +1/2
D) n = 3, l = 2, ml = 3, and ms = +1/2

Question 1188
What is the oxidation number of the oxygen atom in O₂²⁻?
A) -2
B) -1
C) +1
D) +2

Question 1189
Which one of the following binary oxides is the most basic?
A) Na₂O
B) PbO₂
C) I₂O₅
D) TeO₃
Question 1190

Second row elements differ from heavier elements in all of the following ways except
A) atoms of second row elements are smaller.
B) atoms of second row elements have higher electronegativities.
C) heavier elements commonly form multiple bonds while second row elements cannot.
D) heavier elements have electrons in d orbitals while second row elements do not.

Question 1191

What volume of 3.00 M CH₃OH solution is needed to provide 0.320 mol of CH₃OH?
A) 1.04 mL
B) 9.38 mL
C) 107 mL
D) 960 mL

Question 1192

How many sodium atoms are in 3.00 g of sodium dichromate, Na₂Cr₂O₇?
A) 0.023 oxygen atoms
B) 2.82 × 10²₀ oxygen atoms
C) 1.97 × 10²¹ oxygen atoms
D) 1.38 × 10²² oxygen atoms

Question 1193

Refrigeration and air conditioning are a source of greenhouse gases such as
A) CHClF₂.
B) Ne.
C) HBr.
D) H₂.

Question 1194

What is the mole fraction of oxygen in a gas mixture that is 40.0% oxygen and 60.0% nitrogen by volume?
A) 0.632
B) 0.368
C) 0.400
D) 0.600

Question 1195

For an ideal gas, which pairs of variables are inversely proportional to each other (if all other factors remain constant)?
I. P, T
II. P, V
III. V, T
IV. n, T
A) I and II only
B) III and IV only
C) II only
D) I and III only

Question 1196

According to the Balmer-Rydberg equation, the transition from n = 6 to m = 2 results in a spectral line having which color?
A) blue
B) blue-green
C) indigo
D) red
Question 1197
Which bond should have the highest bond dissociation energy?
A) N—N
B) N N
C) N N
D) N—H

Question 1198
A binary ionic compound, MxAy, crystallizes in a cubic structure that contains eight anions (A) entirely within its unit cell and a cation (M) on each corner and on each face. What is the empirical formula of this compound?
A) MA
B) MA2
C) M2A
D) M4A8

Question 1199
Which of the following regions of the earth’s atmosphere is farthest from the surface of the earth?
A) mesosphere
B) stratosphere
C) thermosphere
D) troposphere

Question 1200
An orbital that as the appearance of a three-dimensional clover leaf has a quantum number l = ________.

Question 1201
Metals tend to react with the halogens to form metal halides. What is the reactivity order for the halogens?
A) F2 > Cl2 > Br2 > I2
B) Cl2 > F2 > Br2 > I2
C) Br2 > I2 > Cl2 > F2
D) I2 > Br2 > Cl2 > F2

Question 1202
In which case should CO2(g) be more soluble in water?
A) The total pressure is 6 atm and the partial pressure of CO2 is 1 atm.
B) The total pressure is 4 atm and the partial pressure of CO2 is 3 atm.
C) The total pressure is 1 atm and the partial pressure of CO2 is 0.03 atm.
D) The total pressure is 1 atm and the partial pressure of CO2 is 0.4 atm.

Question 1203
The laser used to read Blu-Ray discs have a wavelength of 405 nm. 405 nm photons have of an energy of ________ J, and a mole of 405 nm photons has an energy of ________ kJ/mol.

Question 1204
The chemical process of roasting is commonly used to facilitate the reduction of which metal ores?
A) Ag, Cu, and Hg
B) Ag, Mg, and Na
C) Hg and Pt
D) Ag, Mn, and V
Question 1205

Which has the largest atomic radius?
A) Sc
B) V
C) Ni
D) Zn

Question 1206

The average distance between nitrogen and oxygen atoms is 115 pm in a compound called nitric oxide. What is this distance in nanometers?
A) 1.15 × 10-2 nm
B) 1.15 × 10-1 nm
C) 1.15 × 1015 nm
D) 1.15 × 1019 nm

Question 1207

Arrange the following compounds in order of their expected increasing solubility in water:
NaF, CH3CH2-O-CH2CH3, CH3CH2CH2CH2-OH, CH3CH2CH2CH3.
A) CH3CH2CH2CH3 < NaF < CH3CH2-O-CH2CH3 < CH3CH2CH2CH2-OH
B) NaF < CH3CH2-O-CH2CH3 < CH3CH2CH2CH2-OH < CH3CH2CH2CH3
C) CH3CH2CH2CH3 < CH3CH2-O-CH2CH3 < NaF < CH3CH2CH2CH2-OH
D) CH3CH2CH2CH3 < CH3CH2-O-CH2CH3 < CH3CH2CH2CH2-OH < NaF

Question 1208

Calculate the pH of a 0.100 M NaCH3CO2 solution. Ka for acetic acid, CH3CO2H, is 1.8 × 10-5.
A) 2.87
B) 5.13
C) 8.87
D) 11.13

Question 1209

What metal is isolated from the ore galena?
A) lead
B) iron
C) zinc
D) silver

Question 1210

For the galvanic cell shown above, in what direction should the anions and cations in half-cell A move?
A) The anions tend to move to the solid electrode and the cations into the salt bridge.
B) The anions tend to move into the salt bridge and the cations toward the solid electrode.
C) The anions tend to move toward the solid electrode and the cations should not move.
D) The cations tend to move toward the solid electrode and the anions should not move.

Question 1211

A fishing boat accidentally spills 6.0 barrels of diesel oil into the ocean. Each barrel contains 42 gallons. If the oil film on the ocean is 2.5 × 102 nm thick, how many square meters will the oil slick cover?
A) 3.8 × 10-3 m2
B) 3.8 × 106 m2
C) 3.8 × 107 m2
D) none of these
Question 1212

Relative to a bulk sample of gold, nanoparticles of gold have
A) greater reactivity and higher melting point.
B) greater reactivity and lower melting point.
C) lower reactivity and higher melting point.
D) lower reactivity and lower melting point.

Question 1213

Which of the group 3A elements is the only one to readily form a +1 ion?
A) B
B) Al
C) In
D) Tl

Question 1214

The magnitude of the heats of vaporization, fusion and sublimation of a substance reflect the
A) density of the substance.
B) magnitudes of the boiling and melting points of the substance.
C) strength of the covalent bonds between atoms in each molecule of the substance.
D) strength of the intermolecular forces of the substance.

Question 1215

When 0.500 g of vitamin K is dissolved in 10.0 g of camphor (Kf = 40.0°C/m), the freezing point of the solution is 4.43°C lower than that of pure camphor. Assuming vitamin K is a nonelectrolyte in camphor, calculate its molar mass.
A) 0.451 g/mol
B) 55.4 g/mol
C) 451 g/mol
D) 3.54 × 104 g/mol

Question 1216

How many electrons are in the valence shell of I in IF4-?
A) 8
B) 10
C) 12
D) 14

Question 1217

Given the reaction: 2 HI ←→ H2 + I2. If Kc' for the reverse reaction is 1.85 × 10-2 at 425°C, what is Kc for the forward reaction at the same temperature?
A) -1.85 × 10-2
B) 1.85 × 10-2
C) 3.70 × 10-2
D) 54.1

Question 1218

The factor 10 corresponds to which prefix?
A) centi
B) deci
C) deka
D) milli
Question 1219

The number of Lewis electron dot resonance structures required to describe NO2- is ________.

Question 1220

Which is expected to have the lowest specific heat capacity at 25°C?
A) air
B) gold
C) ethylene glycol
D) methanol

Question 1221

A property whose value depends only on the present condition of the system and not how the system arrived at that condition is called a ________ function.

Question 1222

What is the third-row element having the successive ionization energies in kJ/mol: 738, 1451, 7733, 10,540, 13,630, 17,995, 21,703?

Question 1223

A mixture of carbon monoxide, hydrogen, and methanol is at equilibrium. The balanced chemical equation is: CO(g) + 2 H2(g) <-- --> CH3OH(g). At 250°C, the mixture contains 0.0960 M CO, 0.191 M H2, and 0.150 M CH3OH. What is the value for Kc?
A) 2.33 × 10-2
B) 0.244
C) 4.09
D) 42.8

Question 1224

What is the strongest monoprotic acid of the following set if all the acids are at 0.100 M concentration?
A) hydrofluoric acid with Ka = 3.5 × 10-4
B) benzoic acid with Ka = 6.5 × 10-5
C) acetic acid with Ka = 1.8 × 10-5
D) hypochlorous acid with Ka = 3.5 × 10-8

Question 1225

What is the approximate pH of a solution X that gives the following responses with the indicators shown?
<table>
<thead>
<tr>
<th>Indicators</th>
<th>HIn — In-</th>
<th>pH range</th>
<th>Solution X</th>
</tr>
</thead>
<tbody>
<tr>
<td>methyl orange-red-yellow</td>
<td>3.2-4.4yellow</td>
<td></td>
<td></td>
</tr>
<tr>
<td>methyl red-red-yellow</td>
<td>4.8-6.0orange</td>
<td></td>
<td></td>
</tr>
<tr>
<td>bromothymol blue-blue-yellow</td>
<td>6.0-7.6yellow</td>
<td></td>
<td></td>
</tr>
<tr>
<td>phenolphthalein-colorless-pink</td>
<td>8.2-10.0colorless</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
A) 3.2 - 4.4
B) 4.8 - 6.0
C) 6.0 - 7.6
D) 8.2 - 10.0

Question 1226

Hydrogen, H2, has a very low boiling point. What is the force that must be overcome in order to boil hydrogen?
A) dipole-dipole
B) H—H covalent bonding
C) hydrogen bonding
D) London dispersion
Question 1227

The number of unpaired electrons in square planar PtCl4^- is ________.

Question 1228

What is the oxidation number of mercury in cinnabar?

Question 1229

How many unpaired electrons are in an atom of Mt in its ground state?
A) 1  
B) 2  
C) 3  
D) 5

Question 1230

Which transition could occur if a solid is heated at a pressure above the triple point pressure?
A) vaporization  
B) deposition  
C) melting  
D) sublimation

Question 1231

Indicate which is larger in each of the following two sets.
(I) Cr2+ or Cr (II)N2- or N  
A) Cr2+ is larger than Cr and N3- is larger than N.  
B) Cr2+ is larger than Cr and N is larger than N3-.  
C) Cr is larger than Cr2+ and N3- is larger than N.  
D) Cr is larger than Cr2+ and N is larger than N3-.

Question 1232

Which of the following is the correct chemical formula for a molecule of nitrogen?
A) N  
B) N-  
C) N+  
D) N2

Question 1233

Each molecule of cortisone contains 21 atoms of carbon (plus other atoms). The mass percentage of carbon in cortisone is 69.98%. What is the molar mass of cortisone?
A) 176.5 g/mol  
B) 252.2 g/mol  
C) 287.6 g/mol  
D) 360.4 g/mol

Question 1234

Which statement about buffers is true?
A) Buffers have a pH = 7.  
B) Buffers consist of a strong acid and its conjugate base.  
C) A buffer does not change pH on addition of a strong acid or strong base.  
D) Buffers resist change in pH upon addition of small amounts of strong acid or strong base.
**Question 1235**

What is not generally considered to be a ceramic?
A) silicon, Si  
B) zirconia, ZrO2  
C) silicon carbide, SiC  
D) silicon nitride, Si3N4  

**Question 1236**

How many unpaired electrons will Co have in the complex [CoCl4]2-?
A) 1  
B) 3  
C) 4  
D) 5  

**Question 1237**

Consider a buffered solution consisting of H2CO3 and HCO3- where the pKa = 6.4. At pH = 6.4, which of the following is true?
A) [H2CO3] > [HCO3-]  
B) [H2CO3] < [HCO3-]  
C) [H2CO3] = [HCO3-]  
D) [H2CO3] < [CO3-2]  

**Question 1238**

What is the decay constant for a radioactive isotope which decreases to 34% of its original value in 2.48 hours?
A) 0.137 hr-1  
B) 0.168 hr-1  
C) 0.435 hr-1  
D) 2.30 hr-1  

**Question 1239**

The slowest step in a reaction mechanism is called the ________ step.
A) termination  
B) elementary  
C) rate law  
D) rate-determining  

**Question 1240**

Which of the halogens forms more than one perhalic acid?
A) F  
B) Cl  
C) Br  
D) I  

**Question 1241**

What is the pH of a 0.020 M Ba(OH)2 solution?
A) 1.40  
B) 1.70  
C) 12.30  
D) 12.60  

**Question 1242**

A buffer solution is prepared by dissolving 27.22 g of KH2PO4 and 3.37 g of KOH in enough water to make 0.100 L of solution. What is the pH of the
Question 1243

A safe method of removing caffeine from coffee is through the use of
A) supercritical carbon dioxide.
B) benzene.
C) methylene chloride.
D) water.

Question 1244

What is the relationship between Ka and Kb at 25°C for a conjugate acid base pair?
A) Ka × Kb = 1 × 10^-14
B) Ka/Kb = 1 × 10^-14
C) Kb/Ka = 1 × 10^-14
D) Ka - Kb = 1 × 10^-14

Question 1245

For an orbital, a node is
A) the midpoint of the orbital.
B) a surface inside which there is a 90% chance of finding the electron.
C) a surface where there is a maximum probability of finding the electron.
D) a surface where there is no chance of finding the electron.

Question 1246

The structure of DNA was proposed by
A) Einstein.
B) Curie.
C) Watson and Crick.
D) Copernicus.

Question 1247

Which statement about diluted solutions is false? When a solution is diluted
A) the concentration of the solution decreases.
B) the molarity of the solution decreases.
C) the number of moles of solute remains unchanged.
D) the number of moles of solvent remains unchanged.

Question 1248

What is the angle between adjacent sp3 hybrid orbitals?
A) 90°
B) 109.5°
C) 120°
D) 180°

Question 1249

Molecular mass can be determined by
A) combustion analysis.
B) mass spectrometry.
C) titration.
Question 1250

Which of the following elements is not a solid at room temperature?
A) Ag
B) Al
C) He
D) Fe

Question 1251

Assume a heteronuclear diatomic molecule, AB, forms a one-dimensional crystal by lining up along the x-axis. Also assume that each molecule can only have one of six possible orientations, corresponding to atom A facing in either the positive or negative direction along the x-, y-, or z-axis. If the molecules are arranged randomly in the six directions, the molar entropy at absolute zero should be
A) R ln 6.
B) R ln 66.
C) R ln 6!
D) 0.

Question 1252

The decomposition of ammonia to nitrogen and hydrogen on a tungsten filament at 800°C is independent of the concentration of ammonia at high pressures of ammonia. What is the order of the reaction with respect to ammonia?
A) zero
B) first
C) second
D) third

Question 1253

Inner transition elements are found in the ________-block of the periodic table.

Question 1254

The element Bh has how many valence electrons?
A) 2
B) 5
C) 7
D) 1

Question 1255

Which of the following elements is an inner transition metal?
A) Pm
B) Ni
C) Zr
D) Lu

Question 1256

What is the molar mass of calcium permanganate?
A) 159 g/mol
B) 199 g/mol
C) 216 g/mol
D) 278 g/mol

Question 1257
Diamond is held together by
A) covalent bonds.
B) ion-dipole forces.
C) van der Waals forces.
D) ionic forces.

Question 1258
What is the concentration of an AlBr3 solution if 150. mL of the solution contains 250. mg of Br- ion?
A) 6.95 \times 10^{-3} \text{ M}
B) 2.08 \times 10^{-2} \text{ M}
C) 1.67 \text{ M}
D) 6.23 \times 10^{-3} \text{ M}

Question 1259
When P4O10 is dissolved in water, the water will have a(n) ________ pH due to the reaction ________.

Question 1260
A reaction with an activation energy, \( E_a = 103 \text{ kJ/mol} \) has a rate constant, \( k = 3.5 \times 10^{-5} \text{ s}^{-1} \) at 25°C. For this reaction the rate constant at 45°C is ________.

Question 1261
What is the strongest oxidizing agent of the following set: FeO, Fe2O3, Fe3O4, FeO42-?
A) FeO
B) Fe2O3
C) Fe3O4
D) FeO42-

Question 1262
The balanced equation for the solubility equilibrium of Ba(OH)2 is shown below. What is the equilibrium constant expression for the Ksp of Ba(OH)2?
\[
\text{Ba(OH)2(s)} \rightleftharpoons \text{Ba}^{2+}(aq) + 2 \text{OH}^-(aq)
\]
A) \( \text{Ksp} = [\text{Ba}^{2+}][\text{OH}^-]^2 \)
B) \( \text{Ksp} = [\text{Ba}^{2+}][\text{OH}^-][\text{H}_2\text{O}] \)
C) \( \text{Ksp} = [\text{Ba}^{2+}][\text{OH}^-]^2 \)
D) \( \text{Ksp} = 1/[\text{Ba}^{2+}][\text{OH}^-]^2 \)

Question 1263
Ammonium bromide is a crystalline solid that decomposes endothermically when heated:
\[
\text{NH4Br(s)} \rightleftharpoons \text{NH}_3(g) + 
\text{HBr(g)}
\]
When solid NH4Br is added to an evacuated flask at 300°C, which change in reaction conditions below will cause the equilibrium to shift to the right?
A) add more HBr
B) add more NH4Br
C) decrease the temperature
D) decrease the pressure

Question 1264
The symbol for technetium-98 is ________.

Question 1265
At a given temperature the vapor pressures of benzene and toluene are 183 mm Hg and 59.2 mm Hg, respectively. Calculate the total vapor pressure over a solution of benzene and toluene with Xbenzene = 0.520.
A) 95.2 mm Hg
Question 1266

Consider two reactants, A and B. The molar mass of A is greater than the molar mass of B. You add equal masses of A and B together and let them react. Which of the following statements must be true?
A) Reactant A must be limiting.
B) Reactant B must be limiting.
C) Reactant A is the excess reactant.
D) None of the above choices must be true.

Question 1267

Which depends only on the initial and final state?
A) q
B) w
C) q + w
D) q - w

Question 1268

The reaction CaCO3(s) ←--→ CaO(s) + O2(g) is endothermic at 298 K. The effect of increasing the temperature of the system at equilibrium will ______ (decrease, increase, have no effect on) the total quantity of CaCO3 once equilibrium is reestablished.

Question 1269

Which compound exhibits the strongest hydrogen bonding between its molecules?
A) H F
B) H Cl
C) H Br
D) H I

Question 1270

What minerals are important commercial sources of metals?
A) silicates
B) chlorides
C) nitrates
D) oxides

Question 1271

Normal rainfall has a concentration of OH- that is 3.99 × 10^-9. The concentration of H3O+ in normal rainfall is
A) greater than 3.99 × 10^-9, and the rain is acidic.
B) greater than 3.99 × 10^-9, and the rain is basic.
C) less than 3.99 × 10^-9, and the rain is acidic.
D) less than 3.99 × 10^-9, and the rain is basic.

Question 1272

Cyclohexane, C6H12, undergoes a molecular rearrangement in the presence of AlCl3 to form methycyclopentane, CH3C5H9, according to the equation:
C6H12 ←--→ CH3C5H9
If Kc = 0.143 at 25°C for this reaction, find the equilibrium concentrations of C6H12 and CH3C5H9 if the initial concentrations are 0.200 M and 0.200 M, respectively.
A) [C6H12] = 0.150 M, [CH3C5H9] = 0.150 M
B) [C6H12] = 0.050 M, [CH3C5H9] = 0.162 M
C) [C6H12] = 0.350 M, [CH3C5H9] = 0.050 M
Question 1273
What is the smallest bond angle in SF6?
A) 60°
B) 90°
C) 109.5°
D) 120°

Question 1274
O2 and O3 are ________ of oxygen.
A) allotropes
B) isomers
C) isotopes
D) stereomers

Question 1275
How many h orbitals are allowed in a given shell?
A) 5
B) 6
C) 11
D) 13

Question 1276
Which is an amino acid polar neutral side chain?
A) -CH3
B) -CH2OH
C) -CH2CO2H
D) -CH2CH2CH2CH2NH2

Question 1277
One mole of gas at 25°C in a 3.0-L flask has a ________ pressure than one mole of gas at 25°C in a 14.0-L flask.

Question 1278
Which of the following elements is most likely to occur as a metal sulfide ore?
A) Al
B) Hg
C) Li
D) Mn

Question 1279
Which one of the following salts, when dissolved in water, produces the solution with the highest pH?
A) LiI
B) LiBr
C) LiCl
D) LiF

Question 1280
In which compound is the oxidation state of oxygen not -2?
A) MgO
B) Na2O
Question 1281

The diameter of the nucleus of an atom is approximately 1 x 10^-13 cm. If 1 nm is equal to 10
what is the diameter of the nucleus in
A) 1 x 10^-23 Å
B) 1 x 10^-8 Å
C) 1 x 10^-7 Å
D) 1 x 10^-5 Å

Question 1282

What volume of a 0.540 M NaOH solution contains 13.5 g of NaOH?
A) 0.182 L
B) 0.625 L
C) 1.60 L
D) 5.49 L

Question 1283

Calculate the Ksp for silver sulfite if the solubility of Ag2SO3 in pure water is 4.6 x 10^-3 g/L.
A) 3.8 x 10^-15
B) 1.5 x 10^-14
C) 2.4 x 10^-10
D) 4.8 x 10^-10

Question 1284

How many cations and how many anions are in the unit cell?
A) 4 cations and 4 anions
B) 4 cations and 8 anions
C) 4 cations and 14 anions
D) 8 cations and 4 anions

Question 1285

A solution with hydronium ion concentration [H+] = 1.60 x 10^-2 M has a hydroxide ion concentration [OH-] =

Question 1286

What is the pH at the equivalence point of a weak base-strong acid titration if 20.00 mL of NaOCl requires 28.30 mL of 0.20 M HCl? Ka = 3.0 x 10^-8 for HOCl.
A) 0.70
B) 3.39
C) 3.76
D) 4.23

Question 1287

An aqueous solution has a normal boiling point of 102.5°C. What is the freezing point of this solution? For water Kf = 0.51°C/m and Kb = 1.86°C/m.
A) -0.69°C
B) -2.5°C
C) -3.6°C
D) -9.1°C

Question 1288

The complex [Ni(CN)4]2- is diamagnetic and the complex [NiCl4]2- is paramagnetic. What can you conclude about their molecular geometries?
A) Both complexes have square planar geometries.
B) Both complexes have tetrahedral geometries.
C) [NiCl4]2- has a square planar geometry while [Ni(CN)4]2- has a tetrahedral geometry.
D) [NiCl4]2- has a tetrahedral geometry while [Ni(CN)4]2- has a square planar geometry.

Question 1289

Which group 3A element exhibits the most nonmetallic character?
A) B
B) Tl
C) Pb
D) Sb

Question 1290

Nickel metal can be prepared by the reduction of nickel oxide:
\[
\text{NiO(s) + CO(g) } \rightleftharpoons \text{ CO}_2(g) + \text{ Ni(s)} 
\]
At 936 K, \( K_p = 4.54 \times 10^3 \) and at 1125 K, \( K_p = 1.58 \times 10^3 \). Which statement is true?
A) The activation energy decreases with increasing temperature.
B) The activation energy increases with increasing temperature.
C) The reaction is endothermic.
D) The reaction is exothermic.

Question 1291

Which of the following liquids will exhibit the highest vapor pressure?
A) Br2, bp = 58.8°C
B) CH3OH, bp = 64.7°C
C) H2O, bp = 100°C
D) All exhibit the same vapor pressure.

Question 1292

Metals that do not react with hydrochloric acid to produce hydrogen gas are found ________ H2 in the activity series.

Question 1293

AgCl is found to have 78.1% ionic character, and its gas phase dipole moment is 11.5 D. What is the distance between the Ag and Cl atoms in gaseous AgCl?
A) 9.19 \times 10^{-10} \text{ pm}
B) 14.7 pm
C) 307 pm
D) 903 pm

Question 1294

All but one of the common amino acids contain a -NH2 amino group. Which one contains an -NH- amino group as part of a ring structure?
A) phenylalanine
B) proline
C) tyrosine
D) arginine

Question 1295

How many electrons are in the ion, Fe2+?
A) 24
B) 26
C) 28
D) 56
Question 1296
Relative to the amount of energy released in a typical chemical reaction, the amount of energy released in a typical fission reaction is about
A) the same.
B) 1/2 times greater.
C) 108 times greater
D) 107 times greater

Question 1297
What is the pH of a 0.300 M NH₃ solution that has Kb = 1.8 × 10⁻⁵? The equation for the dissociation of NH₃ is
NH₃(aq) + H₂O(l) <--→ NH₄⁺(aq) + OH⁻(aq).
A) 2.11
B) 2.63
C) 11.89
D) 11.37

Question 1298
The decay constant, k, is given for each of the beta emitters below. Which one has the shortest half life?
A) 115In, 4.29 × 10⁻⁹ s⁻¹
B) 131I, 9.94 × 10⁻⁷ s⁻¹
C) 217At, 21.4 s⁻¹
D) 42K, 1.55 × 10⁻⁵ s⁻¹

Question 1299
The element in group 7A with the least favorable (least negative) electron affinity is ________.

Question 1300
At what pH is the amino acid glycine with a Ka of 2.51 × 10⁻¹⁰ sixty-six (66%) percent dissociated?
A) 9.60
B) 9.89
C) 10.10
D) 10.60

Question 1301
Dinitrogen monoxide gas decomposes to form nitrogen gas and oxygen gas. How many grams of oxygen are formed when 20.0 g of dinitrogen monoxide decomposes?
A) 0.138 g
B) 7.27 g
C) 14.5 g
D) 29.1 g

Question 1302
What is not a correct expression for the weak acid HA?
A) Ka = [H₃O⁺][A⁻]/[HA]
B) pKa = pH - log([A⁻]/[HA])
C) pKa = log(Ka)
D) pKa = 14 - pKb

Question 1303
Ring strain the cause of high molecular reactivity that occurs when the angles in a ring of atoms are not close to "normal" bond angles (90° when the bonds are formed by atoms using pure p-orbitals, 109.5° using sp³ hybrid orbitals, 120° using sp² orbitals, etc.). The angles in white phosphorus, P₄, measure ________, and P₄ ________ expected to exhibit ring strain and be very reactive.
**Question 1304**

Which of the following can be classified as a weak base?

A) CH₃NH₂  
B) NH₂OH  
C) Both CH₃NH₂ and NH₂OH  
D) Neither CH₃NH₂ nor NH₂OH  


**Question 1305**

Which one of the following salts, when dissolved in water, produces the solution with the lowest pH?

A) NaI  
B) KI  
C) MgI₂  
D) AlI₃  


**Question 1306**

The density of aluminum is 2.702 g/cm³. What is the final liquid level of water if 1.130 ounces of aluminum is dropped into a graduated cylinder containing 15.90 mL of water?

A) 17.08 mL  
B) 21.66 mL  
C) 27.76 mL  
D) 47.95 mL  


**Question 1307**

How many protons (p), neutrons (n), and electrons (e) are in one atom of Mg?

A) 12 p, 12 n, 12 e  
B) 12 p, 11 n, 12 e  
C) 12 p, 11 n, 10 e  
D) 12 p, 11 n, 14 e  


**Question 1308**

Silver oxalate, Ag₂C₂O₄, has a molar solubility = 1.1 × 10⁻⁴ mol/L. Ag₂C₂O₄ has a solubility product Kᵢₚ = ________.


**Question 1309**

When ethylene glycol, HOCH₂CH₂OH, is added to the water in an automobile radiator, the effect is to

A) lower the boiling point and lower the freezing point.  
B) lower the boiling point and raise the freezing point.  
C) raise the boiling point and lower the freezing point.  
D) raise the boiling point and raise the freezing point.  


**Question 1310**

The volume of 0.200 M H₂SO₄ that contains 5.00 mmol of H⁺ is ________ mL.  


**Question 1311**

What is the hydronium ion concentration of a 0.100 M hypochlorous acid solution with Kₐ = 3.5 × 10⁻⁸? The equation for the dissociation of hypochlorous acid is:

\[
\text{HOCI(aq)} + \text{H₂O(l)} \rightleftharpoons \text{H₃O⁺(aq)} + \text{OCl⁻(aq)}.
\]

A) 1.9 × 10⁻⁴  
B) 5.9 × 10⁻⁴  
C) 1.9 × 10⁻⁵  
D) 5.9 × 10⁻⁵  

Question 1312
A solution is made by dissolving 19.5 g of sucrose, C12H22O11, in 117 g of water, producing a solution with a volume of 125 mL at 20°C. What is the expected osmotic pressure at 20°C?
A) 11.0 atm  
B) 23.2 atm  
C) 50.0 atm  
D) 58 atm  

Question 1313
What is the concentration of FeBr3 in a solution prepared by dissolving 10.0 g of FeBr3 in enough water to make 275 mL of solution?
A) 1.23 × 10-4 M  
B) 0.123 M  
C) 1.23 M  
D) 1.23 × 103 M  

Question 1314
What is the entropy of 12 molecules in a system of 100 boxes?

Question 1315
Element M has the valence electron configuration 3d6 4s2. What is the valence electron configuration of the M3+ ion?
A) 3d5  
B) 3d3 4s2  
C) 3d4 4s1  
D) 3d9 4s2  

Question 1316
Among the main-group elements the number of semimetals is
A) five.  
B) six.  
C) seven.  
D) eight.  

Question 1317
The law of conservation of energy is also known as the ________ law of thermodynamics.

Question 1318
When dissolved in water, NaOH behaves as
A) an acid that forms Na+ and OH- ions.  
B) an acid that forms NaO- and H+ ions.  
C) a base that forms Na+ and OH- ions.  
D) a base that forms NaO- and H+ ions.  

Question 1319
A 0.020 m aqueous solution containing which solute will have the lowest freezing point?
A) LiCl  
B) NaF  
C) KCl  
D) All will have approximately the same freezing point.  
Question 1320

What is the ground-state electron configuration of the ion Cu^{2+}?
A) \([\text{Ar}] \ 3d^9\)
B) \([\text{Ar}] \ 4s^1 \ 3d^8\)
C) \([\text{Ar}] \ 4s^2 \ 3d^7\)
D) \([\text{Ar}] \ 4s^2 \ 3d^{10} \ 4p^1\)

Question 1321

What is the approximate pH at the equivalence point of a weak acid-strong base titration if 25 mL of aqueous formic acid requires 29.80 mL of 0.2567 M NaOH? \(K_a = 1.8 \times 10^{-4}\) for formic acid.
A) 2.13
B) 5.56
C) 8.44
D) 11.87

Question 1322

The isotope represented by \(C\) is named
A) carbon-6.
B) carbon-3.
C) carbon-9.
D) carbon-15.

Question 1323

The density of mercury is 13.6 g/cm^3. The mass of 38.0 cm^3 of mercury is ________ g.

Question 1324

Which compound is a ketone?
A) butanal
B) propanoic acid
C) 2-butanone
D) butane

Question 1325

Three atoms have the following properties.
Proton Neutron Electron
Atom X 119 119 119
Atom Y 119 119 118
Atom Z 118 118 119
Which of the following statements is true?
A) Element Y and Z are isotopes of X.
B) Element Y is an isotope of Z.
C) Element Y is an ion of X.
D) Element Z is an ion of Y.

Question 1326

The first transition series element expected to have the lowest second ionization energy is ________.

Question 1327

Which one of the following is the best electrical conductor?
A) C (diamond)
B) C (graphite)

Question 1328
Which has the highest melting point?
A) Sc
B) V
C) Mn
D) Zn

Question 1329
What statement is inconsistent about graphite?
A) Carbon sheets are separated by a distance of 335 pm and are held together by weak London dispersion forces.
B) Electrical conductivity parallel to the planar sheets is 1020 times greater than the conductivity of diamond.
C) Pi electrons are delocalized and free to move perpendicular to the plane of the hexagonal sheets.
D) A two-dimensional sheetlike structure in which each C atom uses sp2 hybrid orbitals.

Question 1330
Calculate the pH for an aqueous solution of pyridine that contains 2.15 × 10-4 M hydroxide ion.
A) 4.65 × 10-11
B) 2.15 × 10-4
C) 3.67
D) 10.33

Question 1331
An unknown gas effuses 2.3 times faster than N2O4 at the same temperature. What is the identity of the unknown gas?
A) CN2
B) NH3
C) N2O
D) O3

Question 1332
Which cation in each set would be expected to have the larger (more negative) hydration energy?
I. Cu+ or Cu2+
II. Li+ or NH4+
A) Cu+ in set I and Li+ in set II
B) Cu+ in set I and NH4+ in set II
C) Cu2+ in set I and Li+ in set II
D) Cu2+ in set I and NH4+ in set II

Question 1333
10% saline solution (sodium chloride dissolved in water) is an example of a ________.

Question 1334
What is the oxidation number of oxygen in KO2?
A) 0
B) -1/2
C) -1
D) -2

Question 1335
The average distance between nitrogen and oxygen atoms is 115 pm in a compound called nitric oxide. What is this distance in centimeters?

A) $1.15 \times 10^{-7}$ cm  
B) $1.15 \times 10^{-8}$ cm  
C) $1.15 \times 10^{13}$ cm  
D) $1.15 \times 10^{18}$ cm


**Question 1336**

The vertical columns of the periodic table are called

A) groups.  
B) periods.  
C) triads.  
D) elements.


**Question 1337**

Which one of the following compounds contains ionic bonds?

A) MgS  
B) HF  
C) NCl3  
D) SiO2


**Question 1338**

Which allotrope of carbon has the atoms arranged in a spherical array?

A) coke  
B) diamond  
C) fullerene  
D) graphite


**Question 1339**

How many electrons are in a neutral atom of iodine-131?

A) 1  
B) 53  
C) 54  
D) 131


**Question 1340**

Is thermal energy a form of kinetic or potential molecular energy?


**Question 1341**

Which electron on an atom of palladium would have the highest value of $W$ in the Boltzmann formula?

A) 3s  
B) 4d  
C) 4s  
D) 3p


**Question 1342**

Which of the following statements is not a postulate of Dalton’s atomic theory?

A) Each element is characterized by the mass of its atoms.  
B) Atoms are composed of protons, neutrons, and electrons.  
C) Chemical reactions only rearrange atomic combinations.  
D) Elements are composed of atoms.

Question 1343
What is the molar solubility of lead(II) chromate in 0.10 M HNO3 if the Ksp for PbCrO4 is $2.8 \times 10^{-13}$ and the Ka2 for H2CrO4 is $3.0 \times 10^{-7}$? Note that H2CrO4 is considered to be a strong acid.
A) $9.2 \times 10^{-11}$ M
B) $2.9 \times 10^{-10}$ M
C) $9.3 \times 10^{-7}$ M
D) $3.1 \times 10^{-4}$ M

Question 1344
The chemical formula for the carbonate ion is
A) C-.
B) CO-.
C) CO32-.
D) CO22-.

Question 1345
What is the pH of the resulting solution if 25 mL of 0.432 M methylamine, CH₃NH₂, is added to 15 mL of 0.234 M HCl? Assume that the volumes of the solutions are additive. Ka = $2.70 \times 10^{-11}$ for CH₃NH₃⁺.
A) 3.11
B) 3.74
C) 10.26
D) 10.89

Question 1346
What type of hybrid orbitals are used by the Ti atom to form chemical bonds in the complex ion [Ti(H₂O)₆]³⁺?
A) sp³
B) dsp²
C) dsp³
D) d²sp³

Question 1347
A student prepared a stock solution by dissolving 15.0 g of KOH in enough water to make 150 mL of solution. She then took 15.0 mL of the stock solution and diluted it with enough water to make 65.0 mL of a final solution. What is the concentration of KOH for the final solution?
A) 0.411 M
B) 0.534 M
C) 1.87 M
D) 2.43 M

Question 1348
A balloon contains 0.76 mol N₂, 0.18 mol Ar, 0.031 mol He, and 0.026 mol H₂ at 739 mm Hg. What is the partial pressure of Ar?
A) 19 mm Hg
B) 23 mm Hg
C) 130 mm Hg
D) 560 mm Hg

Question 1349
What is the abbreviation used for the curie, a unit used in the measurement of nuclear disintegrations per unit time?
A) Cm
B) Cb
C) Ci
D) Ce
Question 1350

What is the structure of rhombic sulfur?
A) crown shaped S8 molecules
B) discrete S atoms
C) discrete S2 molecules
D) polymeric Sn chains

Question 1351

Red blood cells are placed into pure water. Which of the following statements is true?
A) Water molecules flow out of the red blood cells, causing them to collapse.
B) Water flows into the red blood cells, causing them to swell and burst.
C) The osmotic pressure of the cell contents increases, causing the cells to burst.
D) The osmotic pressure inside the cells equals the osmotic pressure outside.

Question 1352

The intermolecular forces responsible for CH3CH2OH being at liquid at 20°C are _______ bonds.

Question 1353

How many moles are in 7.8 g of acetamide, CH3CONH2?

Question 1354

Calculate the freezing point of a solution of 50.0 g methyl salicylate, C7H6O2, dissolved in 800. g of benzene, C6H6. Kf for benzene is 5.10°C/m and the freezing point is 5.50°C for benzene.
A) -2.61°C
B) 2.61°C
C) 2.89°C
D) 8.39°C

Question 1355

What is the [CH3CO2-]/[CH3CO2H] ratio necessary to make a buffer solution with a pH of 4.44? Ka = 1.8 × 10-5 for CH3CO2H.
A) 0.50:1
B) 0.94:1
C) 1.1:1
D) 2.0:1

Question 1356

A fuel cell is a galvanic cell in which the reactant is a fuel such as
A) hydrogen.
B) gasoline.
C) ethane.
D) propanol.

Question 1357

What metal is isolated from the ore sphalerite?
A) chromium
B) iron
C) silver
D) zinc

Question 1358
Gamma radiation can be described as
A) a helium nucleus.
B) a negatively charged free electron.
C) high energy electromagnetic radiation.
D) a positively charged free electron.

Question 1359
Which one of the following is not an empirical formula?
A) CHO
B) CH2O
C) C2H4O
D) C2H2O4

Question 1360
Which is an amino acid nonpolar neutral side chain?
A) -CH3
B) -CH2OH
C) -CH2CO2H
D) -CH2CH2CH2CH2NH2

Question 1361
A solution is prepared by dissolving 171 g of CdCl2 in enough water to make 250.0 mL of solution. If the density of the solution is 1.556 g/mL, what is the molarity of the solution?
A) 0.440 M
B) 0.684 M
C) 0.933 M
D) 3.73 M

Question 1362
Given that 2.54 cm = 1 in, 350 in3 = ________ L.

Question 1363
Of the following, which element has the highest first ionization energy?
A) barium
B) cesium
C) indium
D) rubidium

Question 1364
Using shorthand notation, the electron configuration of Ni is ________.

Question 1365
What is the charge on the Sc ions in Sc2O3?
A) 2-
B) 1+
C) 2+
D) 3+

Question 1366
According to band theory, which of the following metals is expected to have the strongest bonding and highest melting point?
A) Cs
B) Cu  
C) Rb  
D) Ru  

**Question 1367**

A catalyst increases the rate of a reaction by providing a different reaction pathway that  
A) lowers only the activation energy.  
B) raises only the energy of the products.  
C) lowers only the energy of the reactants and products.  
D) All of these are affected by the presence of a catalyst.  

**Question 1368**

Convert 4.300 × 10^{-3} to ordinary notation.  
A) 0.0004300  
B) 0.004300  
C) 430.0  
D) 4300  

**Question 1369**

Which of the following is not a type of energy or energy transfer?  
A) thermal energy  
B) heat  
C) height  
D) work  

**Question 1370**

Na₂S is named  
A) sodium disulfide.  
B) sodium sulfide.  
C) sodium(II) sulfide.  
D) sodium sulfur.  

**Question 1371**

Vinegar is a 5.0% solution by weight of acetic acid (CH₃CO₂H) in water. Given that the pH for acetic acid is 2.41, the Ka = 1.8 × 10^{-5} and assuming the density of vinegar to be 1.00 g/cm³, what is the percent dissociation of acetic acid in vinegar?  
A) 0.47%  
B) 1.5%  
C) 4.0%  
D) 5.0%  

**Question 1372**

Which first row transition element has the highest melting point?  
A) Sc  
B) V  
C) Fe  
D) Zn  

**Question 1373**

Which of the following is not true?  
A) All moving objects have wave characteristics.  
B) For objects moving at a given speed, the larger the mass, the shorter the wavelength.  
C) The de Broglie relation and the Heisenberg uncertainty principle apply only to small particles.  
D) The Heisenberg uncertainty principle is an inequality.
Question 1374
Which transition element is difficult to oxidize with hydronium ion?
A) Ti  
B) Cu  
C) Mn  
D) Zn

Question 1375
Which is classified as an amorphous solid?
A) palladium(II) bromide  
B) phosphorus tetrachloride  
C) plastic  
D) potassium iodide

Question 1376
When an electron is added to the lowest unoccupied molecular orbital of N2, the electron is added to a(n) ________ (antibonding, bonding) molecular orbital and the N—N bond order will ________ (decrease, increase).

Question 1377
Ammonia NH3, has a base dissociation constant of 1.8 × 10-5. What is the conjugate acid of ammonia and what is its acid dissociation constant?
A) NH4+, 1.9 × 109  
B) NH4+, 1.8 × 10-5  
C) NH4+, 5.6 × 10-10  
D) NH2-, 5.6 × 10-10

Question 1378
The element in period 4 with the smallest first ionization energy is ________.

Question 1379
What volume of 5.00 × 10-3 M HNO3 is needed to titrate 20.00 mL of 5.00 × 10-3 M Ca(OH)2 to the equivalence point?
A) 2.50 mL  
B) 10.0 mL  
C) 20.0 mL  
D) 40.0 mL

Question 1380
Polydentate ligands are known as ________ agents.

Question 1381
If the pressure in a gas container that is connected to an open-end U-tube manometer is 126 kPa and the pressure of the atmosphere at the open end of the tube is 732 mm Hg, the level of mercury in the tube will
A) be 213 mm higher in the arm open to the atmosphere.  
B) be 213 mm higher in the arm connected to the gas cylinder.  
C) be 945 mm higher in the arm open to the atmosphere.  
D) be 945 mm higher in the arm connected to the gas cylinder.

Question 1382
Which one of the following processes does not result in transmutation to another element?
A) alpha emission
B) positron decay
C) electron capture
D) gamma emission

**Question 1383**

What is the chemical process most likely to be used to purify nickel metal?
A) distillation
B) electrorefining
C) reaction with carbon monoxide (a Mond process)
D) reaction with iodine

**Question 1384**

If the concentrations of Ag+(aq) and Cu2+(aq) are varied in this galvanic cell, which of the following four cells has the largest cell potential?
A) [Ag+] = 0.10 M and [Cu2+] = 0.10 M
B) [Ag+] = 1.0 M and [Cu2+] = 0.10 M
C) [Ag+] = 0.10 M and [Cu2+] = 1.0 M
D) [Ag+] = 1.0 M and [Cu2+] = 1.0 M

**Question 1385**

Which of the following is a weak diprotic acids?
A) HCN
B) HCO2H
C) H2CO3
D) H2SO3

**Question 1386**

Identify a Group 2A element with the smallest radius.
A) Na
B) Ca
C) Sr
D) F

**Question 1387**

A 1.75 L container filled with CO2 gas at 25°C and 225 kPa pressure springs a leak. When the container is re-sealed, the pressure is 200 kPA and the temperature is 10°C. How many moles of gas were lost?
A) 0.0101 mol
B) 0.149 mol
C) 6.71 mol
D) 99.0 mol

**Question 1388**

What is the identity of M in the hydrate M(H2O)6n+ that has the 0.10 M solution with the lowest pH?
A) Li+
B) Na+
C) Mg2+
D) Al3+

**Question 1389**

In the best Lewis structure for CO2, what is the formal charge on the C atom?
A) -1
B) 0
C) +1
D) +2
Question 1390

Calculate the hydroxide ion concentration in an aqueous solution that contains 3.50 × 10⁻⁵ M in hydronium ion.
A) 2.86 × 10⁻² M
B) 2.86 × 10⁻⁹ M
C) 2.86 × 10⁻¹⁰ M
D) 3.50 × 10⁻¹⁰ M

Question 1391

Convert 98.6 cm³ to m³.
A) 98.6 × 10⁻⁴ m³
B) 98.6 × 10¹ m³
C) 98.6 × 10⁶ m³
D) 98.6 × 10⁸ m³

Question 1392

The number of atoms of carbon in 28 g of silicon is
A) 28
B) 28 × 6.022 × 10²²
C) 2.8 × 10²³
D) 6.022 × 10²³

Question 1393

Which of the following decay processes give a product nuclide whose atomic number is one less than the starting nuclide?
A) alpha decay
B) beta decay and positron decay
C) gamma decay and beta decay
D) positron decay and electron capture

Question 1394

Which one of the following compounds that contains a Group 5A element is least likely to exist?
A) NF₃
B) NBr₅
C) PF₃
D) PI₅

Question 1395

Which of the following forms a molecular solid?
A) CaCl₂
B) C₉H₈O₄
C) C, graphite
D) palladium

Question 1396

In which compound is nitrogen in its lowest possible oxidation state?
A) NH₃
B) N₂H₄
C) HNO₂
D) HNO₃

Question 1397
The rate constant, \( k \), for a first-order reaction is equal to \( 4.2 \times 10^{-4} \) s\(^{-1}\). What is the half-life for the reaction?

A) \( 2.9 \times 10^{-4} \) s  
B) \( 1.2 \times 103 \) s  
C) \( 1.7 \times 103 \) s  
D) \( 2.4 \times 103 \) s  


**Question 1398**

If 1.4% of the mass of a human body is calcium, how many kilograms of calcium are there in a 195-pound man?

A) 1.2 kg Ca  
B) 6.0 kg Ca  
C) 1.2 \times 102 kg Ca  
D) 6.0 \times 102 kg  


**Question 1399**

Identify the statement that is true about nonelectrolytes.

A) Nonelectrolytes dissolve in water to produce ions. 
B) Nonelectrolytes do not dissociate in water. 
C) Nonelectrolytes conduct electricity. 
D) Most nonelectrolytes are ionic compounds.  


**Question 1400**

The density of mercury is 13.5 g/mL. What is the mass in kg of mercury that fills a 0.250 L flask?

A) 0.0540 kg  
B) 3.38 kg  
C) 54.0 kg  
D) 3380 kg  


**Question 1401**

Using the three different isotopes of oxygen, \(^{16}\)O, \(^{17}\)O, \(^{18}\)O, and the major isotope of hydrogen, \(^1\)H, determine the number of different types of isotopically substituted hydrogen peroxide, \( \text{H}_2\text{O}_2 \), that could be formed.

A) 3  
B) 5  
C) 6  
D) 9  


**Question 1402**

Which of the following compounds exhibit only dispersion and dipole-dipole intermolecular interactions?

A) \( \text{N}_2 \)  
B) \( \text{HBr} \)  
C) \( \text{CO}_2 \)  
D) \( \text{H}_2\text{O} \)  


**Question 1403**

What is the ground-state electron configuration of tellurium?

A) [Kr]4d105s25p4  
B) [Kr]5s25p65d8  
C) [Kr]5s25p4  
D) [Kr]4f144d105s25p4  


**Question 1404**

What is the general valence-electron ground-state electron configuration for neutral halogens?

A) ns1  
B) ns2np7
Question 1405

Is a hydroelectric dam a form of kinetic or potential molecular energy?

Question 1406

Chemical and physical changes can be classified as spontaneous or nonspontaneous. At 25°C and 1 atm pressure the decomposition of water into hydrogen and oxygen is classified as ________, and the melting of snow is classified as ________.

Question 1407

Which set of ions precipitate as sulfides?
A) Ag+, Pb2+, Mn2+
B) Pb2+, Fe2+, Ca2+
C) Co2+, Ba2+, K+
D) NH4+, Na+, K+

Question 1408

What is the empirical and molecular formulas of 1-tert-butyl-2-methylcyclodecane?

Question 1409

The ground-state electron configuration of the C4−, is the same as which noble gas?

Question 1410

Predict the products of a reaction between AgNO3(aq) and CsBr(aq).
A) Ag(s) and NO(g)
B) Ag(s) and Br2(l)
C) AgBr(s) and CsNO3(aq)
D) AgNO3(aq) and CsBr(aq)

Question 1411

Which of the following species has the ground-state electron configuration [Ar]3d4?
A) V
B) Ti+
C) V+
D) Fe2+

Question 1412

Limnite is an ore having a formula that is sometimes written as an iron(III) oxide hydrate, Fe2O3•xH2O. If 1.00 kg of limnite produces 0.747 kg of anhydrous Fe2O3 upon heating, what is the number of waters of hydration x in the Fe2O3•xH2O?
A) 1
B) 2
C) 3
D) 4

Question 1413

Which of the noble gases should show the greatest deviation from the ideal gas law at high pressures?
A) He
B) Ar
C) Rn
D) All deviate equally.

**Question 1414**

The percentage of carbon in the endohedral fullerene complexes KrC60 and XeC60 is ________%C and ________%C, respectively.

**Question 1415**

How many atoms are in one face-centered cubic unit cell of a metal?
A) 1
B) 2
C) 3
D) 4

**Question 1416**

Which element of group 6A has the highest melting point?
A) Ge
B) As
C) Po
D) Se

**Question 1417**

A silicon carbide ceramic has a unit cell with carbon atoms in a cubic closest packed arrangement with carbon atoms occupying one-half of the tetrahedral holes. The empirical formula of this ceramic is ________.

**Question 1418**

The rate of a nuclear reaction can be changed by
A) adding a catalyst.
B) increasing the volume.
C) increasing the temperature.
D) None of these

**Question 1419**

The galvanic cell represented by the shorthand notation below contains KNO3(aq) in the salt bridge. During the reaction ________ ions flow into the anode compartment and ________ ions flow into the cathode compartment.
Pt(s)|H2(g)|H+(aq)|| Sn4+(aq)|Sn2+(aq)|Pt(s)

**Question 1420**

What is the selenide ion concentration \([\text{Se}^2-]\) for a 0.100 M H2Se solution that has the stepwise dissociation constants of \(K_a1 = 1.3 \times 10^{-4}\) and \(K_a2 = 1.0 \times 10^{-11}\)?
A) 3.6 \times 10^{-3}\ M
B) 1.3 \times 10^{-4}\ M
C) 1.3 \times 10^{-5}\ M
D) 1.0 \times 10^{-11}\ M

**Question 1421**

Determine the number of water molecules necessary to balance the reduction half reaction of \(\text{Se}^2-\) that occurs in an acidic solution.
A) 1
B) 3
C) 5
D) 7
### Question 1422

The charge to mass ratio of an electron was determined from Rutherford's cathode-ray tube experiment to be $1.759 \times 10^8 \text{ C/g}$ and the charge on a single electron was determined from the Millikan oil drop experiment to be $1.602 \times 10^{-19} \text{ C}$, so the mass of a single electron is ________.  

### Question 1423

Which of the following statements concerning the electrorefining of copper is not true?  
A) The anode is constructed of chalcocite, Cu$_2$S.  
B) The anode mud is a valuable source of silver, gold, and platinum.  
C) Copper is oxidized at the anode and copper(II) ions are reduced at the cathode.  
D) The process is used to purify copper.  

### Question 1424

In order to form a neutral compound, hexafluoroaluminate would require  
A) three Na$^+$ ions.  
B) three Br$^-$ ions.  
C) six K$^+$ ions.  
D) six I$^-$ ions.  

### Question 1425

At an elevated temperature, $K_p = 0.19$ for the reaction $2 \text{NOCl}(g) \rightleftharpoons 2 \text{NO}(g) + \text{Cl}_2(g)$. If the initial partial pressures of NOCl, NO, and Cl$_2$ are 0.50 atm, 0.25 atm, and 0.45 atm, respectively, a net ________ (forward, reverse) reaction must occur in order to achieve equilibrium.  

### Question 1426

At 25°C the vapor pressures of benzene and toluene are 96.0 mm Hg and 30.5 mm Hg, respectively. When a 1:1 molar mixture of benzene and toluene is fractionally distilled, the first fraction will have a mole fraction of benzene that is closest to  
A) 0.0.  
B) 0.5.  
C) 0.7.  
D) 1.0.  

### Question 1427

Arrange the ions N$_3^-$, O$_2^-$, Mg$^{2+}$, Na$^+$, and F$^-$ in order of increasing ionic radius, starting with the smallest first.  
A) Mg$^{2+}$, Na$^+$, F$^-$, O$_2^-$, N$_3^-$  
B) N$_3^-$, Mg$^{2+}$, O$_2^-$, Na$^+$, F$^-$  
C) N$_3^-$, O$_2^-$, Mg$^{2+}$, F$^-$, Na$^+$  
D) N$_3^-$, O$_2^-$, F$^-$, Na$^+$, Mg$^{2+}$  

### Question 1428

Which alkali metal forms preferentially a peroxide or superoxide?  
A) Li  
B) Na  
C) Cs  
D) Sr  

### Question 1429

What is the de Broglie wavelength of an electron ($m = 9.11 \times 10^{-31} \text{ kg}$) moving at a velocity of $(10\% \text{ of the speed of light})$?  
A) less than $3.9 \times 10^{-12} \text{ m}$  
B) $2.4 \times 10^{-11} \text{ m}$  
C) $3.3 \times 10^{-8} \text{ m}$  
D) greater than $1.1 \times 10^{-4} \text{ m}$  
Question 1430

Chloroform is a volatile liquid once commonly used in the laboratory but now being phased out due to its ozone depletion potential. If the pressure of gaseous chloroform in a flask is 195 mm Hg at 25°C and its density is 1.25 g/L, what is the molar mass of chloroform?

A) 10.0 g/mol  
B) 76.3 g/mol  
C) 119 g/mol  
D) None of these


Question 1431

In which compound is phosphorus in its lowest oxidation state?

A) P2O5  
B) PBr3  
C) PH3  
D) PCl5


Question 1432

A solution with a hydrogen ion concentration of 3.25 × 10^{-2} M is ________ and has a hydroxide concentration of ________.

A) acidic, 3.08 × 10^{-12} M  
B) acidic, 3.08 × 10^{-13} M  
C) basic, 3.08 × 10^{-12} M  
D) basic, 3.08 × 10^{-13} M


Question 1433

Which one of the following is not used to describe the condition of a gas?

A) number of moles  
B) electronic configuration  
C) temperature  
D) pressure


Question 1434

What is the approximate pH of a solution X that gives the following responses with the indicators shown?

<table>
<thead>
<tr>
<th>Indicators</th>
<th>HIn — In-</th>
<th>pH range</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>methyl orange-red-yellow</td>
<td>3.2-4.4</td>
<td>yellow</td>
<td></td>
</tr>
<tr>
<td>methyl redred-yellow</td>
<td>4.8-6.0</td>
<td>yellow</td>
<td></td>
</tr>
<tr>
<td>bromothymol blue-yellow-blue</td>
<td>6.0-7.6</td>
<td>green</td>
<td></td>
</tr>
<tr>
<td>phenolphthalein-colorless-pink-colorless</td>
<td>8.2-10.0</td>
<td>colorless</td>
<td></td>
</tr>
</tbody>
</table>

A) 3.2 - 4.4  
B) 4.8 - 6.0  
C) 6.0 - 7.6  
D) 8.2 - 10.0


Question 1435

Of the following elements, which has the lowest electronegativity?

A) Ba  
B) I  
C) Ra  
D) At


Question 1436

Oxalic acid, H2C2O4 has acid dissociation constants Ka1 = 5.9 × 10^{-2} and Ka2 = 6.4 × 10^{-5}. What is the pH after 20.00 mL of 0.0500 M NaOH is added to 5.00 mL of 0.2000 M H2C2O4?

A) 1.23  
B) 2.10
Question 1437

Of the following elements, which has a melting point slightly above room temperature?
A) B
B) Ga
C) In
D) TI

Question 1438

What is the most soluble salt of the following set?
A) Ca(OH)2 with Ksp = 4.7 × 10-6
B) Mg(OH)2 with Ksp = 5.6 × 10-12
C) Fe(OH)2 with Ksp = 4.9 × 10-17
D) Al(OH)2 with Ksp = 1.9 × 10-33

Question 1439

Which acid has the smallest value of Ka?
A) HX
B) HY
C) HZ
D) All have the same Ka value.

Question 1440

There are three different isotopes of hydrogen H1, H2, H3 and three different isotopes of oxygen 16O, 17O, 18O. Indicate the number of different types of isotopically substituted water, H2O, that could be formed.
A) 9
B) 12
C) 15
D) 18

Question 1441

Consider the following electron configurations for neutral atoms:
atom I = 1s2s2s2p63s2
atom II = 1s2s2s2p63s23p4
atom III = 1s2s2s2p63s23p6
Which atom would be expected to have the largest third ionization energy?
A) atom I
B) atom II
C) atom III
D) All of these atoms would be expected to have the same third ionization energy.

Question 1442

Kp is related to Kc by the equation Kp = Kc (RT)n. What is the value of n for the reaction below?
NH4NO3(s) <----> N2O(g) + 2 H2O(g)
A) -2
B) -1
C) +1
D) +2

Question 1443

Of the following, which atom has the smallest atomic radius?
Question 1444

Methane and oxygen react to form carbon dioxide and water. What mass of water is formed if 6.4 g of methane reacts with 25.6 g of oxygen to produce 17.6 g of carbon dioxide?

A) 14.4 g
B) 17.6 g
C) 29.6 g
D) 32.0 g


Question 1445

What is a primary ingredient used in the production of iron by the blast furnace process?

A) bromide
B) sulfate
C) sulfide
D) limestone


Question 1446

What is the value of the gas constant, R, in units of ________?

A) 1.080 × 10^-4
B) 0.1080
C) 62.36
D) 6.236 × 10^4


Question 1447

What is the concentration of HCl in the final solution when 65 mL of a 6.0 M HCl solution is diluted with pure water to a total volume of 0.15 L?

A) 1.4 × 10^-2 M
B) 2.6 M
C) 14 M
D) 2.6 × 10^3 M


Question 1448

The pink and blue species below form a violet colored mixture at equilibrium:

\[ \text{[Co(H}_2\text{O)}_6\text{]}^{2+} \text{(aq)} + 4 \text{Cl}^- \text{(aq)} \rightleftharpoons [\text{CoCl}_4]^{2-} \text{(aq)} + 6 \text{H}_2\text{O} \text{(l)} \]

If the concentration of [Co(H2O)6]2+ is increased, what happens to the solution?

A) The concentration of [CoCl4]2- increases.
B) The concentration of [CoCl4]2- decreases.
C) The solution becomes colorless.
D) No color change is observed.


Question 1449

A sample of pure calcium fluoride with a mass of 15.0 g contains 7.70 g of calcium. How much calcium is contained in 35.0 g of calcium fluoride?

A) 1.99 g
B) 7.70 g
C) 15.0 g
D) 18.0 g


Question 1450

The solubility of a gas in a liquid is greatest at ________ pressures and ________ temperatures.
Question 1451
If dissociation of MgCl₂ in water were 100%, the van’t Hoff factor would be ________; however, for real solutions the van’t Hoff factor for MgCl₂ is ________ (greater than, less than) this value.

Question 1452
To make a 3.0 M solution, one could take 3.00 moles of solute and add
A) 1.00 L of solvent.
B) 1.00 kg of solvent.
C) enough solvent to make 1.00 L of solution.
D) enough solvent to make 1.00 kg of solution.

Question 1453
Assuming that sea water is a 3.5 wt % solution of NaCl in water, calculate its osmotic pressure at 20°C. The density of a 3.5% NaCl solution at 20°C is 1.023 g/mL.
A) 1.0 atm
B) 15 atm
C) 29 atm
D) 100 atm

Question 1454
Which equilibrium below is homogeneous?
A) CaSO₄(s) ⇌ Ca²⁺(aq) + SO₄²⁻(aq)
B) 2 H₂O₂(ℓ) ⇌ → 2 H₂O(ℓ) + O₂(g)
C) NH₄NO₃(s) ⇌ → N₂O(g) + 2 H₂O(g)
D) 2 CO(g) + O₂(g) ⇌ → 2 CO₂(g)

Question 1455
Which has the highest Zeff for its valence electrons?
A) Na
B) Mg
C) Si
D) Cl

Question 1456
Which of the following should have the lowest bond strength?
A) HOI
B) HCl
C) HO⁻
D) HOBr

Question 1457
A solution is 2.25% by weight NaHCO₃. How many grams of NaHCO₃ are in 250.0 g of solution?
A) 0.900 g
B) 5.62 g
C) 117 g
D) 225 g

Question 1458
The atoms of a particular element all have the same number of protons as neutrons. Which of the following must be true?
A) The atomic weight must be a whole number.
B) The mass number for each atom must equal the atomic weight of the element.  
C) The mass number must be exactly twice the atomic number for each atom.  
D) All of these are true.  

**Question 1459**

Which substance is commonly found in nature in an uncombined form?  
A) Fe  
B) Zn  
C) Au  
D) Li  

**Question 1460**

At 50°C the value of Kw is $5.5 \times 10^{-14}$, and the pH of a neutral solution at 50°C is ________.  

**Question 1461**

At a certain temperature, $K_c$ equals $1.4 \times 10^2$ for the reaction:  
$2 \text{CO}(g) + \text{O}_2(g) \rightleftharpoons 2 \text{CO}_2(g)$.  
If a 2.50-L flask contains 0.400 mol of CO2 and 0.100 mol of O2 at equilibrium, how many moles of CO are also present in the flask?  
A) 0.422 mol  
B) 0.169 mol  
C) 0.107 mol  
D) 0.0114 mol  

**Question 1462**

Nitrogen-14 ($14.003074 \text{ amu}$) is synthesized in the sun by fusion of 13C ($13.003355 \text{ amu}$) and 1H ($1.007825 \text{ amu}$). How much energy is released in this nuclear reaction?  
A) $2.432 \times 10^6 \text{ kJ/mol}$  
B) $7.295 \times 10^8 \text{ kJ/mol}$  
C) $9.141 \times 10^{10} \text{ kJ/mol}$  
D) $1.807 \times 10^{11} \text{ kJ/mol}$  

**Question 1463**

An astronaut uses a laboratory balance and weighs an object on earth and again on the moon. Which statement below about the weight and mass of the object is true?  
A) The mass and weight will be identical on the earth and the moon.  
B) The mass will be the same on earth and moon but the weight will be less on the moon.  
C) The weight will be the same on earth and moon but the mass will be less on the moon.  
D) Both the mass and weight will be different on earth and moon.  

**Question 1464**

_______ is used in lights and signs.  
A) Neon  
B) Helium  
C) Iodine  
D) Silicon  

**Question 1465**

The structure of a solid can be determined by diffraction of radiation in which region of the electromagnetic radiation spectrum?  
A) infrared  
B) microwave  
C) visible  
D) X-ray  
Question 1466
If a sample of 233Pa takes 62.7 days to decrease to 20.0% of its original mass, what is its half-life?
A) 0.0370 days
B) 27.0 days
C) 157 days
D) 195 days

Question 1467
In the best Lewis structure for CN -, what is the formal charge on the N atom?
A) -1
B) 0
C) +1
D) +2

Question 1468
Which of the following compounds is not an Arrhenius acid?
A) CH3CO2H
B) C3H7NH2
C) HNO2
D) H2SO4

Question 1469
Which is an ionic binary hydride?
A) HF
B) NaH
C) both HF and NaH
D) neither HF nor NaH

Question 1470
Which has the largest atomic radius?
A) La
B) W
C) Os
D) Hg

Question 1471
How many carbon-carbon bonds are present in C3H8?
A) 3
B) 1
C) 2
D) 0

Question 1472
The alkali metals Li and Na are commercially produced by
A) chemical reduction of their molten salts.
B) electrolysis of their molten salts.
C) thermal decomposition of their molten metal halides.
D) thermal decomposition of their molten metal oxides.

Question 1473
What is the sol-gel process?
A) a series of chemical steps that involves the isolation of CuS and then roasting with oxygen
B) a series of chemical steps that involves the isolation of SO3 and then treatment with H2SO4
C) a series of chemical steps that involves the synthesis of a metal oxide powder from a metal alkoxide
D) a series of chemical steps that involves the thermal decomposition of fibers of polyacrylonitrile

Question 1474
What functional group is commonly found in fats?
A) —NH2
B) —OH
C) —C—O—C
D) 

—O—C—C—


Question 1475
When dissolved in water, LiOH behaves as
A) an acid that forms Li+ and OH- ions.
B) an acid that forms LiO- and H+ ions.
C) a base that forms Li+ and OH- ions.
D) a base that forms LiO- and H+ ions.


Question 1476
Kp is equal to 48.70 at 731 K for the reaction: H2(g) + I2(g) ⇌ 2 HI(g). Initially the mixture contains 0.08592 atm each of H2 and I2 and 1.0000 atm of HI. What is the pressure of HI at equilibrium?
A) 0.7955 atm
B) 0.9108 atm
C) 0.9140 atm
D) 0.9498 atm


Question 1477
Calculate the pH of a 0.200 M NaCH3CO2 solution. Ka for acetic acid, CH3CO2H, is 1.8 × 10-5.
A) 2.72
B) 4.98
C) 9.02
D) 11.28


Question 1478
An “empty” aerosol can at 25°C still contains gas at 1.00 atmosphere pressure. If an “empty” can is thrown into a 450°C fire, what is the final pressure in the heated can?
A) 5.56 × 10-2 atm
B) 0.413 atm
C) 2.42 atm
D) 18.0 atm


Question 1479
How many isomers are there for C5H12?
A) 3
B) 4
C) 5
D) 6


Question 1480
The human body can synthesize ________ amino acids.
### Question 1481
Sodium is an example of an ________ metal that reacts with water to form hydrogen gas and an ________ solution.


### Question 1482
What is the coordination number of the Au atom in K[Au(CN)2(SCN)2]?

A) 2  
B) 3  
C) 4  
D) 6  


### Question 1483
Which of the following substances has increased markedly due to the use of fossil fuels and contributes to the greenhouse effect?

A) CO2  
B) SO2  
C) NO2  
D) O3  


### Question 1484
Which one of the following compounds is insoluble in water?

A) Na2SO4  
B) KNO3  
C) Ba SO4  
D) Li2CO3  


### Question 1485
Which ion does not have a noble gas configuration in its ground state?

A) Sc3+  
B) Al3+  
C) Zn2+  
D) Te2-  


### Question 1486
Which of the following bonds is expected to be stronger?

A) C—C bond with a bond order of 0  
B) C—C bond with a bond order of 1  
C) C—C bond with a bond order of 2  
D) C—C bond with a bond order of 3  


### Question 1487
The osmotic pressure of a 100-mL solution containing 1.0 g of sucrose, C12H22O11 will be ________ (equal to, greater than, less than) the osmotic pressure of a 100-mL solution containing 1.0 g of fructose, C6H12O6.


### Question 1488
What kind of packing do the anions adopt?

A) body-centered cubic  
B) cubic closest packed (face-centered cubic)
C) hexagonal closest packed
D) simple cubic

Question 1489

Which of the following does not have the same number of valence electrons?
A) O
B) S
C) Ca
D) Po

Question 1490

Elements A and Q form two compounds, AQ and A2Q3. The mass ratio (mass Q)/(mass A) for AQ is 0.574. What is the mass ratio (mass Q)/(mass A) for A2Q3?
A) 0.383
B) 0.861
C) 1.16
D) 2.61

Question 1491

Which atomic orbitals are involved in bonding and which as lone pair orbitals for N2H2?
H — — — H
A) bonding: s on H, sp2 on N; lone pair: p on N
B) bonding: sp2 on both H and N; lone pair: p on N
C) bonding: s on H, p on N; lone pair: sp2 on N
D) bonding: s on H, sp2 and p on N; lone pair: sp2 on N

Question 1492

Which alkaline earth metal reacts the most vigorously with water at room temperature?
A) Rb
B) Mg
C) Ba
D) Lr

Question 1493

Which of the following elements would you predict to have an anomalous electron configuration?
A) W
B) Mg
C) Al
D) Sb

Question 1494

Combustion analysis of 2.796 g of an unknown compound containing carbon, hydrogen, and oxygen produced 5.597 g of CO2 and 2.268 g of H2O. What is the empirical formula of the compound?
A) C2H5O
B) C2H5O2
C) C2H10O3
D) C2H4O

Question 1495

How many orbitals are there in the sixth shell?
A) 5
B) 6
C) 15
Question 1496

Convert 17 m³ to liters.
A) 1.7 × 10⁻² L
B) 1.7 L
C) 1.7 × 10² L
D) 1.7 × 10⁴ L

Question 1497

None of the listed compounds contains a ring. Which could have one carbon-carbon triple bond?
A) C₃H₈
B) C₂H₂
C) C₁₀H₂₀
D) All of these

Question 1498

When using the ideal gas law the temperature must be expressed in ________.

Question 1499

Which of the following does not contain a carbonyl group, C=O?
A) an alkene
B) a ketone
C) an amide
D) an ester

Question 1500

Which of the following elements is a gas at room temperature?
A) bromine
B) iron
C) krypton
D) sodium

Question 1501

What type of shielding can be used to protect against gamma rays?
A) paper
B) lead
C) heavy clothing
D) No shielding is effective against gamma rays.

Question 1502

What volume of 0.716 M KBr solution is needed to provide 13.0 g of KBr?
A) 6.55 mL
B) 9.31 mL
C) 18.5 mL
D) 153 mL

Question 1503

How many anions are in 10.0 g of sodium phosphate?
A) 3.67 × 10²² cations
B) 1.10 × 10²³ cations
Question 1504

Dentists employ light-cured materials to fill cavities. The wavelength of electromagnetic radiation used to photopolymerize restorative materials falls in the ultraviolet or visible region, depending on the instrument employed. Which of these wavelengths is in the UV region?
A) 31 nm
B) 300 nm
C) 440 nm
D) 840 nm

Question 1505

The quantity 1.0857 qt rounded to two significant figures is _______ qt.

Question 1506

Based on the variation in Zeff, which oxoanion should be the weakest oxidizing agent?
A) VO₄³⁻
B) CrO₄²⁻
C) MnO₄²⁻
D) FeO₄²⁻

Question 1507

For the reaction 2 A + B₂ ⇌ 2 AB, the rate of the forward reaction is 0.75 M/s and the rate of the reverse reaction is 0.25 M/s. The reaction is not at equilibrium. In order to attain equilibrium the reaction must proceed in the _______ (forward, reverse) direction in order to achieve equilibrium.

Question 1508

The definitive distinction between ionic bonding and covalent bonding is that
A) ionic bonding involves a sharing of electrons and covalent bonding involves a transfer of electrons.
B) ionic bonding involves a transfer of electrons and covalent bonding involves a sharing of electrons.
C) ionic bonding requires two nonmetals and covalent bonding requires a metal and a nonmetal.
D) covalent bonding requires two nonmetals and ionic bonding requires a metal and a nonmetal.

Question 1509

Which metal has maximum filling of bonding molecular orbitals and minimal filling of antibonding molecular orbitals in its composite s-d band?
A) Au
B) Cs
C) Re
D) W

Question 1510

What geometric arrangement does the molecule have for a central atom that has five charge clouds with two lone pairs?
A) tetrahedral
B) octahedral
C) T-shaped
D) trigonal bipyramidal

Question 1511

Human bones found on the west coast of the United States were thought to be remains of a prospector who lived in the 19th century. The bones were subjected to carbon-14 dating. Carbon-14 has a half-life of 5715 years. Living organisms decay at a rate of 15.30 disintegrations per minute per gram of carbon. The bones had a carbon-14 decay rate of 4.660 disintegrations per minute per gram of carbon. To one significant figure the age of the bones is _______ years old, so the person _______ (did, did not) live in the 19th century.
Question 1512
Which of the following mixtures have components which can be separated by filtration?
A) colloids
B) solutions
C) suspensions
D) all of these

Question 1513
The standard potential for the following galvanic cell is +0.90 V:
\[ 3 \text{Cu}^{2+}(aq) + 2 \text{Ga}(s) \rightleftharpoons 3 \text{Cu}(s) + 2 \text{Ga}^{3+}(aq) \]
Given that the standard reduction potential for the Cu^{2+}/Cu half-cell is +0.34 V, what is the standard reduction potential for the Ga^{3+}/Ga half-cell?
A) -1.34 V
B) -0.56 V
C) +0.56 V
D) +1.36 V

Question 1514
How many unpaired electrons are there in the ground state of element N?
A) 1
B) 2
C) 3
D) 4

Question 1515
Which of the following can function as a bidentate ligand?
A) NO^+
B) Cl^-
C) SCN^-
D) H_2NCH_2CO_2^-

Question 1516
Which transition element has the highest melting point?
A) Sc
B) V
C) Cu
D) W

Question 1517
What is the name of the compound formed between Ca and N?
A) calcium dinitride
B) calcium trinitride
C) monocalcium trinitride
D) calcium nitride

Question 1518
Hydrogenation of vegetable oils converts them into what type of molecule?
A) esters
B) ethers
C) polymers
D) saturated fats
Question 1519

Which of the following statements about cis-trans isomers is not correct?
A) Conversion between cis- and trans-isomers occurs easily by rotation around the double bond.
B) In the trans- isomer, the groups of interest are on opposite sides across the double bond.
C) In the cis- isomer, the groups of interest are on the same side of the double bond.
D) There are no cis-trans isomers in alkynes.

Question 1520

Covalent bonding is a
A) gain of electrons.
B) loss of electrons.
C) transfer of electrons.
D) sharing of electrons.

Question 1521

In leu-ala-arg-tyr-his-pro-gln, the amino acid with the N-terminal is
A) gln.
B) val.
C) leu.
D) tyr.

Question 1522

How many alpha amino acids commonly make up the different proteins found in humans?
A) 6
B) 20
C) 22
D) 12

Question 1523

How would one classify a silicon crystal doped with indium?
A) conductor
B) n-type semiconductor
C) p-type semiconductor
D) insulator

Question 1524

Which is the crystal field energy level diagram for a tetrahedral ML4?
A) (A)
B) (B)
C) (C)
D) (D)

Question 1525

Electronegativity of main-group elements generally
A) increases from left to right across a period and increases down a group.
B) increases from left to right across a period and decreases down a group.
C) decreases from left to right across a period and increases down a group.
D) decreases from left to right across a period and decreases down a group.

Question 1526

Sodium hydroxide is available commercially as a 50.0% by weight aqueous solution. Calculate the molality of this sodium hydroxide solution.
Question 1527
What statement is most inconsistent with the chemistry of transition elements?
A) Bromide, chloride and iodide stabilize the higher oxidation states of the transition elements.
B) Early transition metal ions with the metal in its lowest oxidation state are good reducing agents.
C) Ions that have transition metal in their highest oxidation state tend to be good oxidizing agents.
D) The stability of the higher oxidation states increases down a periodic group.

Question 1528
The existence of electrons in atoms of all elements was demonstrated by
A) Millikan's oil drop experiment.
B) Rutherford's gold foil experiment.
C) Thomson's cathode ray tube experiment.
D) None of these

Question 1529
Among the compounds CH₃—CH₃, H₂C=CH₂, and HC CH, the compound with the strongest carbon-carbon bond is ________, and the compound with the longest carbon-carbon bond is ________.

Question 1530
Which of the following elements has the least tendency to form an ion?
A) Ca
B) Li
C) Kr
D) S

Question 1531
Which of the following will result in an increase in the amount of NH₄Cl?
NH₄Cl (s) <-- --> NH₃ (g) + HCl (g)
A) increasing the volume
B) decreasing the amount of HCl (g)
C) increasing the amount of NH₃ (g)
D) none of these

Question 1532
Redox reactions occurring in acid are evident by the appearance of ________ in the balanced equation, and redox reactions occurring in base are evident by the appearance of ________ in the balanced equation.

Question 1533
A basketball is inflated to a pressure of 1.80 atm in a 23.0°C garage. What is the pressure of the basketball outside where the temperature is -2.00°C?
A) 1.65 atm
B) 1.70 atm
C) 1.90 atm
D) 1.97 atm

Question 1534
What does the term "critical mass" mean? It is the
A) amount of fissionable material which will self-sustain a nuclear chain reaction.
B) difference between mass of individual protons and neutrons and the mass of the nucleus.
C) energy which holds the nucleus together.
D) mass of fuel in a nuclear reactor core.

Question 1535

Which one of the following is not considered to be a Lewis base?
A) H2S
B) NH3
C) NH4+
D) Cl-

Question 1536

What is the oxidation number of the sulfur atom in Li2SO4?
A) -2
B) +2
C) +4
D) +6

Question 1537

Which is a measure of the sum of the kinetic and potential energies of each particle in the system?
A) E, the internal energy
B) G, the Gibbs free energy
C) H, the enthalpy
D) T, the temperature

Question 1538

A fishing boat accidentally spills 15 barrels of diesel oil into the ocean. Each barrel contains 42 gallons. If the oil film on the ocean is 2.5 × 102 nm thick, how many square meters will the oil slick cover?
A) 9.5 × 10-3 m2
B) 9.5 × 106 m2
C) 9.5 × 107 m2
D) none of these

Question 1539

Elements A and Q form two compounds, AQ and A2Q. Which of the following must be true?
A) (mass Q)/(mass A) is one for AQ, and 1/2 for A2Q.
B) (mass Q)/(mass A) for AQ must equal (mass Q)/(mass A) for A2Q.
C) (mass Q)/(mass A) for AQ must be 2 times (mass Q)/(mass A) for A2Q.
D) (mass Q)/(mass A) for AQ must be 1/2 (mass Q)/(mass A) for A2Q.

Question 1540

What is the empirical formula of a substance that contains 12.0 g of C, 2.00 g of H, and 5.33 g of O?
A) C3H6O
B) C15H30O5
C) C3H5O3
D) C3H4O4

Question 1541

The average osmotic pressure of blood is about 7 atm. Therefore
A) the average blood pressure is about 7 atm.
B) the average pressure inside the body is about 7 atm above the external pressure.
C) a pressure of about 7 atm would be required to prevent osmosis if blood is in contact with pure water across a semipermeable membrane.
<table>
<thead>
<tr>
<th>Question 1542</th>
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<tbody>
<tr>
<td>The number of protons, neutrons, and total nucleons in ( Ru ) are ________, ________, and ________, respectively.</td>
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<tr>
<th>Question 1543</th>
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<tbody>
<tr>
<td>A constant current is passed through a solution containing ( Cu^2+(aq) ) resulting in the deposition of 4.40 g of ( Cu ) at the cathode. Assuming a current efficiency of 100%, if this same current is passed through a solution of ( TcO_4^- ) for the same amount of time, how many grams of ( Tc ) would form at the cathode?</td>
</tr>
<tr>
<td>A) 0.969 g</td>
</tr>
<tr>
<td>B) 1.94 g</td>
</tr>
<tr>
<td>C) 6.78 g</td>
</tr>
<tr>
<td>D) 13.6 g</td>
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<tr>
<th>Question 1544</th>
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<tbody>
<tr>
<td>What is the approximate carbon-oxygen bond order in ( CO_3^{2-} )?</td>
</tr>
<tr>
<td>A) 2</td>
</tr>
<tr>
<td>B) 4/3</td>
</tr>
<tr>
<td>C) 5/3</td>
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<td>D) 4</td>
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<th>Question 1545</th>
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<tbody>
<tr>
<td>Which one of the following is most penetrating?</td>
</tr>
<tr>
<td>A) alpha particles</td>
</tr>
<tr>
<td>B) beta particles</td>
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<tr>
<td>C) gamma rays</td>
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<tr>
<td>D) positrons</td>
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<tr>
<th>Question 1546</th>
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<tbody>
<tr>
<td>For a particular compound, which is expected to be the largest in general?</td>
</tr>
<tr>
<td>A) the heat required to raise the temperature of one mole of the gas 10.0°C</td>
</tr>
<tr>
<td>B) the heat required to raise the temperature of one mole of the liquid 10.0°C</td>
</tr>
<tr>
<td>C) the molar heat of fusion at the normal melting point</td>
</tr>
<tr>
<td>D) the molar heat of vaporization at the normal boiling point</td>
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<tr>
<th>Question 1547</th>
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<tbody>
<tr>
<td>Carbon is the ________ most abundant element by mass in living organisms.</td>
</tr>
<tr>
<td>A) first</td>
</tr>
<tr>
<td>B) second</td>
</tr>
<tr>
<td>C) third</td>
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<tr>
<td>D) fourth</td>
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<th>Question 1548</th>
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<tbody>
<tr>
<td>Which of the following metal hydroxides are amphoteric?</td>
</tr>
<tr>
<td>A) ( Al(OH)_3, Zn(OH)_2, Cr(OH)_3, Sn(OH)_2 )</td>
</tr>
<tr>
<td>B) ( Cu(OH)_2, Mn(OH)_2, Fe(OH)_2, Fe(OH)_3 )</td>
</tr>
<tr>
<td>C) ( Be(OH)_2, Ca(OH)_2, Ba(OH)_2, Sr(OH)_3 )</td>
</tr>
<tr>
<td>D) ( LiOH, NaOH, KOH, RbOH )</td>
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<tr>
<th>Question 1549</th>
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</table>
| The normal boiling point of this substance is approximately
Question 1550
The cubic unit cell in which the radius of an atom is $31/2 \text{d}/4$, where d is the unit cell edge length, is the ________ unit cell.

Question 1551
What is the approximate value of the equilibrium constant, $K_n$, for the neutralization of hydrochloric acid with sodium hydroxide, shown in the equation below?
$\text{HBr(aq)} + \text{LiOHaq}) \rightleftharpoons \text{H}_2\text{O(l)} + \text{LiBr(aq)}$
A) $1.0 \times 10^2$
B) $1.0 \times 10^7$
C) $1.0 \times 10^{14}$
D) $1.0 \times 10^{28}$

Question 1552
An archeological artifact was subjected to radiocarbon dating. The artifact showed a carbon-14 decay rate of 13.8 disintegrations/min per gram of carbon. Carbon-14 has a half-life of 5715 years, and currently living organisms decay at the rate of 15.3 disintegrations/min per gram of carbon. What is the approximate age of the artifact?
A) 257 years old
B) 371 years old
C) 591 years old
D) 851 years old

Question 1553
List the elements Cs, Ca, Ne, Na, Ar in order of decreasing first ionization energy.
A) Ar > Ca > Cs > Na > Ne
B) Ne > Ar > Ca > Na > Cs
C) Ne > Ar > Na > Cs > Ca
D) Ne > Na > Cs > Ca > Ar

Question 1554
At 80.0°C benzene has a vapor pressure of 96.0 mm Hg and toluene has a vapor pressure of 30.3 mm Hg. If a mixture of benzene and toluene has a vapor pressure of 54.6 mm Hg, what are the mole fractions of benzene and toluene?

Question 1555
Cubic closest-packing
A) has a body-centered cubic unit cell.
B) has a face-centered cubic unit cell.
C) has a simple cubic unit cell.
D) has the same unit cell as hexagonal closest-packing.

Question 1556
Which substance has a larger band gap than silicon?
A) diamond
B) copper
C) germanium
D) silver
Question 1557

How many d electrons are there in CrO_4^{2-}?
A) 0
B) 1
C) 2
D) 3
Answer: [link](https://biology-forums.com/index.php?topic=291546)

Question 1558

Which acid has the lowest percent dissociation?
A) HX
B) HY
C) HZ
D) All have the same percent dissociation.

Question 1559

How many grams of pyridine are there in 100 mL of an aqueous solution that has a pH of 9.00? The Kb for pyridine is 1.9 \times 10^{-9} and the equation of interest is 
C_5H_5N(aq) + H_2O(l) \leftrightarrow C_5H_5NH^+(aq) + OH^-(aq).
A) 0.053 g
B) 0.42 g
C) 0.79 g
D) 7.9 g

Question 1560

An aqueous CsCl solution is 8.00 wt% CsCl and has a density of 1.0643 g/mL at 20°C. What is the boiling point of this solution? Kb = 0.51°C/m for water.
A) 100.27°C
B) 100.53°C
C) 103.8°C
D) 104.3°C
Answer: [link](https://biology-forums.com/index.php?topic=290253)

Question 1561

A 1.50 L vessel contains an equilibrium mixture of 0.100 mol of NO, 0.150 mol of Br_2, and 0.250 mol of NOBr at 25°C. What is the value of Kp for the reaction below?
2 NO(g) + Br_2(g) \leftrightarrow 2 NOBr(g)
A) 2.56
B) 62.5
C) 1.28 \times 10^2
D) 1.53 \times 10^3

Question 1562

What are the molecular structures of orthophosphoric acid and pyrophosphoric acid?
A) 1 and 2
B) 1 and 3
C) 2 and 3
D) 3 and 4
Answer: [link](https://biology-forums.com/index.php?topic=291798)

Question 1563

All of the fatty acids below contain eighteen carbons and range from saturated to three double bonds. Which has the highest melting point?
A) stearic acid (saturated)
B) oleic acid (one double bond)
C) linoleic acid (two double bonds)
D) linolenic acid (three double bonds)
<table>
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<tr>
<th>Question 1564</th>
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<tbody>
<tr>
<td>What is the chemical symbol for arsenic?</td>
</tr>
<tr>
<td>A) Ac</td>
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<tr>
<td>B) Ar</td>
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<td>C) As</td>
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<td>D) At</td>
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<th>Question 1565</th>
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<tbody>
<tr>
<td>Combustion analysis of 0.150 g of an unknown compound containing carbon, hydrogen, and oxygen produced 0.2607 g of CO₂ and 0.1418 g of H₂O. What is the empirical formula of the compound?</td>
</tr>
<tr>
<td>A) C₂H₅O</td>
</tr>
<tr>
<td>B) C₂H₅O₂</td>
</tr>
<tr>
<td>C) C₂H₁₀O₃</td>
</tr>
<tr>
<td>D) C₃H₈O₂</td>
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<th>Question 1566</th>
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<tr>
<td>A supercritical fluid refers to a substance</td>
</tr>
<tr>
<td>A) above both its critical temperature and its critical pressure.</td>
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<tr>
<td>B) at its triple point.</td>
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<td>C) that is in the liquid crystal state.</td>
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<tr>
<td>D) with a viscosity of zero.</td>
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<th>Question 1567</th>
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<tbody>
<tr>
<td>Give the electronic configuration for Mn²⁺.</td>
</tr>
<tr>
<td>A) [Ar]2s²2p⁶3d⁵</td>
</tr>
<tr>
<td>B) [Ar]4s²3d³</td>
</tr>
<tr>
<td>C) [Ar]4s¹3d⁴</td>
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<tr>
<td>D) [Ar]3d⁵</td>
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<th>Question 1568</th>
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<tbody>
<tr>
<td>Elements in a periodic group have similar</td>
</tr>
<tr>
<td>A) chemical properties.</td>
</tr>
<tr>
<td>B) densities.</td>
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<tr>
<td>C) masses.</td>
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<tr>
<td>D) physical properties.</td>
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<th>Question 1569</th>
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<tbody>
<tr>
<td>Which of the following aqueous salt (NaCl) solutions has the greater concentration?</td>
</tr>
<tr>
<td>A) 0.5 M</td>
</tr>
<tr>
<td>B) 2.3 m</td>
</tr>
<tr>
<td>C) 3.0 % by mass</td>
</tr>
<tr>
<td>D) 11.1 g/L</td>
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<tr>
<th>Question 1570</th>
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<tbody>
<tr>
<td>Identify the amine.</td>
</tr>
<tr>
<td>A) CH₃CH₂COOCH₃</td>
</tr>
<tr>
<td>B) CH₃CH₂CH=CHCH₃</td>
</tr>
<tr>
<td>C) CH₃CH₂OH</td>
</tr>
<tr>
<td>D) CH₃CH₂H₂</td>
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</table>
Question 1571

Based on formal charge considerations, the electron-dot structure of CO₃²⁻ ion has
A) two resonance structures involving two single bonds and one double bond.
B) two resonance structures involving one single bond and two double bonds.
C) three resonance structures involving two single bonds and one double bond.
D) three resonance structures involving one single bond and two double bonds.

Question 1572

Which sphere most likely represents the Ca²⁺ ion?
A) A
B) B
C) A or B
D) C or D

Question 1573

Which of the following contains an atom that does not obey the octet rule?
A) LiBr
B) CO₂
C) PCl₃
D) CCl₄

Question 1574

What is the mass of 0.500 mol of carbon tetrafluoride, CF₄?
A) 5.68 × 10⁻³ g
B) 44.0 g
C) 88.0 g
D) 176 g

Question 1575

A 5.00-L flask contains nitrogen gas at 25°C and 1.00 atm pressure. What is the final pressure in the flask if an additional 2.00 g of N₂ gas is added to the flask and the flask cooled to -55°C?
A) 0.255 atm
B) 0.987 atm
C) 1.35 atm
D) 1.84 atm

Question 1576

Iridium crystallizes in a face-centered cubic structure. What is the edge length of the unit cell if the atomic radius of silver is 180 pm?
A) 441 pm
B) 64 pm
C) 38 pm
D) 509 pm

Question 1577

At 1000 K, K_p = 19.9 for the reaction Fe₂O₃(s) + 3 CO(g) ⇌ 2 Fe(s) + 3 CO₂(g). What is the value of K_p for the reaction 2 Fe₂O₃(s) + 6 CO(g) ⇌ 4 Fe(s) + 6 CO₂(g)?

Question 1578

The element in period 3 with the smallest seventh ionization energy is ________.
Question 1579

An element that has the valence electron configuration 3s²3p³ belongs to which period and group?
A) period 3; group 3A
B) period 3; group 5A
C) period 4; group 3A
D) period 4; group 5A

Question 1580

Identify the compound that is an aldehyde.
A) ethyl pentanoate
B) butanal
C) dimethyl ether
D) 3-pentanone

Question 1581

Dinitrogen monoxide is still used as a general anesthetic. The Henry's law constant for the solubility of N₂O in water is 2.5 × 10⁻² mol/L•atm. What is the molar solubility of N₂O in water if the partial pressure of N₂O is 1700 mm Hg?

Question 1582

Which one of the following salts, when dissolved in water, produces the solution with the lowest pH?
A) RbCl
B) NH₄Cl
C) SrCl₂
D) AlCl₃

Question 1583

A common rule in organic chemistry is that increasing the temperature of a reaction at room temperature by 10°C doubles the rate. Calculate Ea for a reaction that follows this rule. Assume room temperature is 25°C.
A) 0.576 kJ
B) 12.2 kJ
C) 38.4 kJ
D) 52.9 kJ

Question 1584

The equilibrium constant, Kp, equals 3.40 for the isomerization reaction:

\[ \text{cis-2-butene} \rightleftharpoons \text{trans-2-butene}. \]

If a flask initially contains 0.250 atm of cis-2-butene and 0.205 atm of trans-2-butene, what is the equilibrium pressure of each gas?
A) P(cis-2-butene) = 0.0603 atm and P(trans-2-butene) = 0.205 atm
B) P(cis-2-butene) = 0.0431 atm and P(trans-2-butene) = 0.147 atm
C) P(cis-2-butene) = 0.0735 atm and P(trans-2-butene) = 0.250 atm
D) P(cis-2-butene) = 0.103 atm and P(trans-2-butene) = 0.352 atm

Question 1585

A gas bottle contains 0.800 mol of gas at 730 mm Hg pressure. If the final pressure is 1.15 atm, how many moles of gas were added to the bottle?
A) 0.0012 mol
B) 0.158 mol
C) 0.958 mol
D) 0.0668 mol

Question 1586

The paramagnetism of O₂ is explained by
A) coordinate covalent bonding.
B) molecular orbital theory.
C) resonance.
D) valence bond theory.

Question 1587
Which of these neutralization reactions has a pH > 7 when equal moles of acid and base are mixed?
A) CH₃CO₂H(aq) + LiOH(aq) ←→ H₂O(l) + LiCH₃CO₂(aq)
B) HI(aq) + C₅H₅N(aq) ←→ C₅H₅NHI(aq)
C) HCl(aq) + LiOH(aq) ←→ H₂O(l) + LiCl(aq)
D) H₂SO₄(aq) + 2 KOH(aq) ←→ 2 H₂O(l) + K₂SO₄(aq)

Question 1588
The number of moles of Li in 34.7 g Li is ________.

Question 1589
Which of the following is the lowest temperature?
A) 37°C
B) 54°F
C) 313 K
D) All of these temperatures are all equal.

Question 1590
Which type of radiation source would pose the greatest health risk when used internally for a medical procedure?
A) an alpha emitter, 1/2 = 6 hours
B) a beta emitter, 1/2 = 5 hours
C) a beta emitter, 1/2 = 15 days
D) a gamma emitter, 1/2 = 4 hours

Question 1591
What is the charge on the In in the ionic compound In₂Te₃?
A) 2-
B) 1+
C) 2+
D) 3+

Question 1592
Which one of the following is an n-type of semiconductor?
A) alumina
B) germanium doped with antimony
C) germanium doped with boron
D) tellurium

Question 1593
Which of the following ionic compounds would be expected to have the highest lattice energy?
A) CaBr₂
B) NaBr
C) KBr
D) RbBr

Question 1594
SiO₂ can be classified as a(n)
A) amorphous solid.
B) covalent network solid.
C) ionic solid.
D) molecular solid.

Question 1595

"Equal volumes of different gases at the same temperature and pressure contain the same molar amounts" is another way of stating
A) Avogadro’s law.
B) Boyle’s law.
C) Charles’ law.
D) Graham’s law.

Question 1596

How many lone pairs of electrons are on the Xe atom in XeF₆?
A) 0
B) 1
C) 2
D) 3

Question 1597

At a given temperature the vapor pressures of benzene and toluene are 183 mm Hg and 59.2 mm Hg, respectively. Calculate the total vapor pressure over a solution of benzene and toluene with Xbenzene = 0.400.
A) 110 mm Hg
B) 133 mm Hg
C) 109 mm Hg
D) 242 mm Hg

Question 1598

How many valence electrons does the element Co have?
A) 1
B) 10
C) 12
D) 9

Question 1599

Which type of spherical packing has the most unused space?
A) body-centered cubic
B) cubic closest-packed
C) cubic closest-packed and hexagonal closest-packed
D) simple cubic

Question 1600

What is the structure of the "gray" allotropic form of tin that is used as a semiconductor?
A) body centered
B) diamond-like
C) graphite-like
D) simple cubic

Question 1601

The value of Ka for a 0.250 M HCN solution having a pH of 4.956 is ________.
Question 1602

What is the pH of a solution prepared by diluting 50.00 mL of 0.020 M Ba(OH)2 with enough water to produce a total volume of 250.00 mL?

A) 2.10  
B) 2.40  
C) 11.60  
D) 11.90  

Question 1603

A galvanic cell consists of a Al³⁺/Al half-cell and a standard hydrogen electrode. If the Al³⁺/Al half-cell standard cell functions as the anode, and the standard cell potential is 1.66 V, what is the standard reduction potential for the Al³⁺/Al half-cell?

A) -1.66 V  
B) -0.55 V  
C) +0.55 V  
D) +1.66 V  

Question 1604

What is geometry around the nitrogen atom?

A) bent  
B) tetrahedral  
C) trigonal planar  
D) trigonal pyramidal  

Question 1605

Using only the elements Be, Cl, and/or P, give the formula of a compound having largely ionic bonds.


Question 1606

Which one of the following combinations of neutrons/protons results in the lowest number of nonradioactive (stable) isotopes?

A) even number protons/even number neutrons  
B) even number protons/odd number neutrons  
C) odd number protons/even number neutrons  
D) odd number protons/odd number neutrons  

Question 1607

What is the molar solubility of Mg(OH)₂ in a basic solution with a pH of 12.00? Ksp for Mg(OH)₂ is

A) 5.6 x 10⁻¹⁰ M  
B) 5.6 x 10⁻⁸ M  
C) 2.4 x 10⁻⁶ M  
D) 1.1 x 10⁻⁴ M  

Question 1608

What volume of 0.100 M NaOH is needed to make 100.0 mL of a buffer solution with a pH of 6.00 if one starts with 50.0 mL of 0.100 M potassium hydrogen phthalate? The Ka₂ for potassium hydrogen phthalate is 3.1 x 10⁻⁶.

A) 22.4 mL  
B) 27.6 mL  
C) 30.2 mL  
D) 37.8 mL  

Question 1609

One liter is approximately the same as one U.S.

A) ounce.  
B) pint.
C) quart.
D) gallon.

**Question 1610**

Below the superconducting transition temperature $T_c$, superconductors
A) become perfect conductors.
B) become perfect magnets.
C) become perfect resistors.
D) fail to work.

**Question 1611**

What is the molecular structure of phosphorous acid?
A) 1
B) 2
C) 3
D) 4

**Question 1612**

How does one commercially reduce the metal oxides or chlorides of sodium and magnesium?
A) electrolysis of the molten salts
B) high temperature reduction with aluminum
C) high temperature reduction with carbon
D) roasting

**Question 1613**

All of the following elements are nonmetals except
A) copper.
B) nitrogen.
C) krypton.
D) phosphorus.

**Question 1614**

What is the pH of a solution made by mixing 20.00 mL of 0.100 M HCl with 40.00 mL of 0.100 M KOH? Assume that the volumes of the solutions are additive.
A) 0.48
B) 1.48
C) 12.52
D) 13.52

**Question 1615**

The mass of a proton is $1.67 \times 10^{-27}$ kg. What is the mass of a proton in Gigagrams?
A) $1.67 \times 10^{-39}$ Gg
B) $1.67 \times 10^{-36}$ Gg
C) $1.67 \times 10^{-33}$ Gg
D) $1.67 \times 10^{-30}$ Gg

**Question 1616**

Determine the acid dissociation constant for a 0.10 M acetic acid solution that has a pH of 2.87. Acetic acid is a weak monoprotic acid and the equilibrium equation of interest is
$$\text{CH}_3\text{COOH(aq)} + \text{H}_2\text{O(l)} \rightleftharpoons \text{H}_3\text{O}^+(aq) + \text{CH}_3\text{CO}_2^-(aq).$$
A) $1.3 \times 10^{-2}$
B) $1.3 \times 10^{-3}$
C) $1.8 \times 10^{-5}$
Question 1617
What is the concentration of \( \text{HNO}_3 \) in the final solution when 70.0 mL of a 6.00 M \( \text{HNO}_3 \) solution is diluted with pure water to a total volume of 0.15 L?
A) \( 3.57 \times 10^{-2} \) M
B) 2.80 M
C) 12.6 M
D) 1.75 M

Question 1618
Sulfurous acid, \( \text{H}_2\text{SO}_3 \) has acid dissociation constants \( K_a1 = 1.5 \times 10^{-2} \) and \( K_a2 = 6.3 \times 10^{-8} \). What is the pH after 10.00 mL of 0.1000 M \( \text{NaOH} \) is added to 10.00 mL of 0.1000 M \( \text{H}_2\text{SO}_3 \)?
A) 1.82
B) 3.60
C) 4.25
D) 7.20

Question 1619
The symbol for mercury is ________.

Question 1620
Which ion has the smallest ionic radius?
A) \( \text{Li}^+ \)
B) \( \text{Na}^+ \)
C) \( \text{K}^+ \)
D) \( \text{Rb}^+ \)

Question 1621
What is the strongest acid among the following?
A) \( \text{H}_2\text{O} \)
B) \( \text{H}_2\text{S} \)
C) \( \text{H}_2\text{Se} \)
D) \( \text{H}_2\text{Te} \)

Question 1622
Which is a net ionic equation for the neutralization reaction of a weak acid with a weak base?
A) \( \text{H}_3\text{O}^+(aq) + \text{OH}^-(aq) \rightarrow 2 \text{H}_2\text{O}(l) \)
B) \( \text{HF}(aq) + \text{NH}_3(aq) \rightarrow \text{NH}_4^+(aq) + \text{F}^-(aq) \)
C) \( \text{HCl}(aq) + \text{OH}^-(aq) \rightarrow \text{H}_2\text{O}(l) + \text{Cl}^-(aq) \)
D) \( \text{H}_3\text{O}^+(aq) + \text{NH}_3(aq) \rightarrow \text{NH}_4^+(aq) + \text{H}_2\text{O}(l) \)

Question 1623
The Lewis electron-dot structure of \( \text{N}_2 \) has ________ nonbonding electrons pairs, ________ bonding electron pairs, and a bond order of ________.

Question 1624
What is the structure of white phosphorus?
A) cage system of \( \text{Px} \) molecules
B) discrete \( \text{P} \) atoms
C) discrete \( \text{P}_4 \) molecules
D) polymeric chain-like structure
Question 1625

For the reaction: \(4 \text{HCl}(g) + \text{O}_2(g) \rightleftharpoons 2 \text{Cl}_2(g) + 2 \text{H}_2\text{O}(l)\), the equilibrium constant is 0.063 at 400 K. If the reaction quotient is 0.100, which of the following statements is not correct?

A) \([\text{HCl}]\) will increase.
B) \([\text{O}_2]\) will increase.
C) \([\text{H}_2\text{O}]\) will decrease.
D) \([\text{O}_2]\) will decrease.


Question 1626

A rad is

A) the amount of sample that undergoes 1 disintegration per second.
B) the amount of sample that undergoes \(3.7 \times 10^{10}\) disintegrations per second.
C) the amount of tissue damage done by radiation.
D) equal to 0.01 J of energy absorbed per kilogram of tissue.


Question 1627

Which of the following compounds has the highest boiling point?

A) \(\text{CH}_3\text{CH}_2\text{OH}\)
B) \(\text{HOCH}_2\text{CH}_2\text{OH}\)
C) \(\text{H}_3\text{C}—\text{O}—\text{CH}_3\)
D) \(\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_3\)


Question 1628

Why does Cu dissolve in concentrated nitric acid but not in concentrated hydrochloric acid?

A) The chloride ion is a stronger oxidizing agent than the nitrate ion.
B) The hydrochloric acid is not as strong as nitric acid.
C) The hydrochloric acid produces insufficient hydronium ion to react with the copper.
D) The nitrate ion is a stronger oxidizing agent than the hydronium ion.


Question 1629

\(\text{CH}_3\text{CO}_2\text{H}\) is an example of a ______ electrolyte.


Question 1630

The reaction for the decomposition of dinitrogen monoxide gas to form oxygen radicals is: \(\text{N}_2\text{O}(g) \rightleftharpoons \text{N}_2(g) + \text{O}(g)\). If the rate constant is \(3.04 \times 10^{-2}\) s\(^{-1}\) and the frequency factor is \(8.00 \times 10^{11}\) s\(^{-1}\), what is the activation energy for the first-order reaction at 700°C?

A) 0.262 kJ/mol
B) 38.2 kJ/mol
C) 180 kJ/mol
D) 250 kJ/mol


Question 1631

Which compound is not an isomer of the other three?

A) cyclohexane
B) 1, 2-dimethylcyclobutane
C) 1, 2-dimethylcyclopropane
D) methylcyclopentane


Question 1632

Nitric oxide reacts with oxygen to form nitrogen dioxide:

\(2 \text{NO}(g) + \text{O}_2(g) \rightleftharpoons 2 \text{NO}_2(g)\)

What is \(K_c'\) for the reverse reaction if the equilibrium concentration of NO is 0.300 M, \(\text{O}_2\) is 0.200 M, and \(\text{NO}_2\) is 0.530 M at 25°C?
Question 1633

Which contains covalent bonds?
A) LiOO
B) NH3
C) LiCl
D) CaI2

Question 1634

The ozone molecules in the stratosphere absorb much of the ultraviolet radiation from the sun, protecting life on Earth. At a certain altitude, the temperature of the stratosphere is 240 K and the partial pressure of ozone is 1.4 × 10^-7 atm. Calculate the number of ozone molecules present in 1.00 L of atmosphere at that altitude.
A) 2.1 × 10^15 molecules of O3
B) 4.3 × 10^15 molecules of O3
C) 8.0 × 10^31 molecules of O3
D) 1.8 × 10^32 molecules of O3

Question 1635

Which concentration becomes smaller as the temperature is increased from 25°C to 60°C?
A) mass %
B) molality
C) molarity
D) mole fraction

Question 1636

For transition elements, which of the following occurs as the effective nuclear charge increases?
A) The atomic radius increases.
B) The density increases.
C) Both the atomic radius and the density increase.
D) The atomic radius decreases and the density increases.

Question 1637

Which of the following statements concerning a lithium battery is false?
A) A lithium battery is rechargeable.
B) A lithium battery has a relatively high voltage, due in part to the high oxidation potential of lithium.
C) It takes a small mass of lithium to provide one mole of electrons in the cell reaction.
D) The cell reaction produces toxic mercury, so the batteries should be recycled.

Question 1638

Which of the following molecules does not have a dipole moment?
A) C2H4
B) NH3
C) CH3NH2
D) HCl

Question 1639

Which one of the following salts, when dissolved in water, produces the solution with the highest pH?
A) LiHSO4
B) NaClO4

### Question 1640
Most elements in the periodic table are
- A) metals.
- B) non-metals.
- C) noble gases.
- D) semi-metals.

Answer: [link](https://biology-forums.com/index.php?topic=288868)

### Question 1641
What is the edge length of a face-centered cubic unit cell made up of atoms having a radius of 200 pm?
- A) 71 pm
- B) 566 pm
- C) 20 pm
- D) 110 pm

Answer: [link](https://biology-forums.com/index.php?topic=290105)

### Question 1642
If the melting point of copper metal is 1085°C, what is its melting point in Kelvin?
- A) 571 K
- B) 812 K
- C) 1358 K
- D) 1985 K

Answer: [link](https://biology-forums.com/index.php?topic=288805)

### Question 1643
"Glycerol" is the common name for
- A) ethanol.
- B) 2-propanol.
- C) 1, 2-ethanediol.
- D) 1, 2, 3-propanetriol.

Answer: [link](https://biology-forums.com/index.php?topic=291963)

### Question 1644
Iodine-123, used in thyroid therapy, has a half-life of 13.27 hours. How many half-lives are required for a 160 mg sample of iodine-123 to decay to 5.0 mg?
- A) 0.031
- B) 1.0
- C) 5.0
- D) 32

Answer: [link](https://biology-forums.com/index.php?topic=291355)

### Question 1645
All of the following elements are nonmetals except
- A) beryllium.
- B) carbon.
- C) hydrogen.
- D) oxygen.

Answer: [link](https://biology-forums.com/index.php?topic=288955)

### Question 1646
The coordination number of each atom in a body-centered cubic unit cell is ________.

Answer: [link](https://biology-forums.com/index.php?topic=290179)

### Question 1647
Round off 00507506 to four significant figures.
Question 1648
Which of the following straight chain molecules has the greatest standard molar entropy at 25°C?
A) C2H2
B) C2H4
C) C2H6
D) All have the same entropy.

Question 1649
Which of the following numbers has the greatest number of significant figures?
A) 0.8010
B) 0.504
C) 742000
D) 9.05 × 10^24

Question 1650
A gold ingot weighs 5.50 lbs. If the density of gold is 19.31 g/cm³, and the length and width of the ingot are 12.0 cm and 3.00 cm respectively, what is the height of the ingot?
A) 6.50 × 10⁻³ cm
B) 3.59 cm
C) 10.2 cm
D) 1.34 × 10³ cm

Question 1651
The color exhibited by coordination compounds is usually due to the absorption of light by a d-electron, resulting in the promotion of the d-electron from its ground-state d-orbital to a higher energy orbital. The first transition series element expected to have a colorless aqueous solution M²⁺ ion is ________.

Question 1652
How many grams of KBr are required to make 850. mL of a 0.115 M KBr solution?
A) 0.0978 g
B) 85.9 g
C) 11.6 g
D) 13.7 g

Question 1653
The equivalence point pH of the titration of four weak acids is given. Which is the strongest acid?
A) 7.18
B) 7.90
C) 8.14
D) 8.43

Question 1654
Predict whether removing two electrons from F₂ will create an ion that is diamagnetic or paramagnetic and have an F—F that is stronger or weaker than the bond in F₂.

Question 1655
<table>
<thead>
<tr>
<th>Question 1656</th>
</tr>
</thead>
<tbody>
<tr>
<td>Determine the direction of electron flow and the direction of ion flow.</td>
</tr>
<tr>
<td>A) Electrons flow from a to c; K+ ions flow toward a and Cl- ions flow toward c.</td>
</tr>
<tr>
<td>B) Electrons flow from a to c; Cl- ions flow toward a and K+ ions flow toward c.</td>
</tr>
<tr>
<td>C) Electrons flow from c to a; K+ ions flow toward a and Cl- ions flow toward c.</td>
</tr>
<tr>
<td>D) Electrons flow from c to a; Cl- ions flow toward a and K+ ions flow toward c.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Question 1657</th>
</tr>
</thead>
<tbody>
<tr>
<td>The smallest number that can be used for m or n in the Balmer-Rydberg equation is ________ and the largest number is ________.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Question 1658</th>
</tr>
</thead>
<tbody>
<tr>
<td>The bonds in the polyatomic ion CO32- are classified as</td>
</tr>
<tr>
<td>A) ionic.</td>
</tr>
<tr>
<td>B) metallic.</td>
</tr>
<tr>
<td>C) nonpolar covalent.</td>
</tr>
<tr>
<td>D) polar covalent.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Question 1659</th>
</tr>
</thead>
<tbody>
<tr>
<td>Which element has the smallest energy band gap?</td>
</tr>
<tr>
<td>A) I</td>
</tr>
<tr>
<td>B) Se</td>
</tr>
<tr>
<td>C) Sn</td>
</tr>
<tr>
<td>D) Te</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Question 1660</th>
</tr>
</thead>
<tbody>
<tr>
<td>Which M3+ ion of group 3A elements is the easiest to reduce?</td>
</tr>
<tr>
<td>A) B</td>
</tr>
<tr>
<td>B) Al</td>
</tr>
<tr>
<td>C) Ga</td>
</tr>
<tr>
<td>D) In</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Question 1661</th>
</tr>
</thead>
<tbody>
<tr>
<td>The oxidation state of chromium in Cr2O72- is ________.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Question 1662</th>
</tr>
</thead>
<tbody>
<tr>
<td>What is the molar mass of nitrogen gas?</td>
</tr>
<tr>
<td>A) 14.0 g/mol</td>
</tr>
<tr>
<td>B) 28.0 g/mol</td>
</tr>
<tr>
<td>C) 6.02 × 1023 g/mol</td>
</tr>
<tr>
<td>D) 1.20 × 1023 g/mol</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Question 1663</th>
</tr>
</thead>
<tbody>
<tr>
<td>What statement is inconsistent about fullerene?</td>
</tr>
<tr>
<td>A) It is an allotrope of carbon and the C60 form has soccer ball shape.</td>
</tr>
<tr>
<td>B) The C60 form of fullerene is a good oxidizing agent.</td>
</tr>
</tbody>
</table>
C) The C60 fullerene is a molecular substance.
D) The C60 form of fullerene is soluble in nonpolar organic solvents.

Question 1664

What is not a true statement?
A) BeO is amphoteric but the oxides of the other group 2A elements are basic.
B) B differs from other elements of group 3A by forming mainly covalent molecular compounds.
C) BF3 is a gaseous molecular halide but AlF3 is a high melting ionic solid.
D) Compounds with C=C double bonds and Si=Si double bonds are quite common.

Question 1665

The dose of amoxicillin given to a young child is 40.0 mg/kg of body weight/day. If the amoxicillin is administered as a suspension having a concentration of 400. mg/5 mL, how many mL of amoxicillin must be administered per dose for a child weighing 30.0 pounds?
A) 3.00 mL
B) 6.82 mL
C) 16.0 mL
D) 9.9 mL

Question 1666

In organic molecules the molecular geometry exhibited by carbon is ________ when carbon is bonded to four atoms by four single bonds, ________ when carbon is bonded to three atoms by one double bond and two single bonds, and ________ when carbon is bonded to two atoms by one triple bond and one single bond.

Question 1667

In order for the reaction A- + H2CO3 <-- --> HA + HCO3- to have an equilibrium constant Kc < 1, the Ka of HA must be ________ (greater, less) than the Ka of H2CO3.

Question 1668

Which of the following is a stronger acid?
A) Cr3+
B) Cr(OH)2
C) Cr(OH)3
D) CrO2(OH)2

Question 1669

The observation that 4.0 g of hydrogen reacts with 32.0 g of oxygen to form a product with O:H mass ratio = 8:1, and 6.0 g of hydrogen reacts with 48.0 g of oxygen to form the same product with O/H mass ratio = 8:1 is evidence for the law of
A) definite proportions.
B) energy conservation.
C) mass conservation.
D) multiple proportions.

Question 1670

An element, X is formed by bombardment of uranium-238 atoms with a beta particle. How many neutrons are produced by this reaction?
A) 3
B) 2
C) 1
D) 0

Question 1671

How many milliliters of a 9.0 M H2SO4 solution are needed to make 0.45 L of a 3.5 M solution?
Question 1672

You are visiting the planet Lagmom. The money exchange rates are shown below. How many Lagmom fizzbarts will you receive in exchange for $500 at the Lagmom Spaceport Currency Exchange counter?

$1.00 = 10 razz
1 morb = 25 pobs
5 pobs = 1 fizzbart
1 tanta = 2 morbs

A) 5.00 × 10^2 fizzbarts
B) 1.00 × 10^3 fizzbarts
C) 1.00 × 10^4 fizzbarts
D) 5.00 × 10^5 fizzbarts


Question 1673

The change in the Gibbs free energy for dissolving more solute in a supersaturated solution is

A) negative.
B) zero.
C) positive.
D) positive at low temperatures and negative at high temperatures.


Question 1674

How many d electrons are there in MnO4-?

A) 0
B) 1
C) 2
D) 3


Question 1675

Choose the words that best complete the following sentence.

The ________ the binding energy, the ________ stable the nucleus.

A) larger, less
B) larger, more
C) smaller, less
D) smaller, more


Question 1676

The number of orbitals in a given subshell, such as the 5d subshell, is determined by the number of possible values of

A) n.
B) l.
C) ml.
D) ms.


Question 1677

If 1.4% of the mass of a human body is calcium, how many kilograms of calcium are there in a 173-pound man?

A) 1.1 kg Ca
B) 5.3 kg Ca
C) 1.1 × 10^2 kg Ca
D) 5.3 × 10^2 kg Ca


Question 1678
How many grams of sucrose, C12H22O11, must be added to 500. g of water at 100°C to change the vapor pressure to 752 mm Hg?

A) 0.295 g  
B) 5.32 g  
C) 10.6 g  
D) 101 g


Question 1679

Which contains both covalent bonds and ionic bonds?

A) HBr  
B) LiI  
C) NH3  
D) NH4Cl


Question 1680

At 25.0°C, a solution has a concentration of 3.179 M and a density of 1.260 g/mL. The density of the solution at 50.0°C is 1.249 g/mL. What is the molarity of the solution at 50.0°C?

A) 2.545 M  
B) 3.151 M  
C) 3.179 M  
D) 3.230 M


Question 1681

Linoleic acid, a fatty acid, contains ________ carbons and ________ double bonds.


Question 1682

Which of the following species is diamagnetic?

A) an isolated, gas-phase Ni²⁺ ion  
B) a high-spin octahedral Ru²⁺ complex  
C) an isolated, gas-phase Co²⁺ ion  
D) a low-spin octahedral Os²⁺ complex


Question 1683

How many of the following numbers contain 3 significant figures?

0.105 5.600 0.0300 7.00 × 10²

A) one  
B) two  
C) three  
D) four


Question 1684

When temperature-volume measurements are made on 1.0 mol of gas at 1.0 atm, a plot V versus T results in a

A) hyperbola.  
B) parabola.  
C) sine curve.  
D) straight line.


Question 1685

According to the kinetic molecular theory of gases, the volume of the gas particles (atoms or molecules) is ________ compared to the volume of the container in which the gas particles are held.


Question 1686
The compound, ClO₂, is named
A) chlorite.
B) hypochlorite.
C) chlorine monoxide.
D) chlorine (II) oxide.

**Question 1687**

A 0.35 m aqueous solution of an unknown solute has a boiling point elevation of 0.79°C. The boiling point elevation of a 0.35 m solution of a nonionizing molecular solute in water is 0.33°C. How many moles of particles are formed per mole of solute when the unknown solute is dissolved in water?

A) 1.4
B) 2.0
C) 2.4
D) 3.0


**Question 1688**

Silicon nitride/zirconia is an example of a
A) ceramic-ceramic composite.
B) ceramic-metal composite.
C) ceramic-polymer composite.
D) superconductor.


**Question 1689**

What is the pH of a solution prepared by diluting 75.00 mL of 0.10 M HCl with enough water to produce a total volume of 100.00 mL?

A) 1.00
B) 1.12
C) 2.00
D) 2.24


**Question 1690**

What is the approximate pH of a solution X that gives the following responses with the indicators shown?

<table>
<thead>
<tr>
<th>Indicators</th>
<th>pH range</th>
<th>Solution X</th>
</tr>
</thead>
<tbody>
<tr>
<td>methyl orange</td>
<td>red-yellow</td>
<td>3.2-4.4</td>
</tr>
<tr>
<td>methyl red</td>
<td>red-yellow</td>
<td>4.8-6.0</td>
</tr>
<tr>
<td>bromothymol blue</td>
<td>yellow-blue</td>
<td>6.0-7.6</td>
</tr>
<tr>
<td>phenolphthalein</td>
<td>colorless-pink</td>
<td>8.2-10.0</td>
</tr>
</tbody>
</table>

A) 4.8 - 6.0
B) 6.0 - 7.6
C) 7.6 - 8.2
D) > 8.2


**Question 1691**

At 25°C the vapor pressures of benzene and toluene are 96.0 mm Hg and 30.5 mm Hg, respectively. The vapor pressure of a solution that has a 0.50 mole fraction of toluene will have a vapor pressure ________ (equal to, greater than, less than) 30.5 mm Hg.


**Question 1692**

Helium can be liquefied when He atoms are attracted to one another by intermolecular ________ forces.


**Question 1693**

Which requires the most electricity (in terms of faradays of charge transferred) per gram of useful product formed?

A) electrolysis of aqueous NaCl (chlor-alkali industry)
B) electrolysis of molten NaCl/CaCl₂ in a Downs cell
C) electorefining copper metal
D) production of aluminum in the Hall-Heroult process

**Question 1694**

What is the average oxidation state of Cu in HgCa2Ba2Cu3O8-x if Hg is in the +2 oxidation state?
A) +1  
B) +2  
C) +2 - 2x/3  
D) +2 + 2x/3

**Question 1695**

Two metals of equal mass with different heat capacities are subjected to the same amount of heat. Which undergoes the smallest change in temperature?
A) The metal with the highest heat capacity.  
B) The metal with the lowest heat capacity.  
C) Both undergo the same change in temperature.  
D) You need to know the initial temperatures of both metals.

**Question 1696**

What is the identity of element Q if the ion Q2+ contains 18 electrons?
A) Si  
B) S  
C) Ar  
D) Ca

**Question 1697**

Using the conjugate acid-base pairs listed below, complete the following equation with the pair that gives an equilibrium constant Kc > 1.
________ + H2CO3 <-- --> ________ + HCO3-
A) HF/F-  
B) HCl/Cl-  
C) HOCl/OCl-  
D) HSO42-/SO42-

**Question 1698**

The energy of an electron in a multielectron atom depends on the quantum numbers ______ and _______.

**Question 1699**

The equivalence point pH of the titration of four weak bases is given. Which is the strongest base?
A) 4.20  
B) 6.10  
C) 6.40  
D) 7.90

**Question 1700**

1.00 mole of O2 contains the same number of molecules as
A) 0.667 mole of O3.  
B) 1.00 mole of CH3CO2CH2Cl.  
C) 2.00 mole of CH3CH2OCH2Br.  
D) All of these

**Question 1701**

An Arrhenius acid is best defined as a
A) electron pair donor.
B) proton acceptor.
C) substance that dissociates in water to produce aqueous hydrogen ions.
D) substance that dissociates in water to produce aqueous hydroxide ions.


**Question 1702**

A curie is
A) the amount of sample that undergoes 1 disintegration per second.
B) the amount of sample that undergoes $3.7 \times 10^{10}$ disintegrations per second.
C) the amount of tissue damage done by radiation.
D) equal to 0.01 J of energy absorbed per kilogram of tissue.


**Question 1703**

What is not a characteristic of white phosphorus?
A) At temperatures less than 0°C it is converted to red phosphorus.
B) It bursts into flames when exposed to air, thus it is stored under water.
C) It has a low melting point (44°C).
D) It is soluble in nonpolar solvent such as carbon disulfide CS$_2$.


**Question 1704**

A reactive element with a relatively high electronegativity would be expected to have a relatively
A) small negative electron affinity and a relatively low ionization energy.
B) small negative electron affinity and a relatively high ionization energy.
C) large negative electron affinity and a relatively low ionization energy.
D) large negative electron affinity and a relatively high ionization energy.


**Question 1705**

For the reaction CaCO$_3$(s) $\rightleftharpoons$ CaO(s) + O$_2$(g) the equilibrium expression is $K_p =$ ________.


**Question 1706**

The small sizes of third transition series atoms is referred to as the ________ contraction.


**Question 1707**

The overall reaction for photosynthesis can be represented by the following equation:

\[ 6 \text{ CO}_2(g) + 6 \text{ H}_2\text{O}(l) \rightleftharpoons C_6\text{H}_{12}\text{O}_6(s) + 6 \text{ O}_2(g) \]

The enthalpy change for this reaction is 2802 kJ. Which of the following changes in condition will shift the equilibrium to the right?
A) increase the pressure of O$_2$
B) increase the temperature
C) add water
D) add C$_6$H$_{12}$O$_6$(s)


**Question 1708**

What is the pH of a solution made by mixing 30.00 mL of 0.10 M HCl with 40.00 mL of 0.10 M KOH? Assume that the volumes of the solutions are additive.
A) 0.85
B) 1.85
C) 12.15
D) 13.15


**Question 1709**

The number of different monochloro substitution products (C$_5$H$_{11}$Cl) that can form from the reaction of 2,2-dimethylpropane with Cl$_2$ is ________.
### Question 1710

What is geometry around the carbon atom labeled C2?
A) bent
B) tetrahedral
C) trigonal planar
D) trigonal pyramidal


### Question 1711

What ion is provided when Arrhenius bases dissolve in water?
A) H+
B) Na+
C) Cl-
D) OH-


### Question 1712

A molecular compound that obeys the octet rule in which all atoms have a zero formal charge is
A) SrBr2.
B) BrF3.
C) NH3.
D) XeF4.


### Question 1713

Which of the following elements will have unpaired electrons in the ground state? Ca, Li, C, F
A) Ca, Li, C, and F
B) Li, C, and F
C) Li and F
D) C and F


### Question 1714

Which of the following elements forms the most ionic binary hydride?
A) Cs
B) N
C) Si
D) Ge


### Question 1715

The electron configuration of an element, X, is [Ne]3s1. The formula of the most probable ionic compound that this element will form with O is
A) X O
B) X2O3
C) X2O
D) X3O2


### Question 1716

As the atomic number of the elements increases, the ratio of neutrons to protons in stable nuclei
A) decreases.
B) stays the same.
C) increases.
D) is unrelated to stability.

Question 1717
When equal molar amounts of the following sets of compounds are mixed in water, which will not form a buffer solution?
A) KH₂PO₄ with K₂HPO₄
B) NH₃ with NH₄I
C) CH₃CO₂H with LiCH₃CO₂
D) HNO₃ with LiNO₃

Question 1718
A neutral N atom has how many valence electrons?
A) 1  
B) 3  
C) 6  
D) 14

Question 1719
Ionic compounds consist of a single three-dimensional network of ions that are attracted to one another by strong ________ and usually exist in the solid state at room temperature, whereas covalent compounds consist of molecules that are attracted to one another by weak ________ and can exist in gaseous, liquid, or solid state at room temperature.

Question 1720
All reactions in the human body are catalyzed by
A) carboxylic acids.  
B) alcohols.  
C) proteins.  
D) alkanes.

Question 1721
Which of the following is a fundamental SI Unit?
A) millimeter  
B) meter  
C) hectometer  
D) nanometer

Question 1722
What is the chemical symbol for an atom that has 29 protons and 36 neutrons?
A) Cu  
B) Kr  
C) N  
D) Tb

Question 1723
The highest oxidation state attainable by Zn is ________.

Question 1724
What are the possible values of l if n = 3?
A) 3  
B) 0, 1, or 2  
C) -4, -3, -2, -1, 0, +1, +2, +3, or +4  
D) -5, -4, -3, -2, -1, 0, +1, +2, +3, +4, or +5
Question 1725
Mica cleaves into thin sheets because at the molecular level its structure is
A) one dimensional.
B) two dimensional.
C) three dimensional.
D) None of these.

Question 1726
What is the oxidation number of oxygen in BaO2?
A) 0
B) -1/2
C) -1
D) -2

Question 1727
What is the pH of a solution made by mixing 30.00 mL of 0.10 M acetic acid with 30.00 mL of 0.10 M KOH? Assume that the volumes of the solutions are additive. Ka = 1.8 × 10⁻⁵ for CH₃CO₂H.
A) 5.28
B) 7.00
C) 8.72
D) 10.02

Question 1728
What is the strongest acid among the following?
A) CH₃CO₂H
B) ClCH₂CO₂H
C) Cl₂CHCO₂H
D) Cl₃CCO₂H

Question 1729
Which element of group 4A has the greatest density?
A) C
B) Ge
C) Sn
D) Pb

Question 1730
The acids HNO₃ and HNO₂ are named _______ and ________, respectively.

Question 1731
Carbon combines with some metals and semimetals to form carbides. What is the formula of aluminum carbide?

Question 1732
Which cation in each set is expected to have the larger (more negative) hydration energy?
I. Mg²⁺ or Ca²⁺
II. Li⁺ or Al³⁺
A) Mg²⁺ in set I and Li⁺ in set II
B) Mg²⁺ in set I and Al³⁺ in set II
C) Ca²⁺ in set I and Li⁺ in set II
D) Ca²⁺ in set I and Al³⁺ in set II
Question 1733
What is the value for Kc for the following reaction:
PbCl₂(s) ⇌ Pb²⁺(aq) + 2 Cl⁻(aq),
if PbCl₂(s) = 1.50 grams, [Pb²⁺] = 1.6 × 10⁻² M and [Cl⁻] = 3.2 × 10⁻² M at equilibrium? (The molar mass of PbCl₂(s) is 278 g/mol and its density is 5.85 g/cm³.)
A) 7.6 × 10⁻⁷
B) 1.6 × 10⁻⁵
C) 6.2 × 10⁴
D) 1.3 × 10⁶

Question 1734
The gas Freon-11, CCl₃F, contains
A) C⁴⁺, Cl⁻, and F⁻ ions.
B) C⁴⁺, Cl₃⁻, and F⁻ ions.
C) C⁴⁺ and Cl₃F⁻ ions.
D) CCl₃F molecules.

Question 1735
Which compound will exhibit cis-trans isomerism?
A) 1, 2-dichloroethane
B) 1, 2-dichloroethene
C) dichloroethyne
D) ethylene

Question 1736
Which statement is most inconsistent with the chemistry of silicon?
A) In nature, it is generally found combined with oxygen in SiO₂ and in various silicate minerals.
B) It crystallizes in a diamond-like structure and does not form the graphite-like allotrope.
C) It is a hard, gray, semiconducting solid that melts at 1410°C.
D) It is obtained by oxidation of silica sand with coke.

Question 1737
Pyrite is called fool's gold because it looks like real gold. However, pyrite has a density of 4.5 g/mL while gold has a density of 19.3 g/mL. Use this information to determine which of the following statements is true.
A) 25 grams of gold will occupy a greater volume than 25 grams of pyrite.
B) 25 grams of gold will occupy the same volume as 25 grams of pyrite.
C) 25 mL of gold will have a greater mass than 25 mL of pyrite.
D) 25 mL of gold will have less mass than 25 mL of pyrite.

Question 1738
A sample of pure calcium fluoride with a mass of 15.0 g contains 7.70 g of calcium. How much calcium is contained in 45.0 g of calcium fluoride?
A) 2.56 g
B) 7.70 g
C) 15.0 g
D) 23.1 g

Question 1739
Which one of the following would be expected to have the lowest standard molar entropy, S°, at 25°C?
A) CH₄(g)
B) C₃H₆(g)
C) C₃H₈(g)
D) C₄H₁₀OH(g)
Question 1740
What is the chemical symbol for thallium?
A) Ti
B) Tl
C) Tm
D) Th

Question 1741
In the mixed aluminum-boron hydride AlBH6, the number of hydrogen involved in 2c-2e bonds is ________, and the number of hydrogen involved in 3c-2e bonds is ________.

Question 1742
Which of the following elements is classified as a semimetal?
A) calcium
B) silicon
C) fluorine
D) uranium

Question 1743
The hybrid orbital used by carbon to overlap with hydrogen in C2H2 is ________.

Question 1744
Isotopes have the same number of ________, but different numbers of ________ in their nuclei.

Question 1745
Because of the high heat and low humidity in the summer in Death Valley, California, a visitor requires about one quart of water for every two miles traveled on foot. Calculate the approximate number of liters required for a person to walk 15 kilometers in Death Valley.
A) 4.4 L
B) 18 L
C) 46 L
D) 70 L

Question 1746
Which acid of the following set has the strongest conjugate base?
A) CH4
B) NH3
C) H2S
D) HCl

Question 1747
A solution of LiCl in water has XLiCl = 0.0800. What is the molality?
A) 4.01 m LiCl
B) 4.44 m LiCl
C) 4.83 m LiCl
D) 8.70 m LiCl

Question 1748
Why is CaCO3 added to a blast furnace in the steel making process?
A) to give a source of CO2
B) to remove basic oxides from the iron ore
C) to remove silicates and phosphates from the iron ore
D) to remove unreactive carbon from the iron ore

Question 1749

Because nanoparticles have a larger percentage of atoms on the surface of the nanoparticle than on the surface of bulk material, nanoparticles have _______ melting points and _______ chemical reactivity than the bulk material.

Question 1750

Which name is not correct?
A) 2, 2-dimethylbutane
B) 2, 3-dimethyloctane
C) 2, 6, 6-trimethylheptane
D) 2, 3, 3-trimethyloctane

Question 1751

Tablets of ascorbic acid, or Vitamin C, C6H8O6, are taken as a dietary supplement. If a typical tablet contains 500 mg, how many molecules of Vitamin C are in a tablet?
A) 500 molecules
B) 1.71 × 10^24 molecules
C) 3.0 × 10^24 molecules
D) 1.71 × 10^21 molecules

Question 1752

What is the identity of element Q if the ion Q^2+ contains 10 electrons?
A) C
B) O
C) Ne
D) Mg

Question 1753

To make a 0.125 M solution, one could take 0.125 moles of solute and add
A) 1.00 L of solvent.
B) 1.00 kg of solvent.
C) enough solvent to make 1.00 L of solution.
D) enough solvent to make 1.00 kg of solution.

Question 1754

Given the hypothetical reaction: 2 A(s) + x B(g) \rightarrow 3 C(g), K_p = 0.0105 and K_c = 0.45 at 250°C. What is the value of the coefficient x?
A) 1
B) 2
C) 3
D) 4

Question 1755

A student prepared a stock solution by dissolving 20.0 g of NaOH in enough water to make 150. mL of solution. She then took 15.0 mL of the stock solution and diluted it with enough water to make 65.0 mL of a final solution. What is the concentration of NaOH for the final solution?
A) 0.769 M
B) 0.548 M
C) 1.40 M
D) 1.82 M
Question 1756

Which pair of ions can be separated by the addition of chloride ion?
A) Ag⁺ and Zn²⁺
B) Ni²⁺ and Bi³⁺
C) Pb²⁺ and Hg²⁺
D) Ca⁺ and Li⁺

Question 1757

What is the common ion in a solution prepared by mixing 0.55 M LiCH₃CO₂ with 0.10 M CH₃CO₂H?
A) H₃O⁺
B) Li⁺
C) CH₃CO₂⁻
D) OH⁻

Question 1758

The number of orbitals in the n = 3 shell is ________.

Question 1759

The first transuranium element was synthesized by bombarding U with neutrons. After capturing one neutron, the resulting nuclide was unstable and decayed by beta emission. What was the product of these two nuclear reactions?
A) Np
B) Pa
C) Th
D) U

Question 1760

What is the pH of the resulting solution if 40. mL of 0.432 M methylamine, CH₃NH₂, is added to 15 mL of 0.234 M HCl? Assume that the volumes of the solutions are additive. Ka = 2.70 × 10⁻¹¹ for CH₃NH₃⁺.
A) 2.84
B) 4.02
C) 9.97
D) 11.16

Question 1761

What does the term “hydrophobic” mean?
A) water reactive
B) water repelling
C) water soluble
D) none of these

Question 1762

Which of the following is not true?
A) A spontaneous reaction need not occur immediately.
B) A spontaneous reaction must be exothermic and must have an increase in entropy.
C) The reverse of a nonspontaneous reaction is always spontaneous.
D) A spontaneous reaction is one that can proceed on its own.

Question 1763

How many liters of SO₃(g) are produced at 25°C and 1.00 atm from the combustion of 1.00 kg of coal which is 1.00% S by weight? Assume all the sulfur in the coal ends up as SO₃.
A) 0.640 L
Question 1764

Which ion has the smallest ionic radius?
A) F-
B) Cl-
C) Br-
D) I-

Question 1765

Which one of the following elements is a poor conductor of heat and electricity?
A) copper
B) phosphorus
C) iron
D) lead

Question 1766

Which battery does not use MnO2(s) as a cell reactant?
A) an alkaline cell
B) an alkaline dry cell
C) a lithium battery
D) a nickel-metal hydride battery

Question 1767

Carbon-14, which is present in all living tissue, radioactively decays via a first-order process. A one-gram sample of wood taken from a living tree gives a rate for carbon-14 decay of 13.6 counts per minute. If the half-life for carbon-14 is 5715 years, how old is a wood sample that gives a rate for carbon-14 decay of 7.9 counts per minute?
A) 2.2 × 10³ yr
B) 3.1 × 10³ yr
C) 4.5 × 10³ yr
D) 1.4 × 10⁴ yr

Question 1768

What geometric arrangement of charge clouds is expected for an atom that has five charge clouds?
A) tetrahedral
B) square planar
C) trigonal bipyramidal
D) octahedral

Question 1769

How would one classify a germanium crystal doped with arsenic?
A) conductor
B) n-type semiconductor
C) p-type semiconductor
D) insulator

Question 1770

The chemical formula for iodous acid is
A) H IO(aq).
B) HIO2(aq).
C) HIO3(aq).
Question 1771
The Haber process is the synthesis of ammonia gas from hydrogen and nitrogen on a hot metal surface. What is the catalyst and what type of catalysis is occurring?
A) H2, heterogeneous
B) N2, heterogeneous
C) NH3, heterogeneous
D) metal surface, heterogeneous

Question 1772
Given three cylinders containing O2 gas at the same volume and pressure. Cylinder A is at -25°C, cylinder B is at -20°F, and cylinder C is at 250 K. Which cylinder contains the largest mass of oxygen?
A) cylinder A
B) cylinder B
C) cylinder C
D) All cylinders contain the same mass of O2.

Question 1773
At 25°C, the pH of a vinegar solution is 2.60. What are the values of [H3O+] and [OH-] in the solution?
A) 3.99 x 10^{-12} M, 2.51 x 10^{-3} M
B) 2.51 x 10^{-3} M, 3.98 x 10^{-12} M
C) 2.51 x 10^{-3} M, 11.40 M
D) 2.60 M, 11.40 M

Question 1774
Which two ions have the same electron configuration in the ground state?
A) Cs+ and Li+
B) Ca2+ and Cl-
C) Se2+ and Cl-
D) Fe2+ and Fe3+

Question 1775
The number of orbitals having the quantum numbers, n = 5 and l = 3 is ________.

Question 1776
Addition of a small amount of Ga impurity in silicon results in a(n) ________-type semiconductor that has a conductivity that is ________ (greater, less) than silicon.

Question 1777
A catalyst increases the rate of a chemical reaction by providing a lower-energy mechanism for the reaction. When this occurs, which one of the following is not affected?
A) activation energy for the forward reaction
B) activation energy for the reverse reaction
C) equilibrium constant
D) rate of the reverse reaction

Question 1778
A basketball is inflated to a pressure of 2.10 atm in a 20.0°C garage. What is the pressure of the basketball outside where the temperature is -5.00°C?
A) 1.92 atm
B) 2.29 atm
Question 1779

What is the mole fraction of I₂ in a solution made by dissolving 27.8 g of I₂ in 260 g of hexane, C₆H₁₄?
A) 0.0350
B) 0.965
C) 1.03
D) 28.57

Question 1780

The temperature of 1.00 mL of water is raised by 1.00°C for every 4.184 joules of heat absorbed by the water. How many liters of water can be raised from 21.0°C to 100.0°C by the absorption of 8.88 kcal of heat generated by the combustion of natural gas?
A) 0.112 L
B) 2.13 L
C) 37.2 L
D) 168 L

Question 1781

The layers of graphite are held together by
A) covalent bonds.
B) ion-ion forces.
C) London dispersion forces.
D) cationic forces.

Question 1782

Which of the following binary hydrides has the highest melting point?
A) AlH₃
B) CaH₂
C) NH₃
D) SnH₄

Question 1783

In the combustion analysis of an unknown compound containing only carbon, hydrogen, and oxygen, the grams of oxygen are found from the grams of
A) CO₂ only.
B) H₂O only.
C) CO₂ and H₂O only.
D) CO₂, H₂O and unknown compound.

Question 1784

What statement is inconsistent about carbon monoxide?
A) It is a colorless, odorless and toxic gas.
B) It is formed by burning carbon or hydrocarbon in excess oxygen.
C) One of its main industrial uses is in the synthesis of methanol, CH₃OH.
D) Toxicity of CO results from its ability to bond strongly to iron(II) atom in hemoglobin.

Question 1785

Sucrose, common table sugar, when hydrolyzed will form
A) amylose and glycogen.
B) cellulose and starch.
C) glucose and fructose.
D) lactose and maltose.
**Question 1786**
Iron crystallizes in a body-centered cubic cell having an edge length of 287 pm. What is the density of iron in g/cm³?

A) 1.99  
B) 7.85  
C) 11.9  
D) 15.9  

**Question 1787**
Which of the following amino acids contains a sulfur in its side chain?
A) aspartic acid  
B) glycine  
C) cysteine  
D) arginine  

**Question 1788**
The concentration of H₃O⁺ in human sweat can be as low as 2.5 × 10⁻⁶. The concentration of OH⁻ in the sweat is ________, and this solution is ________(acidic, basic, neutral).


**Question 1789**
When the temperature of a gas whose activation energy is 55 kJ/mol is increased from 300 K to 320 K, the fraction of collisions with sufficient energy to react
A) decreases by a factor of 2.  
B) decreases by a factor of 4.  
C) increases by a factor of 2.  
D) increases by a factor of 4.  

**Question 1790**
According to molecular orbital theory, is the highest energy orbital that contains an electron antibonding or bonding in O₂⁻?  

**Question 1791**
Which of the following ions should be the strongest reducing agent?
A) V³⁺  
B) Cr³⁺  
C) Fe³⁺  
D) Co³⁺  

**Question 1792**
What is the oxidation number of the sulfur atom in Cs₂SO₃?
A) -2  
B) +2  
C) +4  
D) +6  

**Question 1793**
Which definition best describes isomers that are non-superimposable mirror images of each other that rotate plane polarized light to the same degree but in opposite directions?
A) diastereoisomers  
B) enantiomers  
C) ionization isomers  
D) racemic mixture
Question 1794
The symbol of the isotope having \( Z = 88 \) and \( A = 226 \) is ________.

Question 1795
\( ^{201}\text{Tl} \) is used in myocardial perfusion imaging. It undergoes beta decay with a half-life of 73 hours generating 80 keV X-rays. A typical dose is 2.5 mCi which is equal to ________ Bq.

Question 1796
Which of the compounds, Ca H\(_2\), H\(_2\)O, C H\(_4\), XeF\(_4\) are ionic compounds?
A) only C H\(_4\)
B) only Ca H\(_2\)
C) Ca H\(_2\) and Xe F\(_4\)
D) H\(_2\)O, C H\(_4\), and XeF\(_4\)

Question 1797
In an acid-base neutralization reaction 43.74 mL of 0.500 M potassium hydroxide reacts with 50.00 mL of sulfuric acid solution. What is the concentration of the H\(_2\)SO\(_4\) solution?
A) 0.219 M
B) 0.437 M
C) 0.875 M
D) 1.14 M

Question 1798
For a liquid solution made by dissolving a solid or a gas in a liquid, the
A) liquid is the solute.
B) liquid is the solvent.
C) solute is the component present in the greatest amount.
D) solvent is the component present in the greatest amount.

Question 1799
Which group 3A element has the largest liquid range of any known element?
A) Al
B) Ga
C) In
D) Tl

Question 1800
Of C\(_2\)H\(_5\)OH and C\(_3\)H\(_5\)(OH)\(_3\) the one expected to have the higher viscosity is ________, and the one expected to have the higher surface tension is ________.

Question 1801
Elements in group 3A of the periodic table have the valence electron configuration ________.

Question 1802
The solubility of gaseous solutes in liquid solvents is greater when the
A) external pressure over the solution is increased.
B) external pressure is decreased.
C) partial pressure of the gas above the solution is increased.
D) partial pressure of the solvent is increased.
Question 1803

The element Ga has how many valence electrons?
A) 1
B) 2
C) 3
D) 4

Question 1804

Which of the following combinations of chemicals could be used to make a buffer solution?
A) HCl/KOH
B) HCl/NH3
C) HBr/H3PO4
D) KOH/NH3

Question 1805

How many grams of AgNO3 are needed to make 250. mL of a solution that is 0.140 M?
A) 0.0951 g
B) 0.168 g
C) 5.95 g
D) 95.1 g

Question 1806

Suppose you needed to closely monitor small changes in pressure inside a container using an open end manometer. For the best accuracy, the substance in the manometer should
A) be a solid.
B) be mercury.
C) have a high density.
D) have a low density.

Question 1807

When more than 3000 known nuclides are plotted on a neutron/proton grid, they make up a group called
A) the "island of stability."
B) the "band of nuclear stability."
C) the "sea of instability."
D) none of these

Question 1808

What is the oxidation number of the chromium atom in Li2Cr2O4?
A) -2
B) +2
C) +6
D) +7

Question 1809

The ionic radius of Cs+ is ________ than the atomic radius of Cs, and the ionic radius of I- is ________ than the atomic radius of I.

Question 1810

Benzoic acid (C6H5CO2H = HBz) solutions are sometimes used in experiments to determine the molarity of a basic solution of unknown concentration. What is the pH of a 0.100 M solution of benzoic acid if Ka = 6.5 × 10-5 and the equilibrium equation of interest is HBz(aq) + H2O(l) <---> H3O+(aq) + Bz-(aq).
### Question 1811
Which of the following is not an application of colligative properties?
A) adding silver to mercury to lower the vapor pressure of mercury
B) desalinating sea water by reverse osmosis
C) melting snow by application of salt
D) reduced boiling points of pure liquids at increased altitudes

### Question 1812
The mass of a helium-4 nucleus is _______ (greater than, less than, the same as) the sum of the masses of two protons plus two neutrons.

### Question 1813
How many electrons are in the ion, Zn²⁺?
A) 28
B) 30
C) 32
D) 65

### Question 1814
As one traverses the periodic table from left to right, the effective nuclear charge Zeff increases. As a result of this the periodic properties of
A) atomic size increases, IE increases, EA increases and electronegativity increases.
B) atomic size decreases, IE increases, EA increases and electronegativity increases.
C) atomic size decreases, IE decreases, EA increases and electronegativity increases.
D) atomic size decreases, IE increases, EA decreases and electronegativity increases.

### Question 1815
In the electron dot structure of HCN, the bond order of CN is
A) 0
B) 1
C) 2
D) 3
Answer: [here](https://biology-forums.com/index.php?topic=289613)

### Question 1816
Which one of the following binary oxides is the most acidic?
A) K₂O
B) Ga₂O₃
C) BeO
D) Cl₂O₇
Answer: [here](https://biology-forums.com/index.php?topic=291897)

### Question 1817
Identify one mole of a substance.
A) 32.0 grams of H₂
B) 52.0 grams of Cr
C) 8.0 grams of LiH
D) All of these
How many milliliters of a 6.0 M HNO₃ solution are needed to make 0.25 L of a 3.5 M HNO₃ solution?
A) 686 mL
B) 428 mL
C) 146 mL
D) 119 mL

Question 1819
Precipitation of an ionic compound will occur upon mixing of desired reagents if the initial ion product is
A) greater than the Ksp.
B) equal to the pKsp.
C) equal to the Ksp.
D) less than the Ksp.

Question 1820
Which is the crystal field energy level diagram for a square planar ML₄ complex that contains no ligands on the z-axis?
A) (A)
B) (B)
C) (C)
D) (D)

Question 1821
The strongest homonuclear single bond is
A) H—H
B) Ge—Ge
C) As—As
D) I—I

Question 1822
The solubility of 1:1 salts is measured by the equilibrium constant for the general reaction: MX(s) = Mn⁺(aq) + Xn⁻(aq). Given the following salts and their equilibrium constants for the reaction above at 25°C, which salt is the least soluble?
A) MgCO₃, Kc = 6.8 × 10⁻⁶
B) CaCO₃, Kc = 5.0 × 10⁻⁹
C) SrCO₃, Kc = 5.6 × 10⁻¹⁰
D) BaCO₃, Kc = 2.6 × 10⁻⁹

Question 1823
Transition series elements are all
A) gases.
B) metals.
C) nonmetals.
D) semimetals.

Question 1824
What is the percent dissociation of a benzoic acid solution with pH = 2.59? The acid dissociation constant for this monoprotic acid is 6.5 × 10⁻⁵.
A) 0.50%
B) 1.5%
C) 2.5%
D) 3.5%

Question 1825
Which of the following compounds has the highest boiling point?
A) H₂O
B) H₂S
Question 1826

How many chloride ions are in 1.50 mol of aluminum chloride?
A) 2.00 chloride ions
B) 2.009.023 chloride ions
C) 9.023 × 1023 chloride ions
D) 2.71 × 1024 chloride ions

Question 1827

Convert 0.009723 to standard scientific notation.
A) 9.723 × 10^-3
B) 9723 × 10^-6
C) 9.723 × 10^3
D) 9723 × 10^6

Question 1828

The charge, n, on the cyclic anion Si6O18n that is found in the mineral beryl is ________.

Question 1829

What is the F—B—F bond angle in BF3?
A) less than 109.5°
B) 109.5°
C) 120°
D) greater than 120°

Question 1830

Which has the smallest atomic radius?
A) Sc
B) V
C) Ni
D) Zn

Question 1831

How many grams of CO gas are there in a 5.00-L cylinder at 4.00 × 103 mm Hg and 23°C?
A) 15.2 g
B) 29.9 g
C) 389 g
D) 2.30 × 104 g

Question 1832

The nighttime and daytime temperatures on Mercury are 13 K and 683 K respectively. The melting point and boiling point of sulfur is 246°F and 832°F. Which of the following statements is true? On Mercury sulfur exists
A) only in the liquid state.
B) only in the solid state.
C) as both a liquid and a gas.
D) as both a liquid and a solid.

Question 1833

Arrange the following spectral regions in order of increasing wavelength:
<table>
<thead>
<tr>
<th>Question 1834</th>
</tr>
</thead>
<tbody>
<tr>
<td>A galvanic cell consists of a La\textsuperscript{3+}/La half-cell and a standard hydrogen electrode. If the La\textsuperscript{3+}/La half-cell standard cell functions as the anode, and the standard cell potential is 2.52 V, what is the standard reduction potential for the La\textsuperscript{3+}/La half-cell?</td>
</tr>
<tr>
<td>A) -2.52 V</td>
</tr>
<tr>
<td>B) -0.84 V</td>
</tr>
<tr>
<td>C) +0.84 V</td>
</tr>
<tr>
<td>D) +2.52 V</td>
</tr>
</tbody>
</table>

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<thead>
<tr>
<th>Question 1835</th>
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<tbody>
<tr>
<td>What orbital hybridization is expected for the central atom in a molecule with a trigonal planar geometry?</td>
</tr>
<tr>
<td>A) sp</td>
</tr>
<tr>
<td>B) sp\textsuperscript{2}</td>
</tr>
<tr>
<td>C) sp\textsuperscript{3}</td>
</tr>
<tr>
<td>D) sp\textsuperscript{4}</td>
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</tbody>
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<table>
<thead>
<tr>
<th>Question 1836</th>
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</thead>
<tbody>
<tr>
<td>The chemical formula for nitric acid is</td>
</tr>
<tr>
<td>A) HNO\textsubscript{2}(aq).</td>
</tr>
<tr>
<td>B) HNO\textsubscript{3}(aq).</td>
</tr>
<tr>
<td>C) H\textsubscript{2}NO\textsubscript{3}(aq).</td>
</tr>
<tr>
<td>D) H\textsubscript{2}NO\textsubscript{2}(aq).</td>
</tr>
</tbody>
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<thead>
<tr>
<th>Question 1837</th>
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<tbody>
<tr>
<td>What is the Ka of the amino acid glycine if it is 75.0% dissociated at pH = 10.08?</td>
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<tr>
<th>Question 1838</th>
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<tbody>
<tr>
<td>Amphetamines in urine can be confirmed by mass spectroscopy at a concentration of 500 ng/mL. Assuming a urine density of 1.025 g/mL, what is this concentration in parts per million?</td>
</tr>
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<table>
<thead>
<tr>
<th>Question 1839</th>
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</thead>
<tbody>
<tr>
<td>When alkanes react with chlorine in the presence of ultraviolet light, chlorine atoms substitute for one or more alkane hydrogen atoms. What is the number of different chloroalkane compounds that can be formed by the reaction of C\textsubscript{2}H\textsubscript{6} with chlorine?</td>
</tr>
<tr>
<td>A) 3</td>
</tr>
<tr>
<td>B) 6</td>
</tr>
<tr>
<td>C) 9</td>
</tr>
<tr>
<td>D) 12</td>
</tr>
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<tr>
<th>Question 1840</th>
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<tbody>
<tr>
<td>The solid compound, Na\textsubscript{4}SiO\textsubscript{4}, contains</td>
</tr>
<tr>
<td>A) Na\textsuperscript{+}, Si\textsuperscript{4+}, and O\textsuperscript{2-} ions.</td>
</tr>
<tr>
<td>B) Na\textsuperscript{+} ions and SiO\textsubscript{4}\textsuperscript{-4} ions.</td>
</tr>
<tr>
<td>C) Na\textsuperscript{4+} and SiO\textsubscript{4}\textsuperscript{-4} ions.</td>
</tr>
<tr>
<td>D) Na\textsubscript{4}SiO\textsubscript{4} molecules.</td>
</tr>
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<tr>
<th>Question 1841</th>
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</table>
Which statement about elemental analysis by combustion is not correct?
A) Carbon is determined from the amount of CO2 formed.
B) Hydrogen is determined from the amount of H2O formed.
C) Oxygen is determined from the amount of H2O formed.
D) Only carbon and hydrogen can be determined directly from CO2 and H2O.

Question 1842
Which element can expand its valence shell to accommodate more than eight electrons?
A) C
B) F
C) Xe
D) He

Question 1843
Which compound is a saturated hydrocarbon?
A) benzene
B) cycloheptene
C) 2-methylhexane
D) butyne

Question 1844
A steel pipe can be protected from corrosion by attaching the pipe to a piece of magnesium because
A) magnesium forms a tight oxide coating.
B) magnesium is more easily oxidized than iron.
C) magnesium is inert.
D) magnesium and steel form a corrosion resistant alloy.

Question 1845
What is the freezing point of a solution of 2.86 g MgCl2 in 100 g of water? Kf for water is 1.86°C/m.
A) -0.0558°C
B) -0.558°C
C) -1.12°C
D) -1.67°C

Question 1846
Light emitting diodes (LEDs) used in automobile brake lights illuminate 200 milliseconds faster than conventional incandescent brake lights. The faster illumination gives the driver of a trailing car an additional stopping distance of ________ feet at 55 mph.

Question 1847
According to the law of multiple proportions, if 12 g of carbon combine with 16 g of oxygen to form CO, the number of grams of carbon that combine with 16 g of oxygen in the formation of CO2 is ________.

Question 1848
What is geometry around the carbon atom labeled C1?
A) bent
B) tetrahedral
C) trigonal planar
D) trigonal pyramidal

Question 1849
Which element can form more than one kind of monatomic ion?
Question 1850
What is the pH of a solution prepared by diluting 25.00 mL of 0.020 M Ba(OH)\(_2\) with enough water to produce a total volume of 250.00 mL?
A) 2.40
B) 2.70
C) 11.30
D) 11.60

Question 1851
What effect will a change in temperature have on the value of K\(_p\)?
A) It will have no effect on the value of K\(_p\).
B) The value of K\(_p\) always decreases with an increase in temperature.
C) The value of K\(_p\) always increases with an increase in temperature.
D) The value of K\(_p\) will decrease or increase with an increase in temperature, depending on whether the reaction is exothermic or endothermic.

Question 1852
What is the approximate pH at the equivalence point of a weak acid-strong base titration if 25 mL of aqueous hydrofluoric acid requires 30.00 mL of 0.100 M NaOH? \(K_a = 6.76 \times 10^{-4}\) for HF.
A) 2.05
B) 6.05
C) 7.95
D) 11.95

Question 1853
Which process is used in the fabrication of ceramics?
A) electrolysis
B) reduction
C) roasting
D) sintering

Question 1854
What is the empirical formula for ethyl fluoride if the compound contains 49.97% carbon, 10.51% hydrogen, and 39.52% fluorine by mass?
A) C\(_2\)H\(_5\)F
B) C\(_4\)H\(_{10}\)F\(_2\)
C) C\(_4\)H\(_{10}\)F\(_4\)
D) C\(_{25}\)F\(_2\)

Question 1855
In addition to an amine, which functional group do all amino acids contain?
A) an alcohol
B) an amide
C) a carboxylic acid
D) an oxyacid

Question 1856
What is the hybridization of boron in diborane B\(_2\)H\(_6\)?
A) sp
B) sp\(^2\)
C) sp\(^3\)
### Question 1857
Which metal exhibits the highest oxidation state in its compounds?

- A) Sc
- B) Cr
- C) Mn
- D) Zn


### Question 1858
Of the following, which element has the highest first ionization energy?

- A) Cl
- B) F
- C) O
- D) S


### Question 1859
The observation that 15.0 g of hydrogen reacts with 120.0 g of oxygen to form 135.0 g of water is evidence for the law of

- A) definite proportions.
- B) energy conservation.
- C) mass conservation.
- D) multiple proportions.


### Question 1860
The balanced net ionic equation for the neutralization reaction involving equal molar amounts of HI and KOH is ________.


### Question 1861
Three identical flasks contain three different gases at standard temperature and pressure. Flask A contains Ar, flask B contains Ne, flask C contains H₂. Which flask contains the largest number of molecules?

- A) flask A
- B) flask B
- C) flask C
- D) All flasks contain the same number of molecules.


### Question 1862
Using the conjugate acid-base pairs listed below, complete the following equation with the pair that gives an equilibrium constant Kc > 1.

\[ \text{ } + \text{ HS}_2\text{O}_3^- \leftrightarrow \text{ } + \text{ H}_2\text{SO}_3 \]

- A) CH₃CO₂H/ CH₃CO₂⁻
- B) HCO₂H/ HCO₂⁻
- C) HNO₂/NO₂⁻
- D) HNO₃/NO₃⁻


### Question 1863
A solution is prepared by dissolving 17.75 g sulfuric acid, H₂SO₄, in enough water to make 100.0 mL of solution. If the density of the solution is 1.1094 g/mL, what is the molarity?

- A) 0.1775 M H₂SO₄
- B) 0.1810 M H₂SO₄
- C) 1.810 M H₂SO₄
- D) 1.940 M H₂SO₄


### Question 1864
Kinetic energy increases with increasing ________ and increasing ________.

Question 1865

How many grams of chromium metal are plated out when a constant current of 8.00 A is passed through an aqueous solution containing Cr3+ ions for 40.0 minutes?
A) 3.45 g  
B) 6.15 g  
C) 10.3 g  
D) 31.0 g  

Question 1866

Which one of the following compounds exhibits the strongest hydrogen bonding between its molecules?
A) HF  
B) HBr  
C) H2O  
D) Ar  

Question 1867

Each of three identical 15.0-L gas cylinders contains 7.50 mol of gas at 295 K. Cylinder A contains He, cylinder B contains CO2, and cylinder C contains SO2. According to the kinetic molecular theory, which gas has the highest density?
A) He  
B) CO2  
C) SO2  
D) All have identical densities  

Question 1868

What does the term “essential” mean when referring to amino acids? These are the amino acids which
A) are necessary for digestion.  
B) are necessary for respiration.  
C) are synthesized in our bodies.  
D) we must obtain from our diet.  

Question 1869

Molecular vibrational energy transitions are observed in the infrared, molecular rotational transitions in the microwave, and electronic transitions in the ultraviolet-visible range. Which transitions require the most energy and which the least energy?
A) Electronic transitions require the least energy and vibrational transitions the most.  
B) Rotational transitions require the least energy and electronic transitions the most.  
C) Vibrational transitions require the least energy and electronic transitions the most.  
D) Vibrational transitions require the least energy and rotational transitions the most.  

Question 1870

A student left 40.0 mL of a bottle of 12.0 M HCl out overnight. The next morning, the bottle has only 35.7 mL of liquid left. Assuming that the volume change is only due to loss of water, what will be the molarity if the remaining solution is diluted to 150 mL?
A) 6.0 M  
B) 2.86 M  
C) 3.20 M  
D) 12.0 M  

Question 1871

Which has the highest standard molar entropy at 25°C?
A) F2(g)  
B) N2(g)  
C) Cl2(g)
Question 1872
The molecule H₂NCH₂CH₂OH contains an ________ functional group and an ________ functional group.


Question 1873
An experiment with 55Co takes 47.5 hours. At the end of the experiment, 1.90 ng of 55Co remains. If the half-life is 18.0 hours, how many ng of 55Co were originally present?

A) 2.47 ng
B) 3.05 ng
C) 3.28 ng
D) 11.8 ng


Question 1874
How many sulfate ions are there in 5.00 g of FeSO₄?

A) 5.46 × 10⁻²⁶ iron (II) ions
B) 1.98 × 10²² iron (II) ions
C) 1.83 × 10²⁵ iron (II) ions
D) 4.58 × 10²⁶ iron (II) ions


Question 1875
What is the pH of a solution prepared by mixing 50.00 mL of 0.10 M methylamine, CH₃NH₂, with 15.00 mL of 0.10 M methylammonium chloride, CH₃NH₃Cl? Assume that the volume of the solutions are additive and that Kb = 3.70 × 10⁻⁴ for methylamine.

A) 10.04
B) 10.57
C) 11.09
D) 11.78


Question 1876
What is the chemical formula for cesium bicarbonate?

A) Cs₂HCO₃
B) CsHCO
C) CsHCO₂
D) CsHCO₃


Question 1877
Which element has the most favorable (most negative) electron affinity?

A) B
B) C
C) Li
D) N


Question 1878
Which represents one formula unit?

A) One Cu
B) One F₂
C) One NaH
D) All of these


Question 1879
How many significant figures are there in the answer for the following problem?
23.1 + 0.5848 + 11 = ?
A) one
B) two
C) three
D) four

Question 1880
_________ properties depend only on the identity of the solute and on the number of solute particles present.

Question 1881
The most stable allotrope of sulfur is S8. What are the approximate bond angles in S8?

Question 1882
How many electrons does barium lose and nitrogen need to form Ba3P2?
A) barium loses 2 and phosphorus gains 2
B) barium loses 2 and phosphorus gains 3
C) barium loses 3 and phosphorus gains 2
D) barium loses 3 and phosphorus gains 3

Question 1883
Chloroform has a boiling point of 61.1°C and dichloromethane has a boiling point of 40.0°C. When 0.250 mol of dichloromethane is added to 0.750 mol of chloroform, the resulting solution will have a boiling point:
A) between 40.0°C and 61.1°C, but closer to 61.1°C.
B) between 40.0°C and 61.1°C, but closer to 40.0°C.
C) greater than 61.1°C.
D) less than 40.0°C.

Question 1884
Of BrF3 and PF3, the one with the smaller bond angles is ________.

Question 1885
Which substance is a good semiconductor?
A) diamond
B) germanium
C) gold
D) phosphorus

Question 1886
Which of the following statements about isomers is false?
A) All alkanes have branched chain isomers.
B) As the number of carbon atoms increase in a compound, so do the number of possible isomers.
C) Isomers have different physical properties.
D) Isomers have the same formula but different molecular structures.

Question 1887
When a substance decays by beta emission, the mass number of the nucleus ________ and the atomic number ________.
A) decreases by 2, remains the same
B) increases by 2, remains the same
C) remains the same, decreases by 1
D) remains the same, increases by 1
<table>
<thead>
<tr>
<th>Question 1888</th>
</tr>
</thead>
<tbody>
<tr>
<td>A reaction in which reactants form products in the forward reaction and products simultaneously form reactants in the reverse reaction is said to be ________.</td>
</tr>
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<table>
<thead>
<tr>
<th>Question 1889</th>
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<tbody>
<tr>
<td>Which group 6A element has the most negative electron affinity?</td>
</tr>
<tr>
<td>A) Te</td>
</tr>
<tr>
<td>B) S</td>
</tr>
<tr>
<td>C) N</td>
</tr>
<tr>
<td>D) C</td>
</tr>
</tbody>
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<thead>
<tr>
<th>Question 1890</th>
</tr>
</thead>
<tbody>
<tr>
<td>The HBr bond has a length of 141 pm and 12.1% ionic character. What is the dipole moment of HBr?</td>
</tr>
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<thead>
<tr>
<th>Question 1891</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO2- is expected to have</td>
</tr>
<tr>
<td>A) two single bonds.</td>
</tr>
<tr>
<td>B) one single and one double bond.</td>
</tr>
<tr>
<td>C) two double bonds.</td>
</tr>
<tr>
<td>D) two identical bonds intermediate between a single and a double bond.</td>
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<thead>
<tr>
<th>Question 1892</th>
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</thead>
<tbody>
<tr>
<td>What is the top chemical compound produced in the United States?</td>
</tr>
<tr>
<td>A) Cl2</td>
</tr>
<tr>
<td>B) NI3</td>
</tr>
<tr>
<td>C) NaBr</td>
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<tr>
<td>D) H2SO4</td>
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<tr>
<th>Question 1893</th>
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<tbody>
<tr>
<td>Under thermodynamic standard state conditions the element oxygen occurs as</td>
</tr>
<tr>
<td>A) O(g)</td>
</tr>
<tr>
<td>B) O2(g)</td>
</tr>
<tr>
<td>C) O2(l)</td>
</tr>
<tr>
<td>D) O3(g)</td>
</tr>
</tbody>
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<thead>
<tr>
<th>Question 1894</th>
</tr>
</thead>
<tbody>
<tr>
<td>Which of the following pairs of solutions have roughly the same boiling point elevation?</td>
</tr>
<tr>
<td>A) 0.100 m C6H12O6 and 0.0333 m CuF2</td>
</tr>
<tr>
<td>B) 0.100 m KF and 0.100 m C6H12O6</td>
</tr>
<tr>
<td>C) 0.200 m KCl and 0.300 m Li2SO4</td>
</tr>
<tr>
<td>D) 0.100 m LiBr and 0.0500 m MgBr2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Question 1895</th>
</tr>
</thead>
<tbody>
<tr>
<td>Which is expected to have the most negative standard enthalpy of formation?</td>
</tr>
<tr>
<td>A) N2(g)</td>
</tr>
<tr>
<td>B) C5H12(g)</td>
</tr>
<tr>
<td>C) HBr(g)</td>
</tr>
<tr>
<td>D) H2O(g)</td>
</tr>
</tbody>
</table>

| Question 1896 |
Coinage metals are metals that are not easily oxidized. Based on the activity series, which metal would be least desirable as a coinage metal?

A) Mn  
B) Au  
C) Ca  
D) Co  

**Question 1897**

Which type of radiation is not used for medical applications?

A) alpha emission  
B) beta emission  
C) gamma radiation  
D) positron emission  

**Question 1898**

What is the chemical formula for calcium chromate?

A) CaCrO2  
B) CaCrO  
C) CaCrO3  
D) CaCrO4  

**Question 1899**

A KCl solution is prepared by dissolving 60.0 g KCl in 250.0 g of water at 25°C. What is the vapor pressure of the solution if the vapor pressure of water at 25°C is 23.76 mm Hg?

A) 20.5 mm Hg  
B) 21.3 mm Hg  
C) 22.5 mm Hg  
D) 25.5 mm Hg  

**Question 1900**

The compound ICl contains

A) ionic bonds.  
B) nonpolar covalent bonds.  
C) polar covalent bonds with partial negative charges on the Cl atoms.  
D) polar covalent bonds with partial negative charges on the I atoms.  

**Question 1901**

A 0.529-g sample of gas occupies 125 mL at 60. cm of Hg and 25°C. What is the molar mass of the gas?

A) 11 g/mol  
B) 81 g/mol  
C) 110 g/mol  
D) 130 g/mol  

**Question 1902**

Based on the variation in Zeff, which M2+ ion should be the strongest reducing agent?

A) Ti  
B) Cr  
C) Fe  
D) Zn  

**Question 1903**

Fresh air contains approximately 400 ppm CO2, whereas the breath of an intoxicated person contains about 4 percent CO2. The amount of CO2 in the breath of an intoxicated person is ________ times the amount of CO2 in fresh air.

A) 10^2
Question 1904

Which one of the following amino acids contains a polar side chain?
A) alanine
B) glycine
C) serine
D) histidine

Question 1905

What statement about nitric acid is not true?
A) It is a strong oxidizing agent.
B) It is one of the more common strong acids and is essentially 100% dissociated in water.
C) It often has a yellow color due to the formation of NO2.
D) Its anhydride is N2O3.

Question 1906

The formula of thallium(III) selenide contains ________ thallium(III) and ________ selenide ions.

Question 1907

What is the hydroxide ion concentration of a lye solution that has a pH of 13.20?
A) 6.31 × 10^{-14} M
B) 1.58 × 10^{-1} M
C) 0.80 M
D) 13.20 M

Question 1908

Molecular orbitals extending over more than two atoms provide an explanation for
A) coordinate covalent bonding.
B) ionic bonding.
C) paramagnetism.
D) resonance.

Question 1909

Water is an example of
A) a compound.
B) an element.
C) a mixture.
D) an ion.

Question 1910

How many lone pairs of electrons are on the N atom in NBr3?
A) 0
B) 1
C) 2
D) 3

Question 1911

Which atom in each group (I and II) has the smallest atomic radius?
(I) Rb, Zr, (II) Sb, N, As  
A) Rb; Sb  
B) Rb; As  
C) Te; Sb  
D) Te; As  
Answer: [link]

**Question 1912**

________ is a nonmetal that is a solid at room temperature.  
A) Calcium  
B) Selenium  
C) Bromine  
D) Copper  
Answer: [link]

**Question 1913**

What is the oxidation number of carbon in CaC2?  
A) +4  
B) 0  
C) -1  
D) -2  
Answer: [link]

**Question 1914**

A certain metal crystallizes in a face-centered cubic structure. What is the edge length of the unit cell if the atomic radius of the metal is 134 pm?  
A) 189 pm  
B) 268 pm  
C) 309 pm  
D) 379 pm  
Answer: [link]

**Question 1915**

If a log contains 60.0% of the 14C present in a living tree, how long has the log been dead? The half-life of 14C is 5730 years.  
A) 2290 years  
B) 3430 years  
C) 4220 years  
D) 7560 years  
Answer: [link]

**Question 1916**

Which of the following elements exhibits the most metallic character?  
A) Ga  
B) Ge  
C) C  
D) S  
Answer: [link]

**Question 1917**

Based on the variation in Zeff, which oxoanion should be the strongest oxidizing agent?  
A) VO43-  
B) CrO42-  
C) MnO42-  
D) FeO42-  
Answer: [link]

**Question 1918**

When measuring a solid metal block at constant temperature, which measurement will change in numerical value depending on the location where it is taken?  
A) length  
B) mass
Question 1919
Copper can be obtained from its copper(I) sulfide ore by roasting. What is the balanced equation for the roasting of copper(I) sulfide?

Question 1920
Which of the following is not an advantage of fusion reactions over fission reactions for power generation?
A) cheap and plentiful fuel
B) ease of reaction initiation
C) Fusion products are non-polluting.
D) Fusion products are nonradioactive.

Question 1921
Which pair of ions can be separated by the addition of sulfide ion?
A) Na+ and Fe2+
B) Cu2+ and Bi3+
C) Pb2+ and Ba2+
D) Ca2+ and Ba2+

Question 1922
Calculate the molar solubility of thallium(I) chloride in 0.20 M NaCl at 25°C. Ksp for TlCl is 1.7 × 10^{-4}.
A) 3.4 × 10^{-5} M
B) 8.5 × 10^{-4} M
C) 5.8 × 10^{-3} M
D) 1.3 × 10^{-2} M

Question 1923
Which of the following atoms with the specified electronic configurations would have the lowest first ionization energy?
A) [He]2s22p3
B) [Ne]3s23p4
C) [Xe]6s1
D) [Xe]6s24f145d106p1

Question 1924
What type of bonding is found in the compound PCl5?
A) covalent bonding
B) hydrogen bonding
C) ionic bonding
D) metallic bonding

Question 1925
Which one of the following amino acids does not contain a basic side chain?
A) arginine
B) histidine
C) lysine
D) glutamine

Question 1926
A::A represents
A) a double bond.
B) a quadruple bond.
C) one lone pair of electrons.
D) two lone pairs of electrons.

Question 1927

Using shorthand notation, the ground-state electron configuration for Co\(^{2+}\) is predicted to be ________.

Question 1928

Which is the crystal field energy level diagram for an octahedral ML\(_6\) complex?
A) (A)
B) (B)
C) (C)
D) (D)

Question 1929

In which of the following sets do all species have the same number of protons?
A) At\(^-\), Rn, Ra\(^{2+}\)
B) C, N\(^3-\), O\(^2-\)
C) CO\(_3^{3+}\), Rh\(^3+\), Ir\(^3+\)
D) Br, Co\(^{2+}\), Co\(^{3+}\)

Question 1930

What is the molar solubility of CaF\(_2\) in 0.10 M NaF solution at 25\(^\circ\)C? The K\(_{sp}\) for CaF\(_2\) is 3.4 × 10\(^{-11}\).
A) 8.5 × 10\(^{-10}\) M
B) 3.4 × 10\(^{-10}\) M
C) 3.4 × 10\(^{-9}\) M
D) 2.0 × 10\(^{-4}\) M

Question 1931

Which acid, if any, is a strong acid?
A) All are strong acids.
B) HX and HZ
C) HY
D) None are strong acids.

Question 1932

A solution with a hydrogen ion concentration of 3.25 × 10\(^{-5}\) M is ________ and has a hydroxide ion concentration of ________.
A) acidic, 3.08 × 10\(^{-9}\) M
B) acidic, 3.08 × 10\(^{-10}\) M
C) basic, 3.08 × 10\(^{-9}\) M
D) basic, 3.08 × 10\(^{-10}\) M

Question 1933

Which one of the following is not a main group element?
A) Fr
B) Ra
C) Th
D) C

Question 1934

Which is not true for standard electrode potentials?
A) Cell constituents are in their standard states.
B) E° for oxidation is the negative of E° for reduction.
C) The half-reactions are written as reductions.
D) The potential for the standard hydrogen electrode is chosen to be +1.00 V.

Question 1935

The masses of 4He, 6Li, and 10B are 4.0015, 6.0135, and 10.0102 amu respectively. The fission of a boron-10 nucleus into He-4 and Li-6 would
A) absorb energy.
B) evolve energy.
C) result in no energy change.
D) Need more information

Question 1936

If an equal number of moles of the weak acid HCN and the strong base KOH are added to water, is the resulting solution acidic, basic, or neutral?
A) acidic
B) basic
C) neutral
D) There is insufficient information provided to answer this question.

Question 1937

Which statement is false?
A) For any atom, the 4s orbital lies lower in energy than the 5s orbital.
B) For a hydrogen atom, a 4s orbital, a 4p orbital, and a 4d orbital all have the same energy.
C) The 4s orbital lies lower in energy than the 3d orbital for atoms K, Ca, Sc, and Ti.
D) The 4s orbital lies lower in energy than the 3d orbital for Cu and Fe2+.

Question 1938

According to the kinetic molecular theory of gases, at 290 K the average kinetic energy of O2 is ________ the average kinetic energy of NO2.

Question 1939

What are the major solute-solvent interactions created when LiF dissolves in water?
A) dipole-ion
B) dispersion
C) hydrogen bonding
D) ion-dipole

Question 1940

How many valence electrons does a neutral polonium atom have?
A) 2
B) 4
C) 6
D) 84

Question 1941

White tin is the high temperature form of the metal. Given that the density of gray tin is 5.769 g/cm3 and that of white tin is 7.28 g/cm3 raising the pressure will favor the
A) more dense allotrope and lower the transition temperature of 13.2°C.
B) more dense allotrope and raise the transition temperature of 13.2°C.
C) less dense allotrope and lower the transition temperature of 13.2°C.
D) less dense allotrope and raise the transition temperature of 13.2°C.
Question 1942
Which orbital hybridization is associated with a tetrahedral cloud arrangement?
A) sp
B) sp2
C) sp3
D) sp4

Question 1943
What is the second stepwise equilibrium constant expression for phosphoric acid H3PO4?
A) Ka2 = ([H3O+][H2PO4-])/([H3PO4])
B) Ka2 = ([H3O+]2[HPO42-])/([H3PO4])
C) Ka2 = ([H3O+][PO43-])/([H3PO4])
D) Ka2 = ([H3O+][HPO42-])/([H2PO4-])

Question 1944
What is the value of the equilibrium constant, K for a redox reaction involving the transfer of 6 mol of electrons if its standard potential is 0.043?
A) 4.384 × 105
B) 2.28 × 104
C) 1.70
D) 5.90 × 10-1

Question 1945
How would one synthesize a perchlorate salt?
A) Electrolytic oxidation of a solution of chlorate salt.
B) Electrolytic oxidation of a solution of chorite salt.
C) Electrolytic oxidation of a solution of hypochlorite salt.
D) Oxidation of a solution of chlorate salt by a perbromate salt.

Question 1946
A sample of pure lithium carbonate contains 18.8% lithium by mass. What is the % lithium by mass in a sample of pure lithium carbonate that has twice the mass of the first sample?
A) 9.40%
B) 18.8%
C) 37.6%
D) 75.2%

Question 1947
If 200. mL of 0.100 M Na2SO4 is added to 200. mL of 0.150 M NaCl, what is the concentration of Na+ ions in the final solution? Assume that the volumes are additive.
A) 0.05 M
B) 0.175 M
C) 0.125 M
D) 0.250 M

Question 1948
Given that hypohalous acids form by the following reaction,
which of the following changes will increase the yield of HOX?
A) add water
B) add X-
C) decrease the pH
D) increase the pH
Question 1949

At 25°C calcium fluoride has a solubility product constant Ksp = 3.5 × 10^{-11}. The solubility of CaF₂ at this temperature is ________ mol/L.

Question 1950

How many electrons are in the ion, SO₄²⁻?
A) 26
B) 46
C) 48
D) 50

Question 1951

What class of compounds are cyclic?
A) amino acids
B) lipids
C) monosaccharides
D) proteins

Question 1952

What is the hydroxide ion concentration and the pH for a hydrochloric acid solution that has a hydronium ion concentration of 1.50 × 10⁻⁴ M?
A) 6.67 × 10⁻¹⁰ M, 4.82
B) 6.67 × 10⁻¹⁰ M, 9.18
C) 6.67 × 10⁻¹¹ M, 3.82
D) 6.67 × 10⁻¹¹ M, 10.18

Question 1953

When dissolved in water, which of the following compounds is an Arrhenius acid?
A) HCN
B) NaOH
C) NaF
D) CH₃CH₂OH

Question 1954

A container filled with gas is connected to an open-end manometer that is filled with mineral oil. The pressure in the gas container is 763 mm Hg and atmospheric pressure is 734 mm. How high will the level rise in the manometer if the densities of Hg and mineral oil are 13.6 g/mL and 0.822 g/mL respectively?
A) 1.75 mm
B) 23.8 mm
C) 29.0 mm
D) 480 mm

Question 1955

What is the name of the commercial process for the preparation of sulfuric acid?
A) Contact process
B) Haber process
C) Mond process
D) Ostwald process

Question 1956

Which statement is inconsistent with the chemistry of the noble gases?
A) Both helium and radon are radioactive.
B) Helium and neon are both lighter than air.
C) Neon and argon are used in decorative or designer lights.
D) Xenon and krypton react with fluorine to form fluorides.

Question 1957

A solution of 62.4 g of insulin in enough water to make 1.000 L of solution has an osmotic pressure of 0.305 atm at 25°C. Based on these data, what is the molar mass of insulin?
A) 621 g/mol
B) 5000 g/mol
C) 7570 g/mol
D) 71,900 g/mol

Question 1958

A carbon dioxide monitoring product provides a reading of 202 ppm. Calculate the percent carbon dioxide by volume.
A) 2.02
B) 0.0202
C) 0.202
D) 20.2

Question 1959

Which of the following processes will decrease the neutron/ proton ratio?
A) positron emission
B) electron capture
C) beta emission
D) alpha emission

Question 1960

Calculate the pH of a 0.20 M H2SO3, solution that has the stepwise dissociation constants Ka1 = 1.5 × 10−2 and Ka2 = 6.3 × 10−8.
A) 1.26
B) 1.32
C) 1.82
D) 2.52

Question 1961

What are the possible values of n and ml for an electron in a 6d orbital?
A) n = 1, 2, 3, 4, or 5 and ml = 2
B) n = 1, 2, 3, 4, or 5 and ml = -2, -1, 0, +1, or +2
C) n = 6 and ml = 2
D) n = 6 and ml = -2, -1, 0, +1, or +2

Question 1962

What molality of pentane is obtained by dissolving 50.0 g pentane, C5H12, in 245.0 g hexane, C6H14?
A) 0.200 m
B) 0.240 m
C) 2.83 m
D) 200. m

Question 1963

Predict the product(s) of the reaction of Br2(aq) with I-(aq).
A) No reaction
B) IBr3-(aq)
C) BrO3-(aq) and I2(aq)
D) Br-(aq) and I2(aq)
Question 1964

The smallest sample of carbon atoms that can be observed with the naked eye has a mass of approximately 2 × 10⁻⁸ g. Given that 1 g = 6.02 × 10²³ amu, and that carbon has an atomic weight of 12.01 amu, determine the number of carbon atoms present in the sample.

A) 1 × 10¹⁵  
B) 1 × 10¹⁶  
C) 1 × 10¹⁷  
D) 6 × 10²³


Question 1965

Identify the saturated compound, assuming none of the structures are rings.

A) C₃H₆  
B) C₃H₈  
C) alkyne  
D) C₇H₁₂


Question 1966

1.00 mole of O₂ contains the same number of oxygen atoms as

A) 0.667 mole of O₃.  
B) 1.00 mole of CH₃CO₂H.  
C) 2.00 mole of CH₃CH₂OH.  
D) All of the above


Question 1967

Which one of the following binary oxides is the most basic?

A) B₂O₃  
B) Al₂O₃  
C) Ga₂O₃  
D) In₂O₃


Question 1968

How many Br⁻ ions are around each Na⁺ ion in NaBr, which has a cubic unit cell with Br⁻ ions on each corner and each face?

A) 1  
B) 4  
C) 6  
D) 8


Question 1969

The temperature and pressure at which all three phases can coexist in equilibrium is

A) 0.25 atm and 110°C.  
B) 1.0 atm and 140°C.  
C) 1.25 atm and 300°C.  
D) 0.45 atm and 130°C.


Question 1970

According to molecular orbital theory, materials with completely filled bands are called

A) conductors.  
B) metals.  
C) semiconductors.  
D) insulators.


Question 1971
Selenous acid, H2SeO3 has acid dissociation constants Ka1 = 3.5 × 10^{-2} and Ka2 = 5 × 10^{-8}. When 25.00 mL of 0.100 M selenous acid is titrated with 0.200 M NaOH the first equivalence point occurs at pH = ________.


**Question 1972**

Which chromium species exists only under acidic conditions?
A) Cr(OH)2
B) Cr(OH)4-
C) CrO42-
D) Cr2O72-


**Question 1973**

Which statement is true for a reaction with Kc equal to 8.90 × 10^{-12}?
A) Increasing the temperature will not change the value of Kc.
B) There are appreciable concentrations of both reactants and products.
C) The reaction proceeds hardly at all towards completion.
D) The reaction proceeds nearly all the way to completion.


**Question 1974**

The four cyclic amine bases that occur in DNA are ________, ________, ________, and ________.


**Question 1975**

The ion Q2+ contains 36 electrons. The identity of element Q is ________.


**Question 1976**

Which statement below regarding the half-life of a second-order reaction is true?
A) Each half-life is half as long as the preceding one.
B) Each half-life is twice as long as the preceding one.
C) Each half-life is four times as long as the preceding one.
D) The length of the half-life remains unchanged throughout the course of the reaction.


**Question 1977**

Layers of atoms having a spacing of 105 pm will diffract X-rays with d = 154.2 pm at an angle of ________ degrees.


**Question 1978**

Which one of the following is a metallic conductor at room temperature but a superconductor at 18 K?
A) diamond
B) graphite
C) fullerene
D) potassium fulleride


**Question 1979**

What is the molar solubility of Mg(OH)2 in a basic solution with a pH of 12.00? Ksp for Mg(OH)2 is 5.6 × 10^{-12}.
A) 5.6 × 10^{-10} M
B) 5.6 × 10^{-8} M
C) 2.4 × 10^{-6} M
D) 1.1 × 10^{-4} M


**Question 1980**

What is the approximate value of the equilibrium constant, Kn, for the neutralization of nitrous acid with ammonia, shown in the equation below? The Ka for HNO2 is 4.5 × 10^{-4} and the Kb for NH3 is 1.8 × 10^{-5}.
HNO₂(aq) + NH₃(aq) ↔ NH₄NO₂(aq)

A) 8.1 × 10⁵
B) 1.8 × 10⁹
C) 4.5 × 10¹⁰
D) 8.1 × 10¹⁹


Question 1981

What is the hydronium ion concentration of a 0.100 M acetic acid solution with a Ka = 1.8 × 10⁻⁵? The equation for the dissociation of acetic acid is: CH₃CO₂H(aq) + H₂O(l) ↔ H₃O⁺(aq) + CH₃CO₂⁻(aq).
A) 1.3 × 10⁻² M
B) 4.2 × 10⁻² M
C) 1.3 × 10⁻³ M
D) 4.2 × 10⁻³ M


Question 1982

The number of electrons in the ion Ca²⁺ is _______.


Question 1983

Which statement about the equilibrium constant is true? The value of K_c:
A) changes as product concentration changes.
B) changes as reactant concentration changes.
C) changes as temperature changes.
D) changes under the conditions described in A-C.


Question 1984

Which of the following statements is not true?
A) The reverse of a spontaneous reaction is always nonspontaneous.
B) A spontaneous process always moves toward equilibrium.
C) A nonspontaneous process cannot be caused to occur.
D) A highly spontaneous process need not occur rapidly.


Question 1985

Which of the following regions of the earth's atmosphere is closest to the surface of the earth?
A) mesosphere
B) stratosphere
C) thermosphere
D) troposphere


Question 1986

How many grams of KBr are required to make 250. mL of a 0.115 M KBr solution?
A) 0.242 g
B) 2.17 g
C) 3.42 g
D) 28.8 g


Question 1987

The wavelength of light used to observe an object must be _______ than the object itself.
A) larger
B) smaller
C) of higher energy
D) of lower energy

Question 1988

Hydrochloric acid is an example of
A) a compound.
B) an element.
C) an ion.
D) a mixture.

Question 1989

Which of the following isotopes is the least stable?
A) 7Be, 5.37 MeV/nucleon
B) 23Na, 8.11 MeV/nucleon
C) 94Zr, 8.67 MeV/nucleon
D) 240Pu, 7.26 MeV/nucleon

Question 1990

What is the pH of the resulting solution if 30.00 mL of 0.10 M acetic acid is added to 10.00 mL of 0.10 M NaOH? Assume that the volumes of the solutions are additive. Ka = 1.8 × 10-5 for CH3CO2H.
A) 9.56
B) 8.95
C) 5.05
D) 4.44

Question 1991

In which set are all compounds considered to be ionic binary hydrides?
A) LiH, KH, MgH2, BaH2
B) MgH2, SrH2, AlH3, SiH4
C) MgH2, B2H6, CH4, NH3
D) MgH2, AlH3, SiH4, H2Se

Question 1992

If one mole of gas occupies 22.4 L at STP the same gas would occupy ________ than 22.4 L at 60°C and 630 mm Hg.

Question 1993

A crystalline solid of unknown origin forms an aqueous solution that conducts an electrical current. The solid has a high melting point and shatters when struck with a hammer. The solid is likely to be
A) a covalent network solid.
B) an ionic solid.
C) a metallic solid.
D) a molecular solid.

Question 1994

A low-melting crystalline compound that does not conduct electricity in the solid or liquid state is classified as a ________ solid.

Question 1995

Which elements of group 3A are commonly used in semiconductors?
A) Tl and Al
B) Tl and Ga
C) Ga and In
D) In and Tl
Question 1996
Which of the following statements about electron capture is false?
A) The electron is used to convert a proton to a neutron.
B) The electron involved is most likely an outer shell valence electron.
C) In electron capture decay, the atomic number decreases by one.
D) In electron capture decay, the mass number remains unchanged.
Answer: [link]

Question 1997
What is the volume of 20.0 g of argon gas at 157°C and 2.50 kPa pressure?
A) 2.58 L
B) 7.06 L
C) 262 L
D) 716 L
Answer: [link]

Question 1998
Which of the following elements is most likely to naturally occur as a carbonate?
A) Ba
B) Cu
C) Au
D) Pd
Answer: [link]

Question 1999
Which period 3 element has successive first through seventh ionization energies (kJ/mol) of
E1 = 578; E2 = 1,817; E3 = 2,745; E4 = 11,575; E5 = 14,830; E6 = 18,376; and E7 = 23,293?
A) Mg
B) Al
C) S
D) Cl
Answer: [link]

Question 2000
Which has the smallest dipole-dipole forces?
A) CH3Cl
B) KCN
C) I2
D) H2S
Answer: [link]

Question 2001
A particular 12V battery is based on a reaction having a standard cell potential, E° = +1.92 V. What happens when the battery “dies”?
A) E° = 12 V and E = 0 V
B) E° = 0 V and E = 12 V
C) E° = +1.92 V and E = 0 V
D) E° = +1.92 V and E = 12 V
Answer: [link]

Question 2002
What is the weight percent of a caffeine solution made by dissolving 4.35 g of caffeine, C8H10N4O2, in 75 g of benzene, C6H6?
A) 0.055%
B) 0.058%
C) 5.5%
D) 5.8%
Answer: [link]

Question 2003
For a spontaneous process
A) energy and entropy are conserved.
B) energy is conserved and the entropy of the system and surroundings increases.
C) the energy of the system and the surroundings decreases and the entropy of the system and surroundings increases.
D) both the energy and the entropy of the system and surroundings decrease.

Question 2004
A heptane molecule contains 16 atoms of hydrogen. The number 16 represents how many significant figures?
A) one
B) two
C) three
D) infinite

Question 2005
A reaction has the rate law Rate = k[NO]2[H2]. If the concentration of NO is reduced by half and the concentration of H2 is quadrupled, the rate of reaction will ______ (increase, decrease, not change).

Question 2006
Calculate the pH for an aqueous solution of pyridine that contains hydroxide ion.
A) 2.41 x 10-11
B) 4.15 x 10-4
C) 3.38
D) 10.62

Question 2007
Calcium carbonate is relatively insoluble and the dissolution reaction is endothermic:
CaCO3(s) <-- --> Ca2+(aq) + CO32-(aq).
Which change in reaction condition below will shift the equilibrium to the right?
A) add an acid to react with CO32- ion
B) add an anion with which Ca2+ is even less soluble than calcium carbonate
C) increase the temperature
D) All of these will shift reaction to the right.

Question 2008
What is the molality of ethanol in a solution made by dissolving 7.30 g of ethanol, C2H5OH, in 53.6 g of water?
A) 0.00550 m
B) 0.500 m
C) 2.96 m
D) 400 m

Question 2009
Which one of the following is an electrical insulator?
A) alumina
B) geranium doped with antimony
C) gold
D) tellurium

Question 2010
What statement about nitrogen is not consistent with its chemistry?
A) It is a colorless, odorless, tasteless gas.
B) It makes up 78% of the earth’s atmosphere by volume.
C) It is the most volatile component of liquid air with a boiling point of -196°C.
D) It readily reacts with hydrogen to form NH3 that is used in fertilizers.
### Question 2011
Which of the following most likely represent the atomic radius of a Cr atom, the ionic radius of a Cr\(^{2+}\) ion, and the ionic radius of a Cr\(^{3+}\) ion?

A) 128 pm for Cr, 167 pm for Cr\(^{2+}\), and 193 pm for Cr\(^{3+}\)
B) 128 pm for Cr, 147 pm for Cr\(^{2+}\), and 193 pm for Cr\(^{3+}\)
C) 128 pm for Cr, 109 pm for Cr\(^{2+}\), and 63 pm for Cr\(^{3+}\)
D) 128 pm for Cr, 89 pm for Cr\(^{2+}\), and 63 pm for Cr\(^{3+}\)


### Question 2012
The H-C-H bond angles in C\(_2\)H\(_6\), C\(_2\)H\(_4\), and C\(_2\)H\(_2\) are ________, ________, and ________, respectively.


### Question 2013
In which compound does oxygen have a -1 oxidation state?

A) H\(_2\)O
B) H\(_2\)O\(_2\)
C) O\(_2\)
D) MgO


### Question 2014
Erythromycin is a basic antimicrobial with \(pK_b = 5.2\). A 1.0 \(\times\) 10\(^{-3}\) M solution of erythromycin has a pH of ________ and a ________ percent ionization.


### Question 2015
What bond distance is expected to be longest?

A) A carbon-carbon bond with a bond order of 0
B) A carbon-carbon bond with a bond order of 1
C) A carbon-carbon bond with a bond order of 2
D) A carbon-carbon bond with a bond order of 3


### Question 2016
Which of the following buffer solutions will exhibit the highest pH?

A) 0.100 M NH\(_3\) with 0.100 M NH\(_4^+\)
B) 0.200 M NH\(_3\) with 0.100 M NH\(_4^+\)
C) 0.200 M NH\(_3\) with 0.0400 M NH\(_4^+\)
D) 0.800 M NH\(_3\) with 0.800 M NH\(_4^+\)


### Question 2017
What is the empirical formula of benzene, C\(_6\)H\(_6\)?


### Question 2018
An element forms a body-centered cubic crystalline substance. The edge length of the unit cell is 287 pm and the density of the crystal is 7.92 g/cm\(^3\). Calculate the atomic weight of the substance.

A) 45.0 amu
B) 48.0 amu
C) 56.4 amu
D) 63.5 amu


### Question 2019
The hybrid orbital used by nitrogen to overlap with the 1s orbital of hydrogen in CH\(_3\)NH\(_2\) is ________.

Question 2020

Which of the following should have the largest dipole moment?
A) F2(g)
B) SO2(g)
C) RbBr(g)
D) CH2I2(g)

Question 2021

The ion, NO2-, is named
A) nitrate ion.
B) nitrite ion.
C) nitrogen dioxide ion.
D) nitrogen(II) oxide ion.

Question 2022

The region of the atmosphere that is closest to the earth's surface is the ________.

Question 2023

Which is not a spontaneous process?
A) combustion of gasoline to produce carbon dioxide and water
B) diffusion of perfume in a room
C) dissolution of powdered punch in water
D) freezing of water at 3°C

Question 2024

The heat of combustion per mole for acetylene, C2H2(g), is -1299.5 kJ/mol. Assuming that the combustion products are CO2(g) and H2O(l), and given that the enthalpy of formation is -393.5 kJ/mol for CO2(g) and -285.8 kJ/mol for H2O(l), find the enthalpy of formation of C2H2(g).
A) -846.1 kJ/mol
B) -620.2 kJ/mol
C) -226.7 kJ/mol
D) +226.7 kJ/mol

Question 2025

What mass of ammonia, NH3, contains the same number of molecules as 3.00 g of trichlorofluoromethane, CCl3F?
A) 0.0412 g
B) 0.371 g
C) 2.69 g
D) 24.2 g

Question 2026

In which set do all elements tend to form cations in binary ionic compounds?
A) Li, B, O
B) Mg, Cr, Pb
C) N, As, Bi
D) O, F, Cl

Question 2027

Which of the compounds, Na3P, PH3, C2H6, IBr3, are ionic compounds?
A) only C2H6
B) only Na3P
C) Na3P and PH3
**Question 2028**

A piece of metal ore weighs 7.25 g. When a student places it into a graduated cylinder containing water, the liquid level rises from 21.25 mL to 25.00 mL. What is the density of the ore?

A) 0.281 g/mL  
B) 0.141 g/mL  
C) 1.93 g/mL  
D) 3.21 g/mL


**Question 2029**

The oxidation number of hydrogen in CaH₂ is ________.


**Question 2030**

At 50°C the value of Kw is 5.5 × 10⁻¹⁴. A basic solution at 50°C has

A) [H₃O⁺] < [OH⁻] < 2 × 10⁻⁷ M.  
B) [H₃O⁺] < 2 × 10⁻⁷ M < [OH⁻].  
C) [H₃O⁺] = [OH⁻] < 2 × 10⁻⁷ M.  
D) [H₃O⁺] > 2 × 10⁻⁷ M < [OH⁻].


**Question 2031**

Does tyrosine contain an aromatic ring?


**Question 2032**

Which of the following elements is a liquid at room temperature?

A) neon  
B) helium  
C) mercury  
D) lithium


**Question 2033**

Steel is galvanized by giving it a surface coating of zinc. Galvanized steel is an example of

A) a compound.  
B) an element.  
C) a mixture.  
D) an ion.


**Question 2034**

The mass of a proton is 1.67 × 10⁻²⁷ kg. What is the mass of a proton in Megagrams?

A) 1.67 × 10⁻³⁶ Mg  
B) 1.67 × 10⁻³³ Mg  
C) 1.67 × 10⁻³⁰ Mg  
D) 1.67 × 10⁻²⁷ Mg


**Question 2035**

Which oxide ore will yield the greatest number of grams of pure metal per kilogram of ore?

A) cassiterite, SnO₂  
B) hematite, Fe₂O₃  
C) pyrolusite, MnO₂  
D) rutile, TiO₂

Question 2036

Which element has the chemical symbol, N?
A) nickel
B) niobium
C) nitrogen
D) nobelium

Question 2037

Which of the following should most favor the solubility of an ionic solid in water?
A) a low lattice energy for the solid and a low hydration energy for its ions
B) a low lattice energy for the solid and a high hydration energy for its ions
C) a high lattice energy for the solid and a low hydration energy for its ions
D) a high lattice energy for the solid and a high hydration energy for its ions

Question 2038

Which one of the following is an empirical formula?
A) C2F6
B) H2SO2
C) C2H4O2
D) P4O10

Question 2039

Because it forms some \( H^+ \) and \( OCl^- \) ions when dissolved in water, the molecule HOCl is classified as a(n) ________.

Question 2040

Which one of the following amino acids contains a hydrophobic side chain?
A) alanine
B) asparagine
C) cysteine
D) glutamine

Question 2041

An element that has the valence electron configuration 2s22p2 belongs to which period and group?
A) period 2; group 2A
B) period 2; group 4A
C) period 3; group 2A
D) period 3; group 4A

Question 2042

What is the Celsius temperature of 100.0 g of chlorine gas in a 45.0-L container at 800 mm Hg?
A) -68°C
B) 136°C
C) 205°C
D) 410°C

Question 2043

Which of the following is equivalent to 1 atm pressure?
A) 1.101325 bar
B) 1.00 bar
C) 20 psi
D) 740 mm Hg
Question 2044

Which will alter the composition of an equilibrium mixture?
A) increase the volume
B) increase the temperature
C) increase the pressure
D) all of the above

Question 2045

Which of the following underlined items is not an extensive property?
A) the color of a cobalt compound
B) the diameter of a gold nugget
C) the mass of a diamond
D) the volume of a glucose solution

Question 2046

The factor 10^6 corresponds to which prefix?
A) deka
B) deci
C) mega
D) milli

Question 2047

Of the bonds C—C, C—N, C—O, and C—F, the bond that is most polar is ________.

Question 2048

A 3.17 m solution of CaCl₂ in water has a density of 1.24 g/mL. What is the molarity?
A) 2.56 M CaCl₂
B) 2.91 M CaCl₂
C) 3.50 M CaCl₂
D) 3.93 M CaCl₂

Question 2049

A salt bridge is used to
A) provide reactants in a fuel cell.
B) determine the direction of the cell reaction.
C) control whether the cell is electrolytic.
D) allow the ion flow necessary for cell neutrality.

Question 2050

At 25°C, a certain first order reaction has a rate constant equal to 1.00 × 10⁻³ s⁻¹ and an equilibrium constant, Kc, equal to 4.18. What is the rate constant for the reverse reaction?
A) 2.39 × 10⁻⁴ s⁻¹
B) 4.18 × 10⁻³ s⁻¹
C) 2.39 × 10² s⁻¹
D) 4.18 × 10³ s⁻¹

Question 2051

Which of the following is true?
A) The Bohr atom is the model currently accepted for electrons in atoms.
B) Electrons travel around the nucleus in circular orbits.

C) There is a 5% chance of finding an electron in an atom outside its orbital.  
D) The square of the wave function gives the probability of finding the electron.  

Question 2052

If the mass of one neutron is 1.00866 amu, the mass of one proton is 1.00728 amu, and the mass of 14C nucleus is 13.99995 amu, calculate the binding energy for the 14C nucleus.  
A) 9.92 × 109 kJ/mol  
B) 1.02 × 1010 kJ/mol  
C) 5.54 × 1011 kJ/mol  
D) 5.95 × 1011 kJ/mol  

Question 2053

A catalyst increases the overall rate of reaction by lowering the activation energy, Ea, for  
A) both the forward reaction and the reverse reaction.  
B) neither the forward reaction nor the reverse reaction.  
C) only the forward reaction.  
D) only the reverse reaction.  

Question 2054

A solution of LiCl in water is 22.0 wt% LiCl. What is the mole fraction of LiCl?  
A) 0.107  
B) 0.120  
C) 0.519  
D) 4.33  

Question 2055

What is the Ka of the amino acid glutamine if it is 33.0% dissociated at pH = 8.82?  

Question 2056

An approximation of absolute zero was made from an extrapolation of  
A) P vs. 1/V.  
B) V vs. T.  
C) n vs. V.  
D) V vs. 1/T.  

Question 2057

What is the hydroxide ion concentration of a lye solution that has a pH of 11.20?  
A) 6.31 × 10-12 M  
B) 1.58 × 10-3 M  
C) 2.80 M  
D) 11.20 M  

Question 2058

When dissolved in water, of HClO4, NH3, KOH, HI, and CH3OH which are bases?  
A) NH3 and KOH  
B) HClO4 and HI  
C) only HI  
D) NH3, KOH, and CH3OH  

Question 2059

How many unit cells share an atom that is on the face of a face-centered cubic unit cell?
Question 2060
Which type of bonding does sucrose form upon solidification?
A) metallic
B) amorphous
C) molecular
D) anionic

Question 2061
Which of the following chlorides is the most ionic?
A) CH2Cl2
B) SiCl4
C) PbCl2
D) PbCl4

Question 2062
Which of the following statements does not describe a chemical property of oxygen?
A) Iron will rust in the presence of oxygen.
B) Oxygen combines with carbon to form carbon dioxide gas.
C) The pressure is caused by collision of oxygen molecules with the sides of a container.
D) When coal is burned in oxygen, the process is called combustion.

Question 2063
What is the H-C-H bond angle?
A) 90°
B) 109.5°
C) 120°
D) 180°

Question 2064
Phenobarbital is an antiepileptic drug with a water solubility of 4.3 \times 10^{-3} \text{ M} and pK_a = 7.4. What is the pH and percent ionization of 4.3 \times 10^{-3} \text{ M} phenobarbital?

Question 2065
What is the mass of 9.00 \times 10^{22} \text{ molecules of NH}_3? 
A) 0.00878 g
B) 0.393 g
C) 2.55 g
D) 114 g

Question 2066
In general, as the temperature increases, the solubility of gases in water _______ and the solubility of most solids in water _______.
A) decreases, decreases
B) decreases, increases
C) increases, decreases
D) increases, increases
### Question 2067

Assume that the vapor at point c is condensed and reboiled. What is the liquid composition of the condensed vapor prior to reboiling?

A) 100% decane  
B) composition at point b  
C) composition at point d  
D) composition at point e


### Question 2068

In a representation of an orbital, a region having zero probability of finding an electron is called a ________.


### Question 2069

What is the weakest acid among the following?

A) SiH4  
B) PH3  
C) H2S  
D) HCl


### Question 2070

The initial concentrations of Ag+(aq) and Cu2+(aq) are both 1.0 M. What will happen to the cell voltage if 5.0 M AgNO3 is added to the compartment containing the 1.0 M Ag+(aq)? The cell voltage will

A) decrease.  
B) increase.  
C) remain the same.  
D) can't tell from the information given


### Question 2071

White tin has an electrical conductivity that decreases with increasing temperature, and gray tin has an electrical conductivity that increases with increasing temperature. Therefore, white tin is classified as a(n) ________, and gray tin is classified as a(n) ________.

A) insulator, metal  
B) metal, insulator  
C) metal, semiconductor  
D) semiconductor, metal


### Question 2072

The number of significant digits in 0.01810 g is ________.


### Question 2073

The wave characteristics of a large, moving object, such as an automobile, are difficult to observe because the

A) energy is not quantized.  
B) energy is quantized, but the spacing between energy levels is small.  
C) wavelength is very large.  
D) wavelength is very small.


### Question 2074

What is geometry around the oxygen atom labeled O2?

A) bent  
B) tetrahedral  
C) trigonal planar  
D) trigonal pyramidal

### Question 2075
The solids formed by Na, Na₂O₂, SiO₂, and N₂ are classified as ________, ________, ________, and ________, respectively.


### Question 2076
Units used for measuring radiation include the becquerel, the curie, the gray, and the sievert, which have the abbreviations ________, ________, ________, and ________, respectively.


### Question 2077
What is the electron geometry and molecular shape of CH₂O?

A) Tetrahedral, tetrahedral
B) Trigonal planar, trigonal planar
C) Trigonal planar, bent
D) Tetrahedral, trigonal planar


### Question 2078
When cubic unit cells stack together, how many unit cells share a common corner?

A) 2
B) 4
C) 6
D) 8


### Question 2079
A gas bottle contains 0.450 mol of gas at 730 mm Hg pressure. If the final pressure is 1.15 atm, how many moles of gas were added to the bottle?

A) 0.0471 mol
B) 0.0888 mol
C) 0.497 mol
D) 0.539 mol


### Question 2080
At 25°C the heat of fusion of aluminum is 10.6 kJ/mol and the heat of sublimation is 326.4 kJ/mol. What is the heat of vaporization of aluminum at 25°C?

A) 158.2 kJ/mol
B) 168.5 kJ/mol
C) 315.8 kJ/mol
D) 337.0 kJ/mol


### Question 2081
At 1000 K, K_p = 19.9 for the reaction Fe₂O₃(s) + 3 CO(g) <--> 2 Fe(s) + 3 CO₂(g). What is the value of K_p for the reaction 8 Fe(s) + 12 CO₂(g) <--> 4 Fe₂O₃(s) + 12 CO(g)?


### Question 2082
The highest coordination number for spherical packing is found in the

A) body-centered cubic structure.
B) simple cubic structure.
C) body-centered cubic and face-centered cubic.
D) cubic closest-packing and hexagonal closest packing.


### Question 2083
Which of the following does not have their valence electrons in the same shell?

A) S
<table>
<thead>
<tr>
<th>Question 2084</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>What is the overall reaction order for the reaction that has the rate law:</strong> ( \text{Rate} = k[\text{Cl}]^2[\text{N}_2] )?</td>
</tr>
<tr>
<td>A) zero order</td>
</tr>
<tr>
<td>B) first order</td>
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<td>C) second order</td>
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<td>D) third order</td>
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<tr>
<th>Question 2085</th>
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<tbody>
<tr>
<td><strong>How many possible tripeptides can be made with the amino acids:</strong> tyrosine, histidine, and cysteine, each used only once?</td>
</tr>
<tr>
<td>A) 3</td>
</tr>
<tr>
<td>B) 4</td>
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<tr>
<td>C) 6</td>
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<td>D) 9</td>
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<tr>
<th>Question 2086</th>
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<tbody>
<tr>
<td><strong>What is the molecular geometry of SbCl3?</strong></td>
</tr>
<tr>
<td>A) T-shaped</td>
</tr>
<tr>
<td>B) tetrahedral</td>
</tr>
<tr>
<td>C) trigonal planar</td>
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<tr>
<td>D) trigonal pyramidal</td>
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<tr>
<th>Question 2087</th>
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<tbody>
<tr>
<td>The molecular geometry of OCCl2 is ________ .</td>
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<tr>
<th>Question 2088</th>
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<tbody>
<tr>
<td>Composite materials can be classified as ceramic-ceramic, ceramic-metal, or ceramic-polymer. Silicon carbide-reinforced alumina is classified as ________ .</td>
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<tr>
<th>Question 2089</th>
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<tbody>
<tr>
<td>Fullerene is an ________ of carbon.</td>
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<tr>
<th>Question 2090</th>
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</thead>
<tbody>
<tr>
<td>Which one of the following objects is chiral?</td>
</tr>
<tr>
<td>A) a bottle</td>
</tr>
<tr>
<td>B) a chair</td>
</tr>
<tr>
<td>C) a blank paper</td>
</tr>
<tr>
<td>D) a shoe</td>
</tr>
</tbody>
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<tr>
<th>Question 2091</th>
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<tbody>
<tr>
<td>Which element will not react with liquid water or with aqueous H+ ions?</td>
</tr>
<tr>
<td>A) Hg</td>
</tr>
<tr>
<td>B) Co</td>
</tr>
<tr>
<td>C) Zn</td>
</tr>
<tr>
<td>D) Li</td>
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</table>

| Question 2092 |
Potassium hydrogen phthalate (molar mass = 204.2 g/mol) is one of the most commonly used acids for standardizing solutions containing bases. KHP is a monoprotic weak acid with \( \text{Ka} = 3.91 \times 10^{-6} \). Calculate the pH of the solution that results when 0.40 g of KHP is dissolved in enough water to produce 25.0 mL of solution.

A) 2.10  
B) 3.26  
C) 4.30  
D) 5.41  


**Question 2093**

What is the hydronium ion concentration of an acid rain sample that has a pH of 3.25?

A) \( 1.78 \times 10^{-11} \) M  
B) \( 5.62 \times 10^{-4} \) M  
C) 3.25 M  
D) 10.75 M  


**Question 2094**

Of the following, which element has the highest first ionization energy?

A) P  
B) C  
C) Si  
D) N  


**Question 2095**

Approximately 90% of the Earth’s crust is composed of what type of compounds?

A) carbonates  
B) oxides  
C) silicates  
D) sulfates  


**Question 2096**

One of the group 3A elements is extremely toxic due to the similarities in chemistry of one of its ions to alkali metal chemistry. Which element is it?

A) B  
B) Ga  
C) In  
D) Tl  


**Question 2097**

The fundamental SI unit of mass is the _______.  


**Question 2098**

What is \( k \) in Boltzmann’s formula, \( S = k \ln W \)?

A) the degeneracy of the state  
B) the equilibrium constant for the process  
C) the universal gas constant divided by Avogadro’s number  
D) the universal gas constant times Avogadro’s number  


**Question 2099**

Of the following, which element has the highest first ionization energy?

A) In  
B) I  
C) Rb  
D) Sb  

Question 2100

What statement is inconsistent concerning the correlation of the chemical compositions of the most common ores with the locations of their metals in the periodic table?

A) Gold and the platinum-group metals (Ru, Os, Rh, Ir, Pd, and Pt) are sufficiently unreactive to occur commonly as the free metals.
B) The early transition metals on the left side of the d block generally occur as oxides while the more electronegative, late transition metals on the right side of the d block occur as sulfides.
C) The more electronegative p-block metals are commonly found as oxides and nitrates except for Al and Sn which are found as sulfides.
D) The s-block metals are found in nature as carbonates, silicates and in the case of Na and K as chlorides.

Question 2101

Which ionic compound would be expected to have the highest lattice energy?

A) Li2Se
B) MgS
C) Al2O3
D) CO2

Question 2102

What hybridization scheme is used for Ni in the square planar complex of [Ni(CN)4]2-?

A) sp3
B) dsp2
C) dsp3
D) d2sp3

Question 2103

Of the following elements, which has the lowest electronegativity?

A) Sn
B) As
C) S
D) Tl

Question 2104

A reaction is performed in a 1-L balloon at 25°C and 1 atm pressure. At the end of the reaction the balloon has expanded to 1.5 L and the surface of the balloon has a temperature of 35°C and is at 1 atm pressure. Determine whether the signs of the heat transferred, the work, and the energy change, respectively, are positive or negative.

Question 2105

Consider the following ground state electron configuration: 1s22s22p4. Which of the ions has this ground state electron configuration?

A) F-
B) N+1
C) C-2
D) O-2

Question 2106

Which statement about real gases is true?

A) The volume of the gas particles is zero.
B) The mass of the gas particles is zero.
C) Forces of attraction and repulsion exist between gas particles at close range.
D) The behavior of real gases can be exactly predicted using the ideal gas law.

Question 2107

Which statement concerning any homonuclear diatomic molecule and its 1- ion must be true?
A) X₂ must be more stable than X₂⁻.
B) X₂ must be less stable than X₂⁻.
C) X₂⁻ must be paramagnetic and X₂ must be diamagnetic.
D) X₂⁻ must be paramagnetic and X₂ may be paramagnetic or diamagnetic.

**Question 2108**
The diameter of an atom is approximately 1 × 10⁻¹⁰ m. What is the diameter in millimeters?
A) 1 × 10⁻¹⁶ mm
B) 1 × 10⁻¹³ mm
C) 1 × 10⁻⁷ mm
D) 1 × 10⁻⁴ mm

**Question 2109**
Which one of the following salts, when dissolved in water, produces the solution with a pH closest to 7.00?
A) NH₄I
B) Na₂O
C) KHCO₃
D) CsCl

**Question 2110**
The lowest atmospheric temperatures are found at the
A) earth's surface.
B) troposphere/stratosphere junction.
C) stratosphere/mesosphere junction.
D) mesosphere/thermosphere junction.

**Question 2111**
Of the following, which atom has the smallest atomic radius?
A) Ca
B) As
C) Mn
D) Ni

**Question 2112**
Which of the following ions has the greater effective nuclear charge?
A) V³⁺
B) Cr³⁺
C) Fe³⁺
D) Co³⁺

**Question 2113**
Which of the following elements has chemical properties similar to oxygen?
A) fluorine
B) hydrogen
C) nitrogen
D) sulfur

**Question 2114**
The measured mass of a sample of iron was 1.88 g. Which digit in the measurement has the least certainty?
A) the first digit, 1
B) the middle digit, 8
C) the last digit, 8
D) They are all certain digits.
Question 2115

Cytosine is a base that occurs in ______ (DNA, RNA, DNA and RNA).


Question 2116

The principal source of chromium is chromite. What is the formula of chromite?


Question 2117

The rate constant, k, for a first-order reaction is equal to 6.2 × 10^{-4} \text{ s}^{-1}. What is the half-life for the reaction?

A) 4.3 × 10^{-4} \text{ s}
B) 8.0 × 10^{2} \text{ s}
C) 1.1 × 10^{3} \text{ s}
D) 1.6 × 10^{3} \text{ s}


Question 2118

_______ refers to how well a number of independent measurements agree with one another, whereas _______ refers to how close to the true value a given measurement is.


Question 2119

Which of the following statements is false regarding functional groups?
A) The chemical properties of the functional group dictate the chemistry of the larger molecule.
B) Each functional group has a characteristic chemical behavior.
C) A functional group consists of an atom or a group of atoms that is part of a larger molecule.
D) A functional group consists of only carbon and hydrogen atoms.


Question 2120

Elements in period 2 of the periodic table differ markedly from the heavier elements in the same group due to their especially small _______ and high _______.


Question 2121

Which of the following isotopes is not used for medical purposes?
A) 18F
B) 12C
C) 32P
D) 99mTc


Question 2122

Which species does not have an octet of electrons for its outer core?
A) Si4-
B) As3-
C) Se2-
D) Mg+


Question 2123

What is the hybridization on the N atom in NO2- and in NO3-?
A) sp2 for NO2- and sp3 for NO3-
B) sp3 for NO2- and sp2 for NO3-
C) sp for NO2- and sp3 for NO3-
D) sp2 for both

Question 2124
What is the Haber process?
A) the isolation of N2 from the atmosphere
B) the synthesis of ammonia, NH3
C) the synthesis of nitric acid, HNO3
D) the synthesis of hydrazine, N2H4

Question 2125
A slice of cheese pizza has a caloric content of 550 Cal. If this energy could be used to power a 2500 Watt microwave oven, how many minutes could the microwave oven be operated? 1 W = 1 J/s
A) 917 min
B) 15.3 min
C) 3.00 min
D) 15 min

Question 2126
Which of the following has the greatest mass?
A) 6.02 × 10²³ molecules of Cl₂
B) 35.45 g of Cl₂
C) 0.500 mol of Cl₂
D) All of these have the same mass.

Question 2127
Of XeF₂ and XeF₄, the one with the smaller bond angles is ________.

Question 2128
Ethane is an example of
A) a compound.
B) an element.
C) a mixture.
D) a cation.

Question 2129
Which of the following has the smallest mass?
A) 6.02 × 10²³ molecules of I₂
B) 70.0 g of Cl₂
C) 2.00 mol of F₂
D) 0.040 kg of Br₂

Question 2130
Steel is a mixture composed primarily of
A) iron and chromium.
B) iron and zinc.
C) iron and lead.
D) iron and gold.

Question 2131
An equilibrium mixture of CO, O₂ and CO₂ at a certain temperature contains 0.0010 M CO₂ and 0.0015 M O₂. At this temperature, Kc equals 1.4 × 10² for the reaction:
2 CO(g) + O₂(g) <--→ 2 CO₂(g).
What is the equilibrium concentration of CO?
A) 4.8 × 10^{-6} M  
B) 2.2 × 10^{-3} M  
C) 9.3 × 10^{-2} M  
D) 3.1 × 10^{-1} M  


**Question 2132**

The number of moles of CaCl₂ in 25.0 mL of 0.222 M CaCl₂ is ________.


**Question 2133**

Which of the following is an exact number?

A) 0.0.369 grams  
B) 9.25 liters  
C) 4 oranges  
D) 3.60°C  


**Question 2134**

Why are ceramics so much more brittle than metals?

A) The bonding in ceramics has a very high degree of ionic bonding character.  
B) The bonding in ceramics has a very high degree of pi bonding character.  
C) The bonding in ceramics is highly nondirectional.  
D) The localized bonding in ceramics is highly directional.


**Question 2135**

What is the pH of a 0.30 M pyridine solution that has a \(K_b = 1.9 \times 10^{-9}\)? The equation for the dissociation of pyridine is \(\text{C5H5N}(aq) + \text{H}_2\text{O}(l) \rightleftharpoons \text{C5H5NH}^+(aq) + \text{OH}^-(aq)\).

A) 4.62  
B) 8.72  
C) 9.38  
D) 10.38  


**Question 2136**

In most liquid solutions, the component present in the larger amount is called the

A) dispersed medium.  
B) emulsifying agent.  
C) solute.  
D) solvent.


**Question 2137**

Pb is the symbol for the element ________.


**Question 2138**

The equilibrium constant \(K_c\) for the reaction \(\text{HF}(aq) + \text{H}_2\text{O}(l) \rightleftharpoons \text{H}_3\text{O}^+(aq) + \text{F}^-(aq)\) is \(3.5 \times 10^{-4}\). What is the equilibrium concentration of \(\text{H}_3\text{O}^+\) if the initial concentration of HF is 1.0 M?

A) 1.0 M  
B) 3.5 \times 10^{-2} M  
C) 1.9 \times 10^{-2} M  
D) 1.9 \times 10^{-4} M  


**Question 2139**

A gas occupies 22.4 L at STP and 9.85 L at 100.°C and 2.00 atm pressure. How many moles of gas did the system gain or lose?

A) 1.36 moles gained
Question 2140

The polarity of CCl4 is ________.

Question 2141

According to Le Châtelier's principle, if the volume of the vessel containing the equilibrium system shown below is decreased, there will be an increase in the concentration of ________ and a decrease in the concentration of ________.
H2(g) ⇌ 2 H(g)

Question 2142

Which have the largest number of unpaired electrons in p orbitals in their ground-state electron configurations?
A) N, As, Bi
B) F, At, Br
C) Ne, Ar, Xe
D) B, Ga, Tl

Question 2143

If 1.0 gram each of Cl2, CO2, N2, and O2 are contained in a 5-L flask, the gas with the highest partial pressure is ________.

Question 2144

What is the ground-state electron configuration of V?
A) [Ar]3d5
B) [Ar]4s13d4
C) [Ar]4s23d3
D) [Ar]4s24p64d1

Question 2145

Which is expected to have the strongest C—O bond?
A) CH3OH
B) Cl2CO
C) CF3CO2-
D) CO32-

Question 2146

"If a stress is applied to a reaction mixture at equilibrium, the reaction occurs in the direction that will relieve the stress." This statement is called
A) the Third Law of Thermodynamics.
B) the Law of Combining Volumes.
C) the Law of Mass Action.
D) Le Châtelier's principle.

Question 2147

Which of the following are allowed resonance forms of NCS⁻?
I: \[N\overset{\cdot}{C} \overset{\cdot}{O} \overset{\cdot}{N}\]
II: \[N\overset{\cdot}{C} \overset{\cdot}{O} \overset{\cdot}{N}\]
III: \[N\overset{\cdot}{C} \overset{\cdot}{O} \overset{\cdot}{N}\]
A) only I
B) only II
C) only III
Question 2148

Which of these elements has the most favorable (most negative) electron affinity?

A) Ca  
B) N  
C) Ne  
D) S  

Question 2149

What are the possible values of \( l \) if \( n = 5 \)?

A) 5  
B) 0, 1, 2, 3, or 4  
C) -4, -3, -2, -1, 0, +1, +2, +3, or +4  
D) -5, -4, -3, -2, -1, 0, +1, +2, +3, +4, or +5  

Question 2150

What is the expected freezing point of a 0.50 m solution of \( \text{Na}_2\text{CO}_3 \) in water? \( \text{Kf} \) for water is 1.86°C/m.

A) -0.93°C  
B) -1.9°C  
C) -2.8°C  
D) -6.5°C  

Question 2151

Which element has the highest first electron affinity?

A) Fr  
B) Ra  
C) Po  
D) Rn  

Question 2152

According to the Balmer-Rydberg equation, transitions from \( n = 5 \) to \( m = 2 \) result in a photon of light that give rise to a spectral line with what color?


Question 2153

Pressure is defined as

A) force divided by unit area.  
B) force times unit area.  
C) mass divided by acceleration.  
D) mass times acceleration.  

Question 2154

When sodium metal is heated in excess oxygen it tends to form

A) an oxide.  
B) a peroxide.  
C) a superoxide.  
D) an oxide and a superoxide.  

Question 2155

Which one of the following statements about temperature scales is false?

A) The boiling point of water on the Fahrenheit scale is 212 degrees.  
B) The Celsius degree is smaller than the Fahrenheit degree.
C) The freezing point of water on the Celsius scale is 0 degrees.
D) All temperatures on the Kelvin scale are positive numbers.

Question 2156

Two moles of neon gas at 20.0°C are heated to 350°C while the volume is kept constant. The density of the gas
A) decreases.
B) increases.
C) remains the same.
D) Not enough information was given to answer the question.

Question 2157

The freezing point of methane is -295°F and the boiling point is -263°F. The temperature of the surface of Titan, a moon of Saturn, is 93 K. If methane exists on Titan, it is
A) a gas.
B) a liquid.
C) a solid.
D) a plasma.

Question 2158

What is the oxidation number of the chromium atom in K2Cr2O7?
A) -2
B) +3
C) +6
D) +7

Question 2159

According to the kinetic molecular theory of gases, what is the force of attraction of one CO₂ molecule for another CO₂ molecule?

Question 2160

Which element has the largest energy band gap?
A) C (diamond)
B) Si
C) Ge
D) Sn (white)

Question 2161

Which is the smallest quantity of pressure?
A) 1 atm
B) 1 centimeter of Hg
C) 1 mm Hg
D) 1 pascal

Question 2162

Energy can be classified as either ________ energy (energy of motion) or ________ energy (stored energy).

Question 2163

Which one of the following elements forms the most acidic binary oxide?
A) Ne
B) Cu
C) N
D) Li
Question 2164
The mass defect for the formation of lithium-6 is 0.0343 g/mol. The binding energy for lithium-6 nuclei is ________ kJ/mol.

Question 2165
Human tears have a concentration of H3O+ that is $3.16 \times 10^{-8}$. The concentration of OH− in human tears is
A) greater than $3.16 \times 10^{-7}$ and tears are acidic.
B) greater than $3.16 \times 10^{-7}$ and tears are basic.
C) less than $3.16 \times 10^{-7}$ and tears are acidic.
D) less than $3.16 \times 10^{-7}$ and tears are basic.

Question 2166
A single sp3 hybrid orbital has
A) one lobe.
B) two lobes of equal size.
C) two lobes of unequal size.
D) three lobes of equal size.

Question 2167
Ammonium carbamate can dissociate into gases at 25°C according to the reaction:
\[ \text{NH}_2\text{COONH}_4(s) \leftrightarrow 2 \text{NH}_3(g) + \text{CO}_2(g) \]
If sufficient ammonium carbamate is sealed in a flask, the total pressure will be 0.117 atm at equilibrium. What is the value of Kp at 25°C?
A) 2.37 × 10⁻⁴
B) 2.00 × 10⁻⁴
C) 1.60 × 10⁻³
D) 3.42 × 10⁻¹

Question 2168
Which of the following hydrides is expected to have the highest melting point?
A) H₂S
B) HF
C) H₂Se
D) MgH₂

Question 2169
Which of the following statements about properties of organic compounds is not correct?
A) Most organic compounds are not soluble in water.
B) Most organic compounds do not conduct electricity.
C) Organic compounds have higher melting and boiling points than ionic compounds.
D) Organic compounds have weak intermolecular forces.

Question 2170
What element was one of the “holes” in Mendeleev's periodic table?
A) Si
B) Ge
C) Sn
D) Pb

Question 2171
The solution formed upon adding 80.00 mL of 0.50 M NH₄Cl to 80.00 mL of 0.50 M NH₃ will have a pH that is ________ the pH of the original NH₃ solution.
Question 2172

Which one of the following salts, when dissolved in water, produces the solution with the highest pH?

A) NaI  
B) KBr  
C) RbCl  
D) CsF


Question 2173

Which has the lowest entropy?

A) CH3OH(s, -26°C)  
B) CH3OH(s, -13°C)  
C) CH3OH(l, 16°C)  
D) CH3OH(l, 30°C)


Question 2174

What electron geometry would you expect for atoms that have 6 charge clouds?

A) Tetrahedral  
B) Octahedral  
C) Trigonal planar  
D) Trigonal bipyramid


Question 2175

The most acidic oxides of the group 5A elements are oxides of the element ________.


Question 2176

Which one of the following elements is a poor conductor of heat and electricity?

A) nickel  
B) sulfur  
C) aluminum  
D) lead


Question 2177

What reagent could be used to separate I- from CH3CO2- when added to an aqueous solution containing both?

A) AgNO3 (aq)  
B) Ba(OH)2 (aq)  
C) CuSO4 (aq)  
D) NaI (aq)


Question 2178

Ethanol has the molecular formula C2H6O. Which ball and stick model shown above represents ethanol? [gray spheres = C, black spheres = O, unshaded spheres = H]

A) model a)  
B) model b)  
C) model c)  
D) model d)


Question 2179

At a certain temperature, hydrogen and iodine react to form hydrogen iodide:

\[ \text{H}_2(g) + \text{I}_2(g) \rightleftharpoons 2 \text{HI} (g) \]

When initial amounts of H2, I2, and HI are mixed, the concentration of HI increases. Which statement below is true?
A) Kc < Q  
B) Kc > Q  
C) Kc = Q  
D) More information is needed to make a statement about Kc.  

**Question 2180**

Determine the acid dissociation constant for a 0.020 M formic acid solution that has a pH of 2.74. Formic acid is a weak monoprotic acid and the equilibrium equation of interest is  
HCOOH(aq) + H2O(l) <-- --> H3O+(aq) + HCO2-(aq).  
A) 1.8 x 10^{-3}  
B) 1.8 x 10^{-4}  
C) 3.6 x 10^{-4}  
D) 3.6 x 10^{-5}  

**Question 2181**

What is the volume of 10.0 g of oxygen gas at 157°C and 2.50 kPa pressure?  
A) 51.5 L  
B) 163 L  
C) 1.61 L  
D) 447 L  

**Question 2182**

Which of the following compounds has the highest boiling point?  
A) H2O  
B) HCl  
C) N2  
D) Ar  

**Question 2183**

The pH of 0.150 M CH3CO2H, acetic acid, is 2.78. What is the value of Ka for acetic acid?  
A) 2.8 x 10^{-6}  
B) 1.9 x 10^{-5}  
C) 1.7 x 10^{-3}  
D) 1.1 x 10^{-2}  

**Question 2184**

Which metal sulfides can be precipitated from a solution that is 0.01 M in Mn2+, Zn2+, Pb2+ and Cu2+ and 0.10 M in H2S at a pH of 1.0?  
A) MnS  
B) CuS  
C) PbS, CuS  
D) ZnS, PbS, CuS  

**Question 2185**

To the nearest whole number, the number of grams of Ba in 3.25 mol of Ba is _________.  

**Question 2186**

Each of three identical 15.0-L gas cylinders contains 7.50 mol of gas at 295 K. Cylinder A contains Ar, cylinder B contains Cl2, and cylinder C contains N2. According to the kinetic molecular theory, which gas has the highest collision frequency?  
A) Ar  
B) Cl2  
C) N2  
D) All have identical collision frequencies

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<th>Question 2187</th>
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<tr>
<td>Which one of the following compounds contains ionic bonds?</td>
</tr>
<tr>
<td>A) MgO</td>
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<tr>
<td>B) HCl</td>
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<td>C) PCl3</td>
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<td>D) CO2</td>
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<tr>
<th>Question 2188</th>
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<tbody>
<tr>
<td>In which set do all elements tend to form cations in binary ionic compounds?</td>
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<tr>
<td>A) Na, B, S</td>
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<td>B) Ca, Cr, Pb</td>
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<td>C) S, As, Bi</td>
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<td>D) O, Br, I</td>
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<tr>
<th>Question 2189</th>
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<tr>
<td>The two most efficiently packed unit cells have the hexagonal closest-packed and the ________ the atomic arrangements.</td>
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<tr>
<th>Question 2190</th>
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<tbody>
<tr>
<td>How much water must be added to 42.0 g of CaCl2 to produce a solution that is 40.0 wt% CaCl2?</td>
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<tr>
<td>A) 56.7 g</td>
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<td>B) 63.0 g</td>
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<td>C) 16.8 g</td>
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<td>D) 120 g</td>
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<th>Question 2191</th>
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<tbody>
<tr>
<td>Kc = 1.2 × 10^{-42} at 500 K for the reaction shown below.</td>
</tr>
<tr>
<td>H2(g) &lt;-- --&gt; 2 H(g)</td>
</tr>
<tr>
<td>If [H2] = 1 × 10^{-2} M and [H] = 1.2 × 10^{-22} M, in order to achieve equilibrium a net reaction must occur from ________ to ________ until Qc = ________.</td>
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<tbody>
<tr>
<td>When silver nitrate reacts with barium chloride, silver chloride and barium nitrate are formed. How many grams of silver chloride are formed when 10.8 g of silver nitrate reacts with 15.0 g of barium chloride?</td>
</tr>
<tr>
<td>A) 9.11 g</td>
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<tr>
<td>B) 9.40 g</td>
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<tr>
<td>C) 12.9 g</td>
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<td>D) 18.8 g</td>
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<th>Question 2193</th>
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<tbody>
<tr>
<td>A saturated solution is defined as</td>
</tr>
<tr>
<td>A) a concentrated solution.</td>
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<tr>
<td>B) a solution that is in equilibrium with pure solute.</td>
</tr>
<tr>
<td>C) a solution than is in equilibrium with undissolved solute.</td>
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<tr>
<td>D) a solution that is not in equilibrium with both pure solvent and undissolved solute.</td>
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<tbody>
<tr>
<td>A solution of 0.2113 g of water dissolved in 25.0 g of a solvent freezes at 11.5°C below the freezing point of the solvent. What is Kf for this solvent?</td>
</tr>
<tr>
<td>A) 0.735°C/m</td>
</tr>
<tr>
<td>B) 1.36°C/m</td>
</tr>
<tr>
<td>C) 5.39°C/m</td>
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D) 24.5°C/m

Question 2195
Which ion does not have a noble gas configuration in its ground state?
A) Si4+
B) Sc3+
C) Zn2+
D) Se2-

Question 2196
Sodium phosphate reacts with sulfuric acid to form sodium sulfate and phosphoric acid. What is the stoichiometric coefficient for sulfuric acid when the chemical equation is balanced using the lowest whole-number stoichiometric coefficients?
A) 1
B) 2
C) 3
D) none of these

Question 2197
What is the chemical symbol for carbon?
A) Co
B) Cr
C) C
D) Ca

Question 2198
Which of the following statements about cycloalkanes is true?
A) The bonds in cyclopropane and cyclobutane are weaker than other cycloalkanes.
B) Cycloalkanes are also called "acyclic" compounds.
C) Cyclopropane has 109° bond angles.
D) Most cycloalkanes are planar molecules.

Question 2199
Entropy is a measure of
A) free energy.
B) the heat of a reaction.
C) molecular randomness.
D) the rate of a reaction.

Question 2200
What is the pH of a 0.100 M NH₃ solution that has Kb = 1.8 × 10⁻⁵? The equation for the dissociation of NH₃ is
\[
\text{NH}_3(aq) + \text{H}_2\text{O}(l) \rightleftharpoons \text{NH}_4^+(aq) + \text{OH}^-(aq).
\]
A) 1.87
B) 2.87
C) 11.13
D) 12.13

Question 2201
Arrange in order from the smallest to the largest bond angle: CCl₃⁺, NF₃, NH₄⁺, XeBr₄.
A) CCl₃⁺, NF₃, NH₄⁺, XeBr₄
B) NF₃, NH₄⁺, XeBr₄, CCl₃⁺
C) XeBr₄, NH₄⁺, NF₃, CCl₃⁺
D) XeBr₄, NF₃, NH₄⁺, CCl₃⁺
**Question 2202**

The dipole moment of BrF is 1.29 D, and its bond length is 178 pm. What is the percent ionic character of the Br—F bond?

A) 3.9%
B) 8.5%
C) 15%
D) 33%


**Question 2203**

Which has the smallest dipole-dipole forces?

A) CH3F
B) HCl
C) N2
D) CO


**Question 2204**

Dissolving 0.040 mole of which of the following in enough water to make 0.220 L of solution would result in a solution with the highest pH?

A) LiH
B) SrH2
C) NH3
D) PH3


**Question 2205**

In fusion reactions to make superheavy elements, energy is required to bring the two nuclei together and to form additional mass. How much energy must be converted into mass for the alpha bombardment of 253Es to form 257Md? (The isotopic masses are 253Es = 253.08294 amu, 4He = 4.00260 amu, 257Md = 257.09558 amu.)

A) 3.01 × 10⁶ kJ/mol
B) 9.04 × 10⁸ kJ/mol
C) 3.59 × 10¹¹ kJ/mol
D) 7.21 × 10¹¹ kJ/mol


**Question 2206**

Hydrogen gas is collected over water in an inverted buret. If the atmospheric pressure is 745 mm Hg, the vapor pressure of water is 18 mm Hg, and a 15.0 cm-high column of water remains in the buret, the pressure of the hydrogen gas is

A) 763 mm.
B) 745 mm Hg.
C) 727 mm Hg.
D) less than 727 mm Hg.


**Question 2207**

The thiosulfate ion is

A) HS⁻
B) HSO₄⁻
C) SO₅²⁻
D) S₂O₃²⁻


**Question 2208**

Solids having no ordered long-range structure are classified as

A) amorphous solids.
B) crystalline solids.
C) nonmetallic solids.
D) covalent network solids.

Question 2209
Using shorthand notation, the electron configuration of Co3+ is _______.

Question 2210
Calculate the pH of a 0.060 M carbonic acid solution, H2CO3(aq), that has the stepwise dissociation constants Ka1 = 4.3 × 10^{-7} and Ka2 = 5.6 × 10^{-11}.
A) 1.22
B) 3.79
C) 6.37
D) 10.25

Question 2211
The name of H2SO3 is
A) sulfurous acid.
B) sulfuric acid.
C) hydrosulfuric acid.
D) hydrosulfurous acid.

Question 2212
A buffer prepared by mixing 55.0 mL of 0.40 M HF with 55.0 mL of 0.40 M NaF will have a pH that is _______ 7.0.

Question 2213
Lattice energy increases with _______ cation and anion charges and _______ cation and anion radii.

Question 2214
What is the chemical formula for radium hydride?
A) RaH2
B) RaOH
C) RaOH2
D) Ra(OH)2

Question 2215
In which set do all elements tend to form anions in binary ionic compounds?
A) Cs, B, O
B) Ca, Zn, Pb
C) N, Sb, Bi
D) S, Cl, Br

Question 2216
Which of the following molecules is expected to have the highest melting point?
A) H2
B) Cl2
C) CCl4
D) NaCl

Question 2217
If the units for rate are M s^{-1}, what are the units for the rate constant, k, if the overall order of the reaction is five?
A) s
B) M2 s
C) M^{-1} s^{-1}

### Question 2218
Heat transfer measured in a coffee-cup calorimeter at constant pressure is a measure of ________, but heat transfer measured in a bomb calorimeter at constant volume is a measure of ________.  

### Question 2219
Hydrochloric acid in the hydrolysis of an ester to form an alcohol and a carboxylic acid is an example of a _______ (heterogeneous, homogeneous) catalyst.  

### Question 2220
The first vibrational level for NaH lies at $1.154 \times 10^{-20}$ J and the second vibrational level lies at ________. What is the frequency of the photon emitted when a molecule of NaH drops from the second vibrational level to the first vibrational level?  
A) $1.742 \times 10^{13}$ Hz  
B) $3.399 \times 10^{13}$ Hz  
C) $5.140 \times 10^{13}$ Hz  
D) $6.882 \times 10^{13}$ Hz  

### Question 2221
What is the basic building block of all silicates?  
A) Si$_2$O$_6$-$^4$-  
B) Si  
C) SiO$_2$  
D) SiO$_4$$^4$-  

### Question 2222
Which of the following elements is an inner transition metal?  
A) No  
B) Ni  
C) Ne  
D) Na  

### Question 2223
Calculate the molar solubility of thallium(I) chloride in 0.30 M NaCl at 25°C. $K_{sp}$ for TiCl is $1.7 \times 10^{-4}$.  
A) $5.1 \times 10^{-5}$ M  
B) $5.7 \times 10^{-4}$ M  
C) $7.1 \times 10^{-3}$ M  
D) $1.3 \times 10^{-2}$ M  

### Question 2224
A balanced equation has the same numbers and kinds of ________ on both sides of the reaction arrow.  

### Question 2225
Identify the compound that contains two oxygens.  
A) aldehyde  
B) alkyne  
C) amine  
D) carboxylic acid  

### Question 2226
Which one of the following is not an empirical formula?
A) CHO
B) CH₂O
C) C₃H₆O
D) C₈H₁₆O₄

Question 2227

If K_c equals 0.110 at 25°C for the reaction: N₂O₄(g) ⇌ 2 NO₂(g), what is K_c for the reaction: 6NO₂(g) ⇌ 3 N₂O₄(g)?
A) 1.3 \times 10^{-3}
B) 751
C) 7.5
D) 0.11

Question 2228

Which statement concerning overvoltage is false?
A) Overvoltage is the additional voltage above the calculated voltage required to bring about electrolysis.
B) Overvoltage is often due to a high activation energy for the reaction at one electrode.
C) Overvoltage is small for half-reactions involving the formation of O₂(g) or H₂(g).
D) Overvoltage must be experimentally determined.

Question 2229

A piece of plastic weighing 1.157 g has a volume of 1.48 cm³. A piece of wood has the same volume but weighs 3.85 g. The density of liquid X is 0.765 g/mL and the density of liquid Z is 1.13 g/mL. The two liquids are immiscible. If the plastic and wood are added to the two liquids, what is the order of layers from top to bottom in the container?
A) liquid X, liquid Z, plastic, wood
B) liquid X, plastic, liquid Z, wood
C) plastic, wood, liquid Z, liquid X
D) wood, liquid Z, plastic, liquid X

Question 2230

The quantity 2.27 cm³ is the same as ________ mL.

Question 2231

What is the species present at reaction stage 3?
A) an intermediate
B) a product
C) a reactant
D) a transition state

Question 2232

Addition of 0.0125 mol KOH to 150 mL of a 0.150 M formic acid/0.100 M sodium formate buffer results in a pH = ________. The Ka of formic acid is 1.8 \times 10^{-4}.

Question 2233

An AlGaAs diode laser pointer emits 532 nm light and appears ________ (blue, green, red) in color.

Question 2234

Which has the highest melting point?
A) La
B) W
C) Os
Question 2235

What is the mole fraction of ethanol in a solution made by dissolving 7.30 g of ethanol, C2H5OH, in 53.6 g of water?

A) 0.0505
B) 0.0531
C) 0.120
D) 0.136


Question 2236

What is the chemical process most likely to be used to purify zirconium metal?

A) distillation
B) electrorefining
C) reaction with carbon monoxide (a Mond process)
D) reaction with iodine


Question 2237

Which group 5A element is most metallic?

A) N
B) P
C) Sb
D) Bi


Question 2238

Which of the following statements are true about elements with metallic character?

A) Elements with a low ionization energy are more likely to be nonmetallic.
B) Elements with a high electronegativity are more likely to be metallic.
C) Elements with a high electronegativity and low ionization energy are more likely to be metallic.
D) Elements with a low electronegativity, low ionization energy, and malleability are more likely to be metallic.


Question 2239

The diameter of the nucleus of an atom is approximately 1 × 10^-15 meters. If 1 nm is equal to 10^(-9) meters, what is the diameter of the nucleus in atoms of sodium dichromate, Na2Cr2O7?

A) 0.160 oxygen atoms
B) 1.97 × 10^21 oxygen atoms
C) 1.37 × 10^22 oxygen atoms
D) 9.65 × 10^22 oxygen atoms


Question 2240

A few sheets of ordinary paper can form an effective shield against what type of radiation?

A) alpha particles
B) cosmic rays
C) gamma rays
D) neutrons


Question 2241

How many oxygen atoms are there in 6.00 g of sodium dichromate, Na2Cr2O7?

A) 0.160 oxygen atoms
B) 1.97 × 10^21 oxygen atoms
C) 1.37 × 10^22 oxygen atoms
D) 9.65 × 10^22 oxygen atoms

Question 2242
Of Na2O, SO2, and SO3, equimolar aqueous solutions of ________ would be most acidic and of ________ would be most basic.

Question 2243
What is the pH of a 0.020 M HClO4 solution?
A) 0.020
B) 0.040
C) 1.70
D) 12.30

Question 2244
An automobile uses gasoline at a rate of 35 mi/gal, which is the same as ________ km/L (1 km = 0.6214 mi, 1 gal = 3.78 L).
A) 5.8
B) 15
C) 82
D) 210

Question 2245
Which of the following would have a density of 3.04 g/L at 7.0°C and 0.987 atm?
A) Ar
B) Cl2
C) He
D) N2

Question 2246
A solution of LiCl in water is 9.00 wt% LiCl. What is the mole fraction of LiCl?
A) 0.0407
B) 0.0466
C) 0.212
D) 2.28

Question 2247
At an elevated temperature the decomposition of a gaseous oxide, AO2 occurs with a rate constant, k = 0.54 M⁻¹s⁻¹. If the half-life of this reaction is 926 seconds when [AO2] = 2.0 × 10⁻³ M and 462 seconds when [AO2] = 4.0 × 10⁻³ M, this reaction is ________ order.

Question 2248
Elements with ________ atomic mass are best possible candidates for a fission reaction.
A) very low
B) moderate
C) moderate to heavy
D) very heavy

Question 2249
Which of the following elements exhibits the most metallic character?
A) B
B) C
C) N
D) O

Question 2250
Which of the following metals occurs in nature principally as oxide ores?
A) Li
B) Cu
C) Cr
D) Ru

Question 2251

Ni has a face-centered unit cell. The number of Ni atoms in the unit cell is ________.

Question 2252

The number of grams of NaCl required to prepare 500 mL of 0.100 M NaCl is ________.

Question 2253

Which of the following elements is a liquid at room temperature?
A) fluorine
B) chlorine
C) bromine
D) iodine

Question 2254

Given the reaction at a certain temperature: 2 HI(g) <-- --> H2(g) + I2(g). At equilibrium, the partial pressure of HI is 1.8 × 10^{-3} atm, and the partial pressures for H2 and I2 are 0.10 atm each. Find Kp at that temperature.
A) 3.2 × 10^{-4}
B) 5.6 × 10^{1}
C) 3.1 × 10^{3}
D) 3.1 × 10^{4}

Question 2255

For hydrogen, what is the wavelength of the photon emitted when an electron drops from a 3d orbital to a 2p orbital in a hydrogen atom? The Rydberg constant is 1.097 × 10^{-2} nm^{-1}.
A) 656.3 nm
B) 486.2 nm
C) 364.6 nm
D) 2.057 × 10^{-3} nm

Question 2256

The element that is in period 5 and group 2A has the symbol ________.

Question 2257

The decomposition of ammonia is: 2 NH3(g) <-- --> N2(g) + 3 H2(g). If the partial pressure of ammonia is 1.60 × 10^{-3} atm and the partial pressures of N2 and H2 are each 0.250 atm at equilibrium, what is the value for Kc at 400°C for the forward reaction?
A) 0.500
B) 1.00
C) 1.53 × 10^{3}
D) 6.53 × 10^{-4}

Question 2258

Calculate the pH of a 0.020 M carbonic acid solution, H2CO3(aq), that has the stepwise dissociation constants Ka1 = 4.3 × 10^{-7} and Ka2 = 5.6 × 10^{-11}.
A) 1.70
B) 4.03
Question 2259
Which of the following forms a metallic solid?
A) gold 
B) potassium bromide 
C) quartz 
D) plastic 

Question 2260
What is the geometric structure of BF3 and the hybridization of the B atom?
A) trigonal planar and sp2 hybridization 
B) trigonal planar and sp3 hybridization 
C) pyramidal and sp hybridization 
D) tetrahedral and sp2 hybridization 

Question 2261
Neptunium-239 has a half-life of 2.35 days. How many days must elapse for a sample of 239Np to decay to 1.00% of its original quantity?
A) 0.0640 days 
B) 0.736 days 
C) 1.36 days 
D) 15.6 days

Question 2262
A sievert is
A) the amount of sample that undergoes 1 disintegration per second. 
B) the amount of sample that undergoes 3.7 × 10^{10} disintegrations per second. 
C) the amount of tissue damage done by radiation. 
D) equal to 0.01 J of energy absorbed per kilogram of tissue. 

Question 2263
An incorrect statement about the alkaline earth metals is
A) Melting points generally decrease as one descends the group. 
B) Densities are less than those of the corresponding alkali elements of the same period. 
C) Ionic radii of the M_2^+ ion increases as one descends the group. 
D) The first ionization energy is less than that of the second ionization energy. 

Question 2264
The property of a wave that is associated with brightness or intensity is ________.

Question 2265
Identify the alkene that cannot be drawn cis and trans.
A) 2-pentene 
B) 3-hexene 
C) 4-octene 
D) 1-hexene 

Question 2266
As a rule, which of the following phases are not included in the equilibrium constant expression?
I. pure liquids II. pure solids III. aqueous solutions IV. gases
Question 2267

Which element will not react with liquid water but will react with aqueous H+ ions and steam?
A) K  
B) Fe  
C) Sn  
D) Hg

Question 2268

Metals that do not dissolve in non-oxidizing acids are found at the ________ of the activity series.

Question 2269

Chemistry is the study of the composition, properties, and transformations of ________.

Question 2270

An element Y, has the following ionization energies
Ei1 = 578 kJ/mol  
Ei2 = 1,817 kJ/mol  
Ei3 = 2,745 kJ/mol  
Ei4 = 11,575 kJ/mol
What is the most likely identity for this element?
A) Na  
B) Mg  
C) Al  
D) Si

Question 2271

At a given temperature the vapor pressures of benzene and toluene are 183 mm Hg and 59.2 mm Hg, respectively. Calculate the mole fraction of benzene in the vapor phase over a solution of benzene and toluene with Xbenzene = 0.600.
A) 0.600  
B) 0.678  
C) 0.756  
D) 0.823

Question 2272

The vapor pressure of a pure liquid increases as the
A) average kinetic energy of the molecules in the liquid phase decreases.  
B) intermolecular attractive forces increase.  
C) temperature of the liquid phase decreases.  
D) temperature of the liquid phase increases.

Question 2273

The decomposition of ammonia is: 2 NH3(g) \rightleftharpoons N2(g) + 3 H2(g). If Kp is 1.5 \times 10^3 at 400°C, what is the partial pressure of ammonia at equilibrium when N2 is 0.10 atm and H2 is 0.15 atm?
A) 2.2 \times 10^{-7} \text{ atm}  
B) 4.7 \times 10^{-4} \text{ atm}  
C) 2.1 \times 103 \text{ atm}  
D) 4.4 \times 106 \text{ atm}
Question 2274
Gases do not behave ideally under conditions of ________ pressure and ________ temperature.

Question 2275
What phases can be present at 200°C and 0.75 atm pressure?
A) only the vapor phase
B) only the liquid phase
C) only the solid phase
D) both the solid and vapor phases

Question 2276
Under the same pressure and temperature conditions, the level of water inside a barometer will be ________ than the level of mercury inside the barometer by a factor equal to the ratio of the density of ________ over the density of ________.

Question 2277
In liquid pentanol, CH₃CH₂CH₂CH₂ , which intermolecular forces are present?
A) Dispersion, hydrogen bonding and dipole-dipole forces are present.
B) Only dipole-dipole and ion-dipole forces are present.
C) Only dispersion and dipole-dipole forces are present.
D) Only hydrogen bonding forces are present.

Question 2278
Barium hydroxide is slightly soluble in water, with a Ksp of 5.00 × 10⁻⁴ at 298K. The dissolution of barium hydroxide in water is an endothermic process.
Ba+2 (aq) + 2OH⁻ (aq)
Which of the following will increase the solubility?
A) Barium hydroxide is added to the solution.
B) Sodium hydroxide (NaOH) is added to the solution.
C) The temperature is decreased.
D) HCl is added to the mixture. (HCl reacts with OH⁻, removing it from the system.)

Question 2279
According to band theory, which one of the following metals is expected to have the highest melting point?
A) Cd
B) Cr
C) Hg
D) Zn

Question 2280
Which of the following molecules has polar bonds but has no net dipole?
A) NH₃
B) CCl₄
C) CHCl₃
D) CH₄

Question 2281
Aluminum has a face-centered cubic structure and has a density of 2.70 g/cm³. What is its atomic radius?
A) 143 pm
B) 286 pm
C) 405 pm
D) 1150 pm
Question 2282
Which of the following solutions will have the lowest freezing point?
A) 0.0100 m NaCl
B) 0.0120 m Li2SO4
C) 0.0400 m CH3CH2CH2OH
D) 0.0150 m MgCl2

Question 2283
The compound, NO2, is named
A) nitrate.
B) nitrite.
C) nitrogen dioxide.
D) nitrogen(IV) oxide.

Question 2284
Each of three identical 15.0-L gas cylinders contains 7.50 mol of gas at 295 K. Cylinder A contains HCN, cylinder B contains NO2, and cylinder C contains O3. According to the kinetic molecular theory, which gas has the highest average kinetic energy?
A) HCN
B) NO2
C) O3
D) All have identical average kinetic energies

Question 2285
Which of the following best describes ICl2-? It has a molecular geometry that is
A) linear with no lone pairs on the I atom.
B) linear with lone pairs on the I atom.
C) nonlinear with no lone pairs on the I atom.
D) nonlinear with lone pairs on the I atom.

Question 2286
When zinc sulfide undergoes roasting, the products are
A) Zn and S.
B) Zn and H2S.
C) ZnO and S.
D) ZnO and SO2.

Question 2287
Nuclei that are in the band of stability have a neutron/proton ratio ________ (equal to, greater than, less than) 1:1.

Question 2288
A banana split is an example of
A) a compound.
B) an element.
C) a mixture.
D) an ion.

Question 2289
One mole of gas at 25°C has a ________ volume than one mole of gas at standard temperature.
Question 2290

What is the pH of a 2.4 M pyridine solution that has $K_b = 1.9 \times 10^{-9}$? The equation for the dissociation of pyridine is $C_5H_5N(aq) + H_2O(l) \rightleftharpoons C_5H_5NH^+(aq) + OH^-(aq)$.

A) 4.17  
B) 8.72  
C) 9.83  
D) 10.83


Question 2291

Methylamine $\text{CH}_3\text{NH}_2$, has a base dissociation constant of $3.7 \times 10^{-4}$. What is the conjugate acid of methylamine and what is its acid dissociation constant?

A) $\text{CH}_3\text{NH}_3^+$, $2.7 \times 10^3$  
B) $\text{CH}_3\text{NH}_3^+$, $3.7 \times 10^{-4}$  
C) $\text{CH}_3\text{NH}_3^+$, $2.7 \times 10^{-11}$  
D) $\text{CH}_3\text{NH}_2^-$, $2.7 \times 10^{-11}$


Question 2292

Which of the following statements is false regarding the equilibrium constant, $K_c$?

A) $K_c$ for a reaction at a particular temperature always has the same value.  
B) $K_c$ for the reverse reaction is the negative of $K_c$ for the forward reaction.  
C) The numerical value of $K_c$ depends on the form of the balanced equation.  
D) When quoting $K_c$ it is customary to omit units.


Question 2293

If you know $K_b$ for ammonia, $\text{NH}_3$, you can calculate the equilibrium constant, $K_a$, for the following reaction: $\text{NH}_4^+ + \text{H}_2\text{O} \rightleftharpoons \text{NH}_3 + \text{H}_3\text{O}^+$ using the equation:

A) $K_a = K_w \times K_b$  
B) $K_a = K_w / K_b$  
C) $K_a = 1 / K_b$  
D) $K_a = K_b / K_w$


Question 2294

Which of the following statements about mass spectrometry is false?

A) Mass spectrometry can be used to determine the molecular weight of a compound.  
B) The curvature of the path in a magnetic field is determined by the mass of the ion.  
C) The paths of heavier ions are deflected more strongly than the paths of lighter ions.  
D) The sample is changed into positively charged ions.


Question 2295

Which is the only element that contains more protons than neutrons in its most abundant stable isotope?

A) lithium  
B) nitrogen  
C) hydrogen  
D) copper


Question 2296

At the normal body temperature of 37°C, $K_w = 2.42 \times 10^{-14}$. The $\text{H}_3\text{O}^+$ concentration of normal blood ranges from $3.5 \times 10^{-8}$ to $4.5 \times 10^{-8}$. The $\text{OH}^-$ concentration of normal blood ranges from ________ to ________, and blood is ________ (acidic, basic, neutral).


Question 2297
Using shorthand notation, the ground-state electron configuration for Sr\(^2\) is predicted to be ________.
Answer: [link](https://biology-forums.com/index.php?topic=289561)

**Question 2298**

Positron emission changes the atomic number of an element by
A) -2.
B) -1.
C) +1.
D) +2.
Answer: [link](https://biology-forums.com/index.php?topic=291335)

**Question 2299**

The chlor-alkali industry is based on the electrolysis of aqueous NaCl. What are the products of this electrolysis?
A) Na and Cl\(_2\)
B) NaOH, H\(_2\), and O\(_2\)
C) NaOH, H\(_2\), and Cl\(_2\)
D) NaOH, O\(_2\), and Cl\(_2\)
Answer: [link](https://biology-forums.com/index.php?topic=291163)

**Question 2300**

What is the number of spherical nodes in a 6s orbital?
A) zero
B) six
C) five
D) seven
Answer: [link](https://biology-forums.com/index.php?topic=289425)

**Question 2301**

What is the average oxidation number of Cu in the 1-2-3 superconductor YBa\(_2\)Cu\(_3\)O\(_7\) if Y is in the +3 oxidation state?
A) +2
B) +2.33
C) +0.67
D) +4.33
Answer: [link](https://biology-forums.com/index.php?topic=291678)

**Question 2302**

One mole of which element has the smallest mass?
A) Co
B) Zn
C) Ni
D) Ru
Answer: [link](https://biology-forums.com/index.php?topic=288983)

**Question 2303**

The empirical formula of a compound that contains 82.66% carbon and 17.34% hydrogen is ________.
Answer: [link](https://biology-forums.com/index.php?topic=289202)

**Question 2304**

Which is an amino acid basic side chain?
A) -CH\(_3\)
B) -CH\(_2\)OH
C) -CH\(_2\)CO\(_2\)H
D) -CH\(_2\)CH\(_2\)CH\(_2\)NH\(_2\)
Answer: [link](https://biology-forums.com/index.php?topic=291974)

**Question 2305**

A solution is prepared by dissolving 17.75 g sulfuric acid, H\(_2\)SO\(_4\), in enough water to make exactly 100.0 mL of solution. If the density of the solution is 1.1094 g/mL, what is the weight % H\(_2\)SO\(_4\) in the solution?
A) 16.00%
B) 18.00%
C) 19.00%
D) 84.00%

**Question 2306**

The addition of ______ mL of 0.3000 M NaOH is required to titrate 60.00 mL of 0.2000 M HCl to the equivalence point, which occurs at a pH of ______.

**Question 2307**

Which of the species below has 28 protons and 26 electrons?
A) Fe2+
B) Ni2+
C) Fe
D) Ni

**Question 2308**

What is the pressure in a gas container that is connected to an open-end U-tube manometer if the pressure of the atmosphere is 752 torr and the level of mercury in the arm connected to the container is 9.60 cm higher than the level of mercury open to the atmosphere?
A) 656 mm Hg
B) 742 mm Hg
C) 762 mm Hg
D) 848 mm Hg

**Question 2309**

Rubidium belongs to the ________ group of the periodic table.
A) alkali metal
B) alkaline earth metal
C) halogen
D) noble gas

**Question 2310**

What is the chemical symbol for manganese?
A) Hg
B) Mg
C) Mn
D) Na

**Question 2311**

What is the molecular geometry of ICl4–?
A) seesaw
B) square planar
C) square pyramidal
D) tetrahedral

**Question 2312**

Which of the following compounds is not an Arrhenius acid?
A) HF
B) KOH
C) HClO
D) H2SO3
Question 2313
Which one of the following statements about isotopes is false?
A) The ratio of neutrons to protons is about 1:1 for elements lighter than Ca.
B) The ratio of neutrons to protons is > 1:1 for elements heavier than Ca.
C) Nonradioactive isotopes generally have an odd number of neutrons.
D) All isotopes beyond 209Bi are radioactive.

Question 2314
Each of three identical 15.0-L gas cylinders contains 7.50 mol of gas at 295 K. Cylinder A contains HCN, cylinder B contains CO2, and cylinder C contains O3. According to the kinetic molecular theory, which gas has the highest pressure?
A) HCN
B) CO2
C) O3
D) All have identical pressures

Question 2315
Copper has the anomalous short-hand electron configuration __________.

Question 2316
By what factor does the entropy increase for a collection of 100 molecules from a system of 1 × 105 boxes to 1 × 106 boxes?

Question 2317
Which one of the following gases will have the highest rate of effusion?
A) HCN
B) CO2
C) Ar
D) SO2

Question 2318
Which of the following is the smallest volume?
A) 11 cm³
B) 0.25 dL
C) 1.4 × 10³ mL
D) 2.5 × 10⁷ nL

Question 2319
Which compound is most likely to exist as a gas at room temperature?

Question 2320
Which combination of semiconductors can be employed to make a diode?
A) GaAs doped with Ge and GaP doped with Si
B) GaAs doped with Se and GaP doped with Zn
C) Si doped with B and Ge doped with Ga
D) Si doped with P and Ge doped with As

Question 2321
Which unit of radiation is frequently used in medicine to describe the amount of tissue damage caused by a radioactive substance?
A) becquerel
B) curie
C) rad
### Question 2322
Which of the following statements concerning the rusting of iron is false?
A) The oxidation site can occur at a different place on the metal surface than the reduction site.
B) The metal is reduced.
C) The rusting of iron requires both oxygen and water.
D) Salt increases the rate of corrosion by providing ions to carry the current.

**Answer:** [Link](https://biology-forums.com/index.php?topic=291155)

### Question 2323
The secondary pollutants in photochemical smog are ________.

**Answer:** [Link](https://biology-forums.com/index.php?topic=290072)

### Question 2324
How many orbitals are there in the seventh shell?
A) 6
B) 7
C) 21
D) 49

**Answer:** [Link](https://biology-forums.com/index.php?topic=289390)

### Question 2325
At a given temperature and pressure, which of the following would be expected to have the greatest molar entropy?
A) I₂(s)
B) I₂(l)
C) I₂(g)
D) All of these would be expected to have the same molar entropy.

**Answer:** [Link](https://biology-forums.com/index.php?topic=289879)

### Question 2326
What volume of 3.00 M CH₃OH solution is needed to provide 0.500 mol of CH₃OH?
A) 3.12 mL
B) 9.38 mL
C) 167 mL
D) 150 mL

**Answer:** [Link](https://biology-forums.com/index.php?topic=290216)

### Question 2327
24.0 g of which element contains the greatest number of atoms?
A) Be
B) C
C) O
D) Na

**Answer:** [Link](https://biology-forums.com/index.php?topic=288984)

### Question 2328
The HI bond has a length of 161 pm and 4.92% ionic character. What is the experimental dipole moment of HI?
A) 0.380 D
B) 0.772 D
C) 3.80 D
D) 7.72 D

**Answer:** [Link](https://biology-forums.com/index.php?topic=289685)

### Question 2329
How many subshells are there in the shell with n = 4?
A) 3
B) 4

**Answer:** [Link](https://biology-forums.com/index.php?topic=288984)
Question 2330
Beta decay of 24Na produces a beta particle and
A) 20F.
B) 23Na.
C) 24Ne.
D) 24Mg.

Question 2331
State whether the solubility of Mg(OH)2 will increase or decrease upon the addition of aqueous solutions of a) HCl, b) LiOH, c) NH3.

Question 2332
How many double and single bonds are in the resonance form for SO2 in which the formal charges on each atom are zero?
A) two single bonds and no double bonds
B) one single bond and one double bond
C) no single bonds and two double bonds
D) Each of these is possible.

Question 2333
At 1 atm pressure the heat of sublimation of gallium is 277 kJ/mol and the heat of vaporization is 271 kJ/mol. How much heat is required to melt 0.500 mol of gallium at 1.00 atm pressure?
A) 6.00 kJ
B) 3.00 kJ
C) 268 kJ
D) 271 kJ

Question 2334
Calculate the pH of a 0.100 M KBrO solution. Ka for hypobromous acid, HBrO, is 2.0 \times 10^{-9}.
A) 3.15
B) 4.85
C) 9.15
D) 10.85

Question 2335
Which of the intermolecular forces is the most important contributor to the high surface tension shown by water?
A) dipole-dipole forces
B) dispersion forces
C) hydrogen bonding
D) ion-dipole forces

Question 2336
What hybrid orbitals are used by carbon to form covalent bonds with hydrogen?
A) sp
B) sp2
C) sp3
D) sp3d

Question 2337
Ethyl chloride, C2H5Cl, is used as a local anesthetic. It works by cooling tissue as it vaporizes; its heat of vaporization is 26.4 kJ/mol. How much heat
could be removed by 10.0 g of ethyl chloride?
A) 4.09 kJ
B) 170 kJ
C) 264 kJ
D) 1700 kJ

**Question 2338**

Acetic acid CH₃COOH, has an acid dissociation constant of 1.8 × 10⁻⁵. What is the conjugate base of acetic acid and what is its base dissociation constant?
A) CH₃C(OH)₂⁺, 5.6 × 10⁻⁴
B) CH₃C(OH)₂⁺, 5.6 × 10⁻¹⁰
C) CH₃COOH, 5.6 × 10⁻¹⁰
D) CH₃CO₂⁻, 5.6 × 10⁻¹⁰

**Question 2339**

When dissolved in water, of HClO₄, NH₃, KOH, HI, and CH₃OH which are acids?
A) NH₃ and KOH
B) HClO₄ and HI
C) only HI
D) only KOH

**Question 2340**

All of the following are fundamental SI units except the
A) year.
B) kilogram.
C) mole.
D) Kelvin.

**Question 2341**

Chromium can be electroplated from an aqueous solution containing sulfuric acid and chromic acid, H₂CrO₄. What current is required to deposit chromium at a rate of 1.25 g/min?
A) 38.1 A
B) 38.7 A
C) 116 A
D) 232 A

**Question 2342**

An orbital with n = 5 and l = 2 is a ________ orbital.

**Question 2343**

Which of the following statements concerning ionic compounds is true?
A) Essentially all ionic compounds are solids at room temperature and pressure.
B) Ionic compounds do not contain any covalent bonds.
C) Ionic compounds contain the same number of positive ions as negative ions.
D) The chemical formula for an ionic compound must show a nonzero net charge.

**Question 2344**

Which of the following amino acids contains a benzyl group?
A) isoleucine
B) proline
C) asparagine
D) tryrosine
Question 2345
One mole of which gas has the greatest density at STP?
A) Kr  
B) CO2  
C) Ar  
D) All three gases have the same density.

Question 2346
A 75.0 L steel tank at 20.0°C contains acetylene gas, C2H2, at a pressure of 1.20 atm. Assuming ideal behavior, how many grams of acetylene are in the tank?
A) 3.74 g  
B) 54.8 g  
C) 97.3 g  
D) 1425 g

Question 2347
HBr, HCl, HClO4, KBr, and NaCl are all classified as  
A) acids.  
B) nonelectrolytes.  
C) strong electrolytes.  
D) weak electrolytes.

Question 2348
Stored energy is ______ energy, and energy of motion is ______ energy.

Question 2349
Using exponential notation, there are ______ bytes of memory are contained in a 2 TB external hard drive.

Question 2350
What is the most important copper containing ore?
A) bauxite  
B) chalcopyrite  
C) pyrolusite  
D) ilmenite

Question 2351
The short hand electron configuration of iron in [FeF6]3- is ______.

Question 2352
How many valence shell electrons does an atom of Si have?
A) 1  
B) 6  
C) 4  
D) 2

Question 2353
To the correct number of significant figures, an automobile traveling at 28 mi/h is traveling at ______ km/h (1 km = 0.6214 mi).
A) 17  
B) 17.40  
C) 45
Question 2354

Which of the following compounds is an Arrhenius base in water?
A) C6H12O6
B) CH3COOH
C) KCl
D) NH2CH2CH2NH2

Question 2355

Dihydrogen phosphate H2PO4-, has an acid dissociation constant of $6.2 \times 10^{-7}$. What is the conjugate base of H2PO4- and what is its base dissociation constant?
A) H3PO4, $1.6 \times 10^6$
B) H3PO4, $1.6 \times 10^{-8}$
C) HPO42-, $1.6 \times 10^6$
D) HPO42-, $1.6 \times 10^{-8}$

Question 2356

A solution of LiCl in water has $XLiCl = 0.0400$. What is the molality?
A) 4.16 m LiCl
B) 2.22 m LiCl
C) 2.31 m LiCl
D) 4.21 m LiCl

Question 2357

What is the range of oxidation states that are exhibited by P?
A) from -3 to 0
B) from -2 to +2
C) from -3 to +5
D) from -1 to +5

Question 2358

Which does not apply to a nuclear fusion reaction?
A) Atoms of one element cannot be converted to atoms of another element.
B) Energy is conserved.
C) Matter is conserved.
D) None of these apply to a nuclear fusion reaction.

Question 2359

The number of semimetals in group 4A of the periodic table is ________.

Question 2360

What statement is not consistent with the chemistry of tin?
A) It is abstracted from the mineral cassiterite by reduction of the oxide with carbon.
B) It is an important component of alloys such as bronze, pewter, and some solders.
C) It is a relatively abundant ore within the earth's crust.
D) It is used as a protective coating over steel in making tin cans.

Question 2361

What is the equilibrium constant expression (Ka) for the acid dissociation of nitrous acid HNO2? The equation of interest is $HNO2(aq) + H2O(l) \leftrightarrow H3O^+(aq) + NO2^-(aq)$. 

A) Ka = ([H3O+][NO2-])/([HNO2][H2O])
B) Ka = ([H3O+][NO2-])/([HNO2])
C) Ka = ([HNO2][H2O])/([H3O+][NO2-])
D) Ka = ([HNO2])/([H3O+][NO2-])

Question 2362

Arrange the following in order of increasing ionic character: Al2S3, MgS, Na2S, P4S3, S8.
A) MgS, Na2S, Al2S3, P4S3, S8
B) Na2S, MgS, Al2S3, P4S3, S8
C) S8, P4S3, Al2S3, MgS, Na2S
D) S8, P4S3, Al2S3, Na2S, MgS

Question 2363

Kp = 1.5 × 103 at 400°C for the reaction 2 NH3(g) <-- --> N2(g) + 3 H2(g). What is the value of Kp for the reaction:
2 N2(g) + 6 H2(g) <-- --> 4 NH3(g)?
A) 4.4 × 10-7
B) 3.3 × 10-4
C) 6.7 × 10-4
D) 2.3 × 106

Question 2364

For the reaction: N2(g) + 2 O2(g) <-- --> 2 NO2(g), Kc = 8.3 × 10-10 at 25°C. What is the concentration of N2 gas at equilibrium when the concentration of NO2 is twice the concentration of O2 gas?
A) 2.1 × 10-10 M
B) 4.2 × 10-10 M
C) 2.4 × 109 M
D) 4.8 × 109 M

Question 2365

A student measured the diameter of a sphere and determined the average value. His measurements are and If the true diameter is 6.18 cm, what can be said about the student's results?
A) It is accurate and precise.
B) It is accurate but not precise.
C) It is precise but not accurate.
D) It is neither precise nor accurate.

Question 2366

Which of the following elements is a good conductor of heat and electricity?
A) carbon
B) chlorine
C) neon
D) zinc

Question 2367

Which of the following titrations result in an acidic solution at the equivalence point?
A) CH3COOH titrated with LIOH
B) NaF titrated with LIOH
C) HBr titrated with KOH
D) C5H5N titrated with HCl

Question 2368

What is the strongest acid among the following?
A) HIO
<table>
<thead>
<tr>
<th>Question 2369</th>
</tr>
</thead>
<tbody>
<tr>
<td>The chemical formula for the nitrite ion is</td>
</tr>
<tr>
<td>A) N2-.</td>
</tr>
<tr>
<td>B) N 3-.</td>
</tr>
<tr>
<td>C) NO2-.</td>
</tr>
<tr>
<td>D) NO3-.</td>
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</table>

<table>
<thead>
<tr>
<th>Question 2370</th>
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</thead>
<tbody>
<tr>
<td>Which conducts electricity?</td>
</tr>
<tr>
<td>A) a large collection of iron atoms</td>
</tr>
<tr>
<td>B) a single iron atom</td>
</tr>
<tr>
<td>C) both a large collection of iron atoms and a single iron atom</td>
</tr>
<tr>
<td>D) neither a large collection of iron atoms nor a single iron atom</td>
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</table>

<table>
<thead>
<tr>
<th>Question 2371</th>
</tr>
</thead>
<tbody>
<tr>
<td>A reaction has a rate constant, ( k = 1.2 \times 10^{-12} \text{ s}^{-1} ) at 273 K and ( k = 5.1 \times 10^{-7} \text{ s}^{-1} ) at 373 K has an activation energy, ( \text{Ea} = ) ________ kJ/mol.</td>
</tr>
</tbody>
</table>

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<thead>
<tr>
<th>Question 2372</th>
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<tbody>
<tr>
<td>Radium occurs only in uranium ores, typically with an observed Ra/U ratio of 1mg/3kg. Uranium ores normally contain only about 200 ppm of U. How many kilograms of uranium ore must be processed to obtain 1 mg of radium?</td>
</tr>
<tr>
<td>A) 1700 kg ore</td>
</tr>
<tr>
<td>B) 15,000 kg ore</td>
</tr>
<tr>
<td>C) 6.0 \times 10^8 kg ore</td>
</tr>
<tr>
<td>D) None of these</td>
</tr>
</tbody>
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<thead>
<tr>
<th>Question 2373</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cyanogen is a gas which contains 46.2% C and 53.8% N by mass. At a temperature of 25°C and a pressure of 750 mm Hg, 1.50 g of cyanogen occupies 0.714 L. What is the molecular formula of cyanogen?</td>
</tr>
<tr>
<td>A) CN</td>
</tr>
<tr>
<td>B) C2N2</td>
</tr>
<tr>
<td>C) C3N4</td>
</tr>
<tr>
<td>D) C4N5</td>
</tr>
</tbody>
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<thead>
<tr>
<th>Question 2374</th>
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<tbody>
<tr>
<td>The activation energy for the forward reaction is given by the difference in energy between which two reaction stages?</td>
</tr>
<tr>
<td>A) reaction stage 2 — reaction stage 1</td>
</tr>
<tr>
<td>B) reaction stage 2 — reaction stage 3</td>
</tr>
<tr>
<td>C) reaction stage 1 — reaction stage 3</td>
</tr>
<tr>
<td>D) reaction stage 3 — reaction stage 1</td>
</tr>
</tbody>
</table>

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<thead>
<tr>
<th>Question 2375</th>
</tr>
</thead>
<tbody>
<tr>
<td>One gram is approximately the same as half the mass of a new U.S.</td>
</tr>
<tr>
<td>A) penny.</td>
</tr>
<tr>
<td>B) dime.</td>
</tr>
<tr>
<td>C) quarter.</td>
</tr>
<tr>
<td>D) dollar.</td>
</tr>
</tbody>
</table>
Question 2376

How many molecules of N₂ are in a 250.0 mL container at 780 mm Hg and 135°C?
A) 4.38 × 10²¹ molecules
B) 4.62 × 10²¹ molecules
C) 1.32 × 10²² molecules
D) 1.39 × 10²² molecules

Question 2377

What is the least soluble salt of the following set?
A) Ca(OH)₂ with Ksp = 4.7 × 10⁻⁶
B) Cd(OH)₂ with Ksp = 5.3 × 10⁻¹⁵
C) Fe(OH)₂ with Ksp = 4.9 × 10⁻¹⁷
D) Cr(OH)₂ with Ksp = 6.7 × 10⁻³¹

Question 2378

For a reaction that follows the general rate law, Rate = k[A][B]², what will happen to the rate of reaction if the concentration of B is increased by a factor of 1.50? The rate will
A) decrease by a factor of 1/2.25.
B) decrease by a factor of 1/1.50.
C) increase by a factor of 1.50.
D) increase by a factor of 2.25.

Question 2379

Al₂O₃ can be separated from iron oxide impurities in bauxite by dissolving the Al₂O₃ in hot aqueous NaOH. Give the formula of the aluminum complex ion that forms, and write a balanced net ionic equation for its formation by the reaction between Al₂O₃ and NaOH.

Question 2380

A becquerel is
A) the amount of sample that undergoes 1 disintegration per second.
B) the amount of sample that undergoes 3.7 × 10¹⁰ disintegrations per second.
C) the amount of tissue damage done by radiation.
D) equal to 0.01 J of energy absorbed per kilogram of tissue.

Question 2381

Identify a chemical property.
A) tarnishing
B) boiling point
C) taste
D) solubility

Question 2382

A 1.25 × 10⁻⁴ M solution of the anti-inflammatory drug naproxen has a pH = 4.2. The Ka and pKa of naproxen are ________ and ________.

Question 2383

Which carbon containing compound is an inorganic compound?
A) C₇H₇NO₂
B) HCN
C) CH₃CO₂H
D) C₆H₅Br
Question 2384
When dissolved in water, which compound is generally considered to be an Arrhenius acid?
A) CH₃CO₂H
B) NaOH
C) Na₂CO₃
D) CH₃CH₂OH

Question 2385
For an octahedral complex what metal d orbitals are directly towards the ligands?
A) dₓᵧ, dₓz
B) dₓᵧ, dₓz, dyz
C) dz², dx²−y²
D) dz², dₓz, dyz

Question 2386
Which of the following compounds is an Arrhenius base in water?
A) CH₃CH₃
B) CH₃SH
C) HOCl
D) KOH

Question 2387
A property that depends on the amount of a substance is an ________ property, whereas a property that is independent on the amount of substance is an ________ property.

Question 2388
A greenhouse gas of greatest concern that is from human activities is
A) oxygen.
B) fluorine.
C) radon.
D) methane.

Question 2389
How many protons (p) and neutrons (n) are in an atom of calcium-46?
A) 20 p, 26 n
B) 20 p, 46 n
C) 26 p, 20 n
D) 46 p, 60 n

Question 2390
The number of milliliters of 12.0 M HCl required to prepare 250 mL of 0.500 M HCl is ________.

Question 2391
Which has the most positive standard oxidation potential?
A) Sc
B) V
C) Cu
D) Zn

Question 2392
A 0.50 M KNO₂ solution will have a pH ________ seven.

Question 2393
Which one of the following compounds behaves as an acid when dissolved in water?
A) CH₃OCH₃
B) CH₄
C) H₂SO₃
D) KOH

Question 2394
What mass of sulfur hexafluoride, SF₆, has the same number of fluorine atoms as 25.0 g of oxygen difluoride, OF₂?
A) 0.901 g
B) 8.33 g
C) 22.5 g
D) 203 g

Question 2395
A solution is prepared by dissolving 171 g of CdCl₂ in enough water to make exactly 250.0 mL of solution. If the density of the solution is 1.556 g/mL, what is the weight percent of CdCl₂ in the solution?
A) 7.17%
B) 44.0%
C) 56.0%
D) 68.4%

Question 2396
What is the pH of a solution prepared by mixing 25.00 mL of 0.10 M CH₃CO₂H with 25.00 mL of 0.050 M CH₃CO₂Na? Assume that the volume of the solutions are additive and that Ka = 1.8 × 10⁻⁵ for CH₃CO₂H.
A) 2.87
B) 4.44
C) 4.74
D) 5.05

Question 2397
How many cations are in 0.500 g of MgBr₂?
A) 1.37 × 10²¹ anions
B) 1.64 × 10²¹ anions
C) 2.22 × 10²⁶ anions
D) 4.43 × 10²⁶ anions

Question 2398
Mg can react with HCl to produce the white solid MgCl₂ and H₂ gas. A student mixes 1.99 g of Mg with 5.98 g of HCl. If the mass of the white solid is 7.79 g, then what is the mass of H₂ produced?
A) 0.0 g
B) 0.18 g
C) 2.0 g
D) 15.76 g

Question 2399
The subshell designations follow the alphabet after f. What is the first shell in which an h orbital would be allowed?
A) fifth
B) sixth
C) seventh
D) eighth
Question 2400
What is the minimum energy barrier that must be overcome for a chemical reaction to occur?
A) activation energy
B) net energy
C) potential energy
D) rate limiting energy

Question 2401
Identify and give the sign of each electrode.
A) a is Ag and (+), c is Cu and (-).
B) a is Ag and (-), c is Cu and (+).
C) a is Cu and (+), c is Ag and (-).
D) a is Cu and (-), c is Ag and (+).

Question 2402
Which of the following mixtures would result in a buffered solution when 1.0 L of each of the two solutions are mixed.
A) 0.2 M HNO3 and 0.2 M NaNO3
B) 0.2 M HNO3 and 0.4 M HF
C) 0.2 M HNO3 and 0.4 M NaF
D) 0.2 M HNO3 and 0.4 M NaOH

Question 2403
Which cell involves a nonspontaneous redox reaction?
A) concentration cell
B) electrolytic cell
C) fuel cell
D) galvanic cell

Question 2404
What is the coldest temperature possible?
A) 0°C
B) 0°F
C) 0 K
D) None of these

Question 2405
The reaction CaCO3(s) <-- --> CaO(s) + O2(g) is endothermic 298 K. The effect of adding CaO to the system at equilibrium will ________ (decrease, increase, have no effect on) the total quantity of CaO once equilibrium is reestablished.

Question 2406
Which of the following metals is commonly obtained by electrolysis?
A) Pt
B) Ag
C) Ni
D) Na

Question 2407
Calculate the pH for an aqueous solution of acetic acid that contains 2.15 × 10⁻³ M hydronium ion.
A) 4.65 × 10⁻¹²
B) 2.15 × 10⁻³
Question 2408

The dipole moment of ClF is 0.88 D, and its bond length is 163 pm. What is the percent ionic character of the Cl—F bond?
A) 0.54%
B) 7.8%
C) 11%
D) 25%

Question 2409

How many electrons are in the ion, CO32−?
A) 16
B) 28
C) 30
D) 32

Question 2410

Which is a net ionic equation for the neutralization reaction of a strong acid with a weak base?
A) HF(aq) + LiOH(aq) ←→ H2O(l) + LiF(aq)
B) H3O+(aq) + OH−(aq) ←→ 2 H2O(l)
C) HI(aq) + NH3(aq) ←→ NH4+(aq) + H2O(l)
D) H3O+(aq) + NH3(aq) ←→ NH4+(aq) + H2O(l)

Question 2411

Based on formal charges, the best Lewis electron-dot structure of BF3 has a B—F bond order equal to ________.

Question 2412

The Br—Cl bond has 5.05% ionic character and a dipole moment of 0.518 D. What is the distance between atoms in BrCl?

Question 2413

Which of the following statements must be true for the entropy of a pure solid to be zero?
I. The temperature must be 0 K.
II. The solid must be crystalline, not amorphous.
III. The solid must be perfectly ordered.
IV. The solid must be an element.
A) I
B) I and II
C) I, II, and III
D) I, II, III, and IV

Question 2414

How many grams of KNO3 are needed to make 250. mL of a solution that is 0.135 M?
A) 1.71 g
B) 0.341 g
C) 3.41 g
D) 6.82 g

Question 2415

An element in a ground state electron configuration has 4 electrons in the 4p orbitals. Which of the following statements can not describe the electron configurations in this atom?
A) At least one electron has an orbital angular momentum (l) of 2.
B) Six electrons are in the n=4 shell.
C) The valence electron configuration is identical to carbon.
D) No electrons have an orbital angular momentum (l) of 3.3.

Question 2416
Beta decay of 60Co produces a beta particle and
A) 56Mn.
B) 59Co.
C) 60Fe.
D) 60Ni.

Question 2417
Which molecule contains the most easily broken carbon-carbon bond?
A) H3C—CH3
B) H2C=CH2
C) F2C=CF2
D) HC CH

Question 2418
Which thermodynamic function is most related to disorder and probability?
A) enthalpy
B) internal energy
C) entropy
D) heat capacity

Question 2419
How many valence shell electrons does an atom of aluminum have?
A) 1
B) 2
C) 3
D) 13

Question 2420
The compound that does not contain oxygen is
A) aldehyde.
B) ester.
C) amide.
D) aromatic.

Question 2421
If Kc = 2.0 × 10^33 at 25°C, for the following reaction: H2(g) + Cl2(g) ⇌ 2 HCl(g), then find Kp at the same temperature.
A) 8.2 × 10^31
B) 9.7 × 10^32
C) 2.0 × 10^33
D) 4.9 × 10^34

Question 2422
What volume of a 0.716 M KBr solution is needed to provide 10.5 g of KBr?
A) 7.52 mL
B) 14.7 mL
C) 63.2 mL
D) 123 mL
<table>
<thead>
<tr>
<th>Question</th>
<th>Description</th>
</tr>
</thead>
</table>
| **Question 2423** | KI crystallizes in a cubic unit cell with I- ions on each corner and each face. How many K+ and I- ions are in each unit cell of KI?  
A) 1 K+ ion and 1 I- ion  
B) 2 K+ ions and 2 I- ions  
C) 4 K+ ions and 4 I- ions  
D) 8 K+ ions and 8 I- ions  
| **Question 2424** | How many electrons are in the outermost shell of the K+ ion in its ground state?  
A) 0  
B) 2  
C) 6  
D) 8  
| **Question 2425** | Combustion analysis of a 0.675 g sample of an unknown compound that contains only carbon, hydrogen, and oxygen gives 0.627 g of CO2 and 1.534 g of H2O. The molecular mass of the unknown is  
A) C3H6O.  
B) C6H12O2.  
C) C9H18O3.  
D) unable to be determined from this data.  
| **Question 2426** | What is the pH of 1 L of 0.30 M TRIS, 0.60 M TRISH+ buffer to which one has added 5.0 mL of 12 M HCl? The Kb for the TRIS/TRISH+ is 1.2 × 10^-6.  
A) 5.92  
B) 6.36  
C) 7.36  
D) 7.64  
| **Question 2427** | The chemical formula for potassium peroxide is  
A) KOH.  
B) KO2.  
C) K2O.  
D) K2O2.  
| **Question 2428** | Each of three identical 15.0-L gas cylinders contains 7.50 mol of gas at 295 K. Cylinder A contains Ne, cylinder B contains F2, and cylinder C contains Cl2. According to the kinetic molecular theory, which gas has the highest average speed?  
A) Ne  
B) F2  
C) Cl2  
D) All have identical average speeds  
| **Question 2429** | Name the product of hydrogenation of trans-2-pentene.  
A) pentane  
B) cis-2-pentene  
C) trans-2-pentane  
D) none of these  
Question 2430

What is the pH of a 0.20 M H2Se solution that has the stepwise dissociation constants Ka1 = 1.3 × 10^{-4} and Ka2 = 1.0 × 10^{-11}?

A) 2.29  
B) 3.89  
C) 4.59  
D) 5.57  

Question 2431

A bottle of pure element was missing part of a label. The label said 2.258 x 10^{23} atoms. You determine the mass of the elements in the bottle to be 10.51946. What is the identity of this element?

A) B  
B) N  
C) Si  
D) Sr  

Question 2432

If the ionization constant of water, Kw, at 40°C is 2.92 × 10^{-14}, then what is the hydronium ion concentration for a neutral solution?

A) [H3O+] < 1.00 × 10^{-7} M  
B) [H3O+] > 1.71 × 10^{-7} M  
C) [H3O+] = 1.71 × 10^{-7} M  
D) [H3O+] < 1.71 × 10^{-7} M  

Question 2433

The edge length of a face-centered cubic lattice of NaCl is 564 pm. What is the density of NaCl in g/cm^3?

A) 0.720  
B) 1.08  
C) 2.16  
D) 4.32  

Question 2434

Breaking a chemical bond requires approximately 102 kJ/mol of energy. What is closest to the order of magnitude of the energy required to split a nucleus in to its individual protons and neutrons?

A) 103 kJ/mol  
B) 104 kJ/mol  
C) 108 kJ/mol  
D) 1010 kJ/mol  

Question 2435

Which substance is a monosaccharide?

A) cellulose  
B) glucose  
C) glycogen  
D) starch  

Question 2436

The most important characteristic of carbon atoms for forming organic molecules is

A) ability to bond together to form long chains.  
B) ability to form multiple covalent bonds.  
C) use of hybrid orbitals.  
D) A and B  
Question 2437

Of the following, which element has the highest first ionization energy?
A) Ba
B) I
C) Rb
D) Po


Question 2438

Which of the following statements about positrons is false?
A) The positron has same mass as an electron.
B) A positron is ejected from the nucleus during the conversion of a proton into a neutron.
C) A positron is a positive electron.
D) When positron emission occurs, the atomic number of the nucleus increases.


Question 2439

How many carbons are found in a molecule that contains the prefix but-?
A) 2
B) 4
C) 3
D) 7


Question 2440

The orbital hybridization on the central carbon atom in CH3CCH is
A) sp.
B) sp2.
C) sp3.
D) sp4.


Question 2441

An electron in an oxygen p orbital on which of the following would have the highest entropy?
A) CH3CH2OH
B) CH3CH2O-
C) CH3CO2OH
D) CH3CO2-


Question 2442

What is the temperature of SO2 gas if the average speed (actually the root-mean-square speed) of the molecules is 750 m/s?
A) 1.92 K
B) 1.44 × 10³ K
C) 1.92 × 10³ K
D) 1.44 × 10⁶ K


Question 2443

For a reaction that follows the general rate law, Rate = k[A][B]², what will happen to the rate of reaction if the concentration of A is increased by a factor of 1.50? The rate will
A) decrease by a factor of 1/2.25.
B) decrease by a factor of 1/1.50.
C) increase by a factor of 1.50.
D) increase by a factor of 2.25.


Question 2444
The acid strength of an oxoacid having the general formula HnYOm increases as the electronegativity of Y ________ and as the oxidation number of Y ________.

**Question 2445**

2-Propanol has the molecular formula C3H8O. Which ball and stick model shown above represents 2-propanol? [gray spheres = C, black spheres = O, unshaded spheres = H]
A) model a)  
B) model b)  
C) model c)  
D) model d)  

**Question 2446**

At 298 K the average kinetic energy is the same for H2, He, and N2. The gas with the highest average velocity is
A) H2.  
B) Kr.  
C) Cl2.  
D) All have the same average velocity.  

**Question 2447**

The algebraic signs (+ and -) sometimes written within the lobes of orbitals are analogous to different ________ of a wave.  

**Question 2448**

The osmotic pressure of a 0.10 M solution of sucrose, C12H22O11 will be ________ (equal to, greater than, less than) the osmotic pressure of a 0.10 M solution of fructose, C6H12O6.  

**Question 2449**

How is slag separated from molten ore in a blast furnace?  
A) chemical treatment  
B) density differences  
C) distillation  
D) magnetic differences  

**Question 2450**

A compound responsible for the odor of garlic has a molecular weight of 146 g/mol. A 0.650 g sample of the compound contains 0.321 g of carbon, 0.044 g of hydrogen, and 0.285 g of sulfur. What is the molecular formula of the compound?
A) CH5S  
B) C3H5S  
C) C3H15S3  
D) C6H10S2  

**Question 2451**

What is the scandium ion concentration for a saturated solution of Sc(OH)3 if the Ksp for Sc(OH)3 is
A) 3.00 x 10-8 M  
B) 1.31 x 10-8 M  
C) 3.22 x 10-10 M  
D) 3.76 x 10-8 M  

**Question 2452**

The percent dissociation of acetic acid changes as the concentration of the acid decreases. A 100-fold decrease in acetic acid concentration results in a ________ fold ________ in the percent dissociation.
A) 10, increase
B) 10, decrease
C) 100, increase
D) 100, decrease

Question 2453

What is the identity of M in the hydrate M(H2O)6n+ that has the 0.10 M solution with the highest pH?
A) Li+
B) Na+
C) Mg2+
D) Al3+

Question 2454

If a constant current of 1.50 \times 10^8 \, \text{A} is passed through a molten mixture of aluminum oxide and cryolite for 4.00 hour ________ kg of aluminum can be produced.

Question 2455

For a multielectron atom, a 3s orbital lies lower in energy than a 3p orbital because
A) a 3p orbital has more nodal surfaces than a 3s orbital.
B) other electrons more effectively shield electrons in the 3s orbital from the nucleus.
C) other electrons more effectively shield electrons in the 3p orbital from the nucleus.
D) there are more p orbitals than s orbitals in a given shell.

Question 2456

Carbon-14, which is present in all living tissue, radioactively decays via a first-order process. A one-gram sample of wood taken from a living tree gives a rate for carbon-14 decay of 13.6 counts per minute. If the half-life for carbon-14 is 5715 years, how old is a wood sample that gives a rate for carbon-14 decay of 3.9 counts per minute?
A) 4.6 \times 10^3 \, \text{yr}
B) 6.6 \times 10^3 \, \text{yr}
C) 1.0 \times 10^4 \, \text{yr}
D) 2.9 \times 10^4 \, \text{yr}