2007 Chemistry Review: Name: _____

1) Which particles are found in the nucleus of an atom?

A) electrons, only
B) protons and neutrons
C) neutrons, only
D) protons and electrons

2) All atoms of a given element must contain the same number of

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

3) Which statement *best* describes electrons?

A) They are negative subatomic particles and are found in the nucleus.
B) They are positive subatomic particles and are found surrounding the nucleus.
C) They are positive subatomic particles and are found in the nucleus.
D) They are negative subatomic particles and are found surrounding the nucleus.

4) Which subatomic particle has *no* charge?

A) neutron
B) electron
C) beta particle
D) alpha particle

5) The atomic number of an atom is *always* equal to the number of its

A) protons, only
B) neutrons, only
C) protons plus neutrons
D) protons plus electrons

6) What is the mass number of the nuclear symbol $^{19}_{9}\mathrm{F}$?

A) 10
B) 28
C) 19
D) 9

7) The number of neutrons in the nucleus of an atom can be determined by

A) subtracting the atomic number from the mass number
B) subtracting the mass number from the atomic number
C) adding the mass number to the atomic mass
D) adding the atomic number to the mass number

8) Atoms of the same element that have different numbers of neutrons are classified as

A) isotopes
B) charged nuclei
C) charged atoms
D) isomers

9) When a lithium atom forms an Li^{+} ion, the lithium atom

A) gains an electron
B) gains a proton
C) loses a proton
D) loses an electron

10) An oxide ion (O^{2-}) formed from an oxygen-18 atom contains *exactly*

A) 10 protons, 8 neutrons, 8 electrons
B) 8 protons, 10 neutrons, 8 electrons
C) 8 protons, 8 neutrons, 10 electrons
D) 8 protons, 10 neutrons, 10 electrons

11) Which conclusion is based on the "gold foil experiment" and the resulting model of the atom?

A) An atom is mainly empty space, and the nucleus has a positive charge.
B) An atom is mainly empty space, and the nucleus has a negative charge.
C) An atom has hardly any empty space, and the nucleus has a negative charge.
D) An atom has hardly any empty space, and the nucleus has a positive charge.

12) John Dalton was an English scientist who proposed that atoms were hard, indivisible spheres. In the modern model, the atom has a different internal structure.

(a) Identify *one* experiment that led scientists to develop the modern model of the atom.

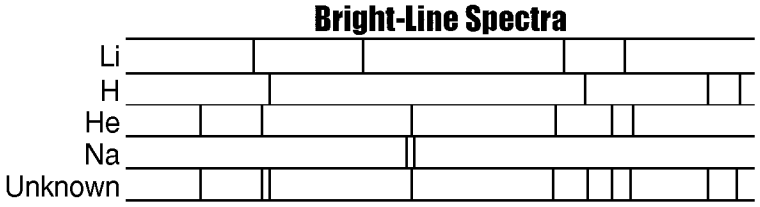
(b) Describe this experiment.

(c) State *one* conclusion about the internal structure of the atom, based on this experiment.

13) In the modern wave-mechanical model of the atom, the orbitals are regions of the most probable location of

A) neutrons
B) positrons
C) protons
D) electrons

14) The diagram below shows bright-line spectra of selected elements.



Identify the *two* elements in the given unknown spectrum.

15) Which substance can *not* be decomposed by a chemical change?

A) N_2O C) H_2O

B) Ne D) HF

16) Which substance represents a compound?

A) C(s) C) Co(s)

B) CO(g) D) $O_2(g)$

17) Which mass measurement contains four significant figures?

A) 3870 g C) 0.086 g

B) 1003 g D) 0.431 g

18) During a laboratory experiment, a sample of aluminum is found to have a mass of 12.50 grams and a volume of 4.6 milliliters. What is the density of this sample, expressed to the correct number of significant figures?

A) 3 g/mL C) 2.7 g/mL

B) 2.717 g/mL D) 2.72 g/mL

19) Which of these terms refers to matter that could be heterogeneous?

A) compound C) solution

B) element D) mixture

20) A sample is prepared by completely dissolving 10.0 grams of NaCl in 1.0 liter of H_2O. Which classification *best* describes this sample?

A) heterogeneous mixture

B) heterogeneous compound

C) homogeneous mixture

D) homogeneous compound

21) Describe, in terms of subatomic particles found in the nucleus, *one* difference between the nuclei of carbon-12 atoms and the nuclei of carbon-13 atoms. [*The response must include both isotopes*.]

22) What is the electron configuration of a sulfur atom in the ground state?

A) 2-4 C) 2-6

B) 2-8-4 D) 2-8-6

23) Show a correct numerical setup for calculating the number of moles of CO_2 (gram-formula mass = 44 g/mol) present in 11 grams of CO_2.

24) Gypsum is a mineral that is used in the construction industry to make drywall (sheetrock). The chemical formula for this hydrated compound is $CaSO_4 \cdot 2H_2O$. A hydrated compound contains water molecules within its crystalline structure. Gypsum contains 2 moles of water for each 1 mole of calcium sulfate.

(a) Show a correct numerical setup for calculating the percent composition by mass of water in the gypsum compound.

(b) Solve the numerical setup written in *part (a)*.

25) What is the correct IUPAC name for the compound NH_4Cl?

A) nitrogen chloride C) ammonium chlorate

B) ammonium chloride D) nitrogen chlorate

26) Given the unbalanced equation:

$$\_\_Al + \_\_CuSO_4 \longrightarrow \_\_Al_2(SO_4)_3 + \_\_Cu$$

When the equation is balanced using the *smallest* whole-number coefficients, what is the coefficient of Al?

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

27) What is the chemical formula for copper (II) hydroxide?

A) $Cu(OH)_2$ C) CuOH

B) $Cu_2(OH)$ D) $CuOH_2$

28) Which process represents a chemical change?

A) evaporation of water

B) crystallization of sugar

C) melting of ice

D) corrosion of copper

29) Which statement correctly describes an endothermic chemical reaction?

A) The products have lower potential energy than the reactants, and the ΔH is positive.

B) The products have higher potential energy than the reactants, and the ΔH is positive.

C) The products have higher potential energy than the reactants, and the ΔH is negative.

D) The products have lower potential energy than the reactants, and the ΔH is negative.

30) Given the reaction:

$$CH_4(g) + 2O_2(g) \longrightarrow 2H_2O(g) + CO_2(g)$$

What is the overall result when $CH_4(g)$ burns according to this reaction?

A) Energy is absorbed and ΔH is negative.

B) Energy is absorbed and ΔH is positive.

C) Energy is released and ΔH is positive.

D) Energy is released and ΔH is negative.

31) Given the reaction:

$$Mg(s) + 2AgNO_3(aq) \longrightarrow Mg(NO_3)_2(aq) + 2Ag(s)$$

Which type of reaction is represented?

A) synthesis C) decomposition

B) double replacement D) single replacement

32) Which equation represents a double replacement reaction?

A) $LiOH + HCl \longrightarrow LiCl + H_2O$

B) $CaCO_3 \longrightarrow CaO + CO_2$

C) $2Na + 2H_2O \longrightarrow 2NaOH + H_2$

D) $CH_4 + 2O_2 \longrightarrow CO_2 + 2H_2O$

33) The equation below represents a balanced chemical reaction.

$$2H_2O \longrightarrow 2H_2 + O_2$$

What type of reaction does the given equation represent?

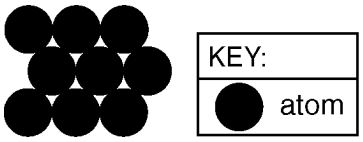
34) The gram formula mass of NH_4Cl is

A) 95.5 g/mole
B) 28.0 g/mole
C) 22.4 g/mole
D) 53.5 g/mole

35) What is the percent by mass of oxygen in propanal, CH_3CH_2CHO?

A) 62.1%
B) 38.1%
C) 27.6%
D) 10.0%

36) Given the particle diagram:



At 101.3 kPa and 298 K, which element could this diagram represent?

A) Ag
B) Xe
C) Kr
D) Rn

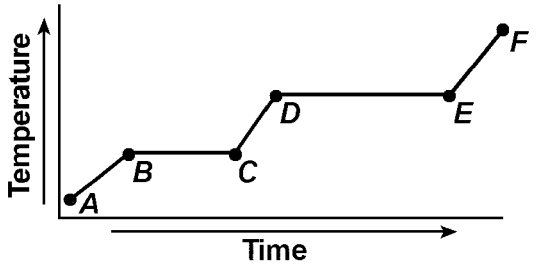
37) Which statement correctly describes a sample of gas confined in a sealed container?

A) It consists of particles arranged in a regular geometric pattern.
B) It takes the shape and the volume of any container in which it is confined.
C) It always has a definite volume, and it takes the shape of the container.
D) It has a crystalline structure.

38) Which sample contains particles in a rigid, fixed, geometric pattern?

A) $CO_2(aq)$
B) $HCl(g)$
C) $H_2O(\ell)$
D) $KCl(s)$

39) The graph below represents the uniform heating of a substance, starting with the substance as a solid below its melting point.



Which line segment represents an increase in potential energy and *no* change in average kinetic energy?

A) *AB*
B) *EF*
C) *CD*
D) *BC*

40) In which process does a solid change directly into a vapor?

A) solidification
B) sublimation
C) condensation
D) deposition

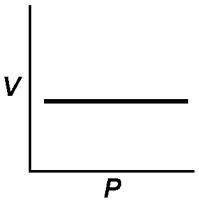
41) Convert the melting point of iron metal to degrees Celsius.

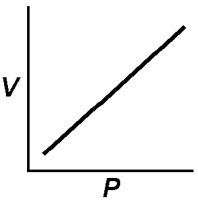
42) How much heat energy must be absorbed to completely melt 35.0 grams of $H_2O(s)$ at 0°C?

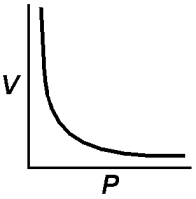
A) 79,100 J
B) 146 J
C) 11,700 J
D) 9.54 J

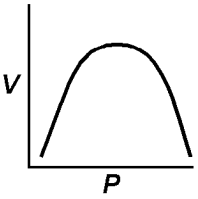
43) Calculate the heat released when 25.0 grams of water freezes at 0°C. [*Show all work. Record your answer with an appropriate unit.*]

44) Which graph *best* represents the pressure-volume relationship for an ideal gas at constant temperature?

A) 

C) 

B) 

D) 

45) The volume of a gas is 4.00 liters at 293 K and constant pressure. For the volume of the gas to become 3.00 liters, the Kelvin temperature must be equal to

A) $\frac{293}{3.00 \times 4.00}$
B) $\frac{4.00 \times 293}{3.00}$
C) $\frac{3.00 \times 293}{4.00}$
D) $\frac{3.00 \times 4.00}{293}$

46) A sample of helium gas has a volume of 900. milliliters and a pressure of 2.50 atm at 298 K. What is the new pressure when the temperature is changed to 336 K and the volume is decreased to 450. milliliters?

A) 5.64 atm
B) 0.177 atm
C) 14.1 atm
D) 4.43 atm

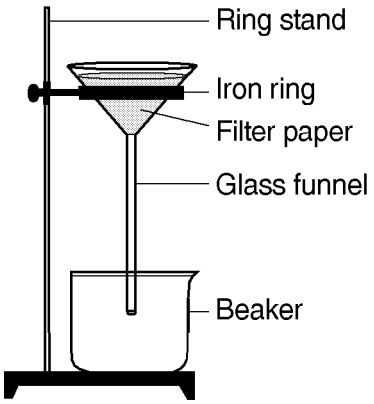
47) Under which conditions does a real gas behave most like an ideal gas?

A) at low temperatures and low pressures
B) at high temperatures and high pressures
C) at low temperatures and high pressures
D) at high temperatures and low pressures

48) A bottle of rubbing alcohol contains both 2-propanol and water. These liquids can be separated by the process of distillation because the 2-propanol and water

A) have combined chemically and retain their different boiling points
B) have combined physically and have the same boiling point
C) have combined physically and retain their different boiling points
D) have combined chemically and have the same boiling point

49) Which mixture can be separated by using the equipment shown below?



A) $CO_2(aq)$ and $C_6H_{12}O_6(aq)$
B) $NaCl(aq)$ and $C_6H_{12}O_6(aq)$
C) $NaCl(aq)$ and $SiO_2(s)$
D) $CO_2(aq)$ and $NaCl(aq)$

50) On the present *Periodic Table of the Elements*, the elements are arranged according to increasing

A) number of oxidation states
B) number of neutrons
C) atomic mass
D) atomic number

51) Which element has chemical properties that are *most* similar to the chemical properties of sodium?

A) Se
B) Mg
C) Cl
D) K

52) In Period 3, from left to right in order, each successive element will

A) decrease in electronegativity
B) increase in number of protons
C) increase in metallic character
D) decrease in atomic mass

53) The high electrical conductivity of metals is primarily due to

A) high ionization energies
B) filled energy levels
C) high electronegativities
D) mobile electrons

54) What are two properties of *most* nonmetals?

A) high ionization energy and good electrical conductivity
B) high ionization energy and poor electrical conductivity
C) low ionization energy and good electrical conductivity
D) low ionization energy and poor electrical conductivity

55) What is a property of most metals?

A) They are poor conductors of heat.
B) They tend to gain electrons easily when bonding.
C) They are poor conductors of electricity.
D) They tend to lose electrons easily when bonding.

56) Which list of elements contains a metal, a metalloid, and a nonmetal?

A) Si, Ge, Sn
B) F, Cl, Br
C) Cd, Sb, I
D) Zn, Ga, Ge

57) Which group of the Periodic Table contains atoms with a stable outer electron configuration?

A) 1
B) 8
C) 16
D) 18

58) As the elements of Group 1 on the Periodic Table are considered in order of increasing atomic radius, the ionization energy of each successive element generally

A) remains the same
B) increases
C) decreases

59) As the elements in Period 2 of the Periodic Table are considered in succession from left to right, there is a decrease in atomic radius with increasing atomic number. This may *best* be explained by the fact that the

A) number of protons increases, and the number of shells of electrons remains the same
B) number of protons decreases, and the number of shells of electrons increases
C) number of protons increases, and the number of shells of electrons increases
D) number of protons decreases, and the number of shells of electrons remains the same

60) As each successive element in Group 15 of the Periodic Table is considered in order of increasing atomic number, the atomic radius

A) decreases
B) increases
C) remains the same

61) The strength of an atom's attraction for the electrons in a chemical bond is the atom's

A) heat of reaction
B) heat of formation
C) ionization energy
D) electronegativity

62) Which element is classified as a noble gas at STP?

A) neon
B) nitrogen
C) hydrogen
D) oxygen

63) As the atoms of the Group 17 elements in the ground state are considered from top to bottom, each successive element has

A) the same number of valence electrons and similar chemical properties
B) an increasing number of valence electrons and identical chemical properties
C) the same number of valence electrons and identical chemical properties
D) an increasing number of valence electrons and similar chemical properties

64) Which of the following Group 2 elements has the *lowest* first ionization energy?

A) Ca
B) Mg
C) Be
D) Ba

65) What occurs when an atom of chlorine and an atom of hydrogen become a molecule of hydrogen chloride?

A) A chemical bond is formed and energy is absorbed.
B) A chemical bond is formed and energy is released.
C) A chemical bond is broken and energy is released.
D) A chemical bond is broken and energy is absorbed.

66) What is the total number of electrons in the outermost shell of a phosphorus atom in the ground state?

A) 1 B) 2 C) 3 D) 5

67) Which Lewis electron-dot structure is drawn correctly for the atom it represents?

A) 

C) 

B) 

D) 

68) Metallic bonding occurs between atoms of

A) sulfur
B) fluorine
C) copper
D) carbon

69) Which electron configuration is correct for a sodium ion?

A) 2-8-1
B) 2-8-2
C) 2-8
D) 2-7

70) Covalent bonds are formed when electrons are

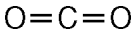
A) transferred from one atom to another
B) mobile within a metal
C) shared between two atoms
D) captured by the nucleus

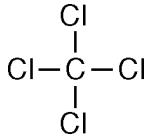
71) Which type of bond is formed when electrons are transferred from one atom to another?

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

72) Which molecule contains a nonpolar covalent bond?

A) 

C) 

B) 

D) 

73) Which substance is correctly paired with its type of bonding?

A) HCl — nonpolar covalent
B) NH_3 — polar covalent
C) Br_2 — polar covalent
D) NaBr — nonpolar covalent

74) Which compound contains ionic bonds?

A) NO
B) CO_2
C) CaO
D) NO_2

75) The bond between Br atoms in a Br_2 molecule is

A) covalent and is formed by the sharing of two valence electrons
B) covalent and is formed by the transfer of two valence electrons
C) ionic and is formed by the sharing of two valence electrons
D) ionic and is formed by the transfer of two valence electrons

76) Which compound contains *both* ionic and covalent bonds?

A) CH_2O
B) $CaCO_3$
C) MgF_2
D) PCl_3

77) Which intermolecular force of attraction accounts for the relatively high boiling point of water?

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

78) Which of the following compounds is *least* soluble in water?

A) copper (II) chloride
B) aluminum acetate
C) potassium sulfate
D) iron (III) hydroxide

79) Hexane (C_6H_{14}) and water do *not* form a solution. Which statement explains this phenomenon?

A) Hexane is nonpolar and water is ionic.
B) Hexane is polar and water is nonpolar.
C) Hexane is nonpolar and water is polar.
D) Hexane is ionic and water is polar.

80) The solubility of $KClO_3(s)$ in water increases as the

A) pressure on the solution decreases
B) temperature of the solution increases
C) pressure on the solution increases
D) temperature of the solution decreases

81) At room temperature, the solubility of which solute in water would be *most* affected by a change in pressure?

A) methanol
B) sodium nitrate
C) carbon dioxide
D) sugar

82) According to *Solubility Curves* chemistry reference table, which solution is saturated at 30°C?

A) 30 grams of NaCl in 100 grams of water
B) 12 grams of $KClO_3$ in 100 grams of water
C) 12 grams of $KClO_3$ in 200 grams of water
D) 30 grams of NaCl in 200 grams of water

83) What is the molarity of a solution of NaOH if 2 liters of the solution contains 4 moles of NaOH?

A) 2 M
B) 80 M
C) 0.5 M
D) 8 M

84) What is the concentration of a solution, in parts per million, if 0.02 gram of Na_3PO_4 is dissolved in 1,000 grams of water?

A) 20 ppm
B) 0.2 ppm
C) 2 ppm
D) 0.02 ppm

85) What occurs when NaCl(s) is added to water?

A) The boiling point of the solution increases, and the freezing point of the solution increases.
B) The boiling point of the solution decreases, and the freezing point of the solution increases.
C) The boiling point of the solution decreases, and the freezing point of the solution decreases.
D) The boiling point of the solution increases, and the freezing point of the solution decreases.

86) As the pressure on the surface of a liquid decreases, the temperature at which the liquid will boil

A) increases
B) decreases
C) remains the same

87) Which event must *always* occur for a chemical reaction to take place?

A) effective collisions between reacting particles
B) formation of a precipitate
C) formation of a gas
D) addition of a catalyst to the reaction system

88) Increasing the temperature increases the rate of a reaction by

A) lowering the frequency of effective collisions between reacting molecules
B) increasing the frequency of effective collisions between reacting molecules
C) lowering the activation energy
D) increasing the activation energy

89) Based on the nature of the reactants in each of the equations below, which reaction at 25 °C will occur at the *fastest* rate?

A) $CaCO_3(s) \longrightarrow CaO(s) + CO_2(g)$
B) $NaOH(aq) + HCl(aq) \longrightarrow NaCl(aq) + H_2O(\ell)$
C) $C(s) + O_2(g) \longrightarrow CO_2(g)$
D) $CH_3OH(\ell) + CH_3COOH(\ell) \longrightarrow CH_3COOCH_3(aq) + H_2O(\ell)$

90) A 1.0-gram piece of zinc reacts with 5 milliliters of HCl(aq). Which of these conditions of concentration and temperature would produce the *greatest* rate of reaction?

A) 1.0 M HCl(aq) at 20. °C
B) 1.0 M HCl(aq) at 40. °C
C) 2.0 M HCl(aq) at 40. °C
D) 2.0 M HCl(aq) at 20. °C

91) At STP, which 4.0-gram zinc sample will react *fastest* with dilute hydrochloric acid?

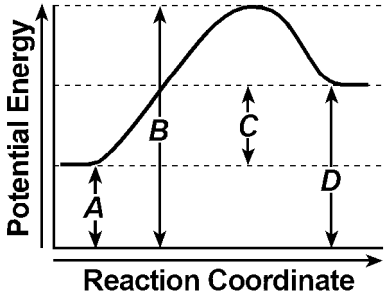
A) lump
B) bar
C) powdered
D) sheet metal

92) Which statement *best* explains the role of a catalyst in a chemical reaction?

A) A catalyst changes the kinds of products produced.
B) A catalyst provides an alternate reaction pathway that requires less activation energy.
C) A catalyst is added as an additional reactant and is consumed but not regenerated.
D) A catalyst limits the amount of reactants used.

Questions 93 through 95 refer to the following:

Chemical cold packs are often used to reduce swelling after an athletic injury. The diagram below represents the potential energy changes when a cold pack is activated.

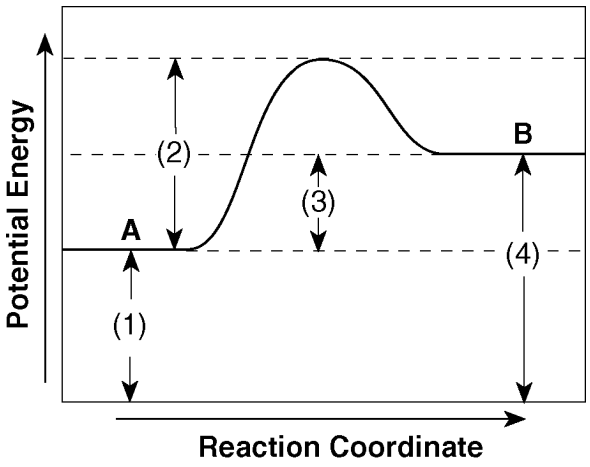


93) Which lettered interval on the given diagram represents the potential energy of the products?

94) Which lettered interval on the given diagram represents the heat of reaction?

95) Identify a reactant listed in the *Heats of Reaction at 101.3 kPa and 298 K* chemistry reference table that could be mixed with water for use in a chemical cold pack.

96) Given the potential energy diagram and the equation below:



$2C(s) + H_2(g) + 227.4\ kJ \longrightarrow C_2H_2(g)$

Describe how the potential energy diagram shown will change if a catalyst is added.

97) Which statement correctly describes a chemical reaction at equilibrium?

A) The concentrations of the products and reactants are constant.
B) The rate of the forward reaction is less than the rate of the reverse reaction.
C) The rate of the forward reaction is greater than the rate of the reverse reaction.
D) The concentrations of the products and reactants are equal.

98) Which statement about a system at equilibrium is true?

A) The forward reaction rate is equal to the reverse reaction rate.
B) The forward reaction rate is less than the reverse reaction rate.
C) The forward reaction rate stops and the reverse reaction rate continues.
D) The forward reaction rate is greater than the reverse reaction rate.

99) Given the reaction at equilibrium:

$$A(g) + B(g) \rightleftharpoons AB(g) + \text{heat}$$

The concentration of *A*(g) can be increased by

A) adding a catalyst
B) increasing the concentration of *B*(g)
C) lowering the temperature
D) increasing the concentration of *AB*(g)

100) Given the equilibrium reaction in a closed system:

$$H_2(g) + I_2(g) + \text{heat} \rightleftharpoons 2HI(g)$$

What will be the result of an increase in temperature?

A) The equilibrium will shift to the left and $[H_2]$ will decrease.
B) The equilibrium will shift to the left and $[H_2]$ will increase.
C) The equilibrium will shift to the right and [HI] will decrease.
D) The equilibrium will shift to the right and [HI] will increase.

101) When cola, a type of soda pop, is manufactured, $CO_2(g)$ is dissolved in it.

A capped bottle of cola contains $CO_2(g)$ under high pressure. When the cap is removed, how does pressure affect the solubility of the dissolved $CO_2(g)$?

102) Given the reaction at equilibrium:

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g) + 92.05 \text{ kJ}$$

(a) State the effect on the number of moles of $N_2(g)$ if the temperature of the system is increased.

(b) State the effect on the number of moles of $H_2(g)$ if the pressure on the system is increased.

(c) State the effect on the number of moles of $NH_3(g)$ if a catalyst is introduced into the reaction system. [*Explain why this occurs.*]

103) Given the reaction:

$$2H_2(g) + O_2(g) \longrightarrow 2H_2O(\ell) + 571.6 \text{ kJ}$$

What is the approximate ΔH for the formation of 1 mole of $H_2O(\ell)$?

A) -571.6 kJ
B) -285.8 kJ
C) +571.6 kJ
D) +285.8 kJ

104) Which of these changes produces the *greatest* increase in entropy?

A) $CaCO_3(s) \longrightarrow CaO(s) + CO_2(g)$
B) $H_2O(g) \longrightarrow H_2O(\ell)$
C) $2Mg(s) + O_2(g) \longrightarrow 2MgO(s)$
D) $CO_2(g) \longrightarrow CO_2(s)$

105) Given the reaction:

$$Mg + CuSO_4 \longrightarrow MgSO_4 + Cu$$

Which equation represents the oxidation that takes place?

A) $Cu^{2+} + 2e^- \longrightarrow Cu$
B) $Mg \longrightarrow Mg^{2+} + 2e^-$
C) $Mg^{2+} + 2e^- \longrightarrow Mg$
D) $Cu \longrightarrow Cu^{2+} + 2e^-$

106) Given the equation:

$$2Al + 3Cu^{2+} \longrightarrow 2Al^{3+} + 3Cu$$

What is the reduction half-reaction?

A) $Al + 3e^- \longrightarrow Al^{3+}$
B) $Cu^{2+} + 2e^- \longrightarrow Cu$
C) $Cu^{2+} \longrightarrow Cu + 2e^-$
D) $Al \longrightarrow Al^{3+} + 3e^-$

107) The transfer of which particle is required for a redox reaction to occur?

A) proton
B) ion
C) neutron
D) electron

108) Which reaction is an example of an oxidation-reduction reaction?

A) $Ba(OH)_2 + 2HCl \longrightarrow BaCl_2 + 2H_2O$

B) $2KOH + H_2SO_4 \longrightarrow K_2SO_4 + 2H_2O$

C) $Cu + 2AgNO_3 \longrightarrow Cu(NO_3)_2 + 2Ag$

D) $AgNO_3 + KI \longrightarrow AgI + KNO_3$

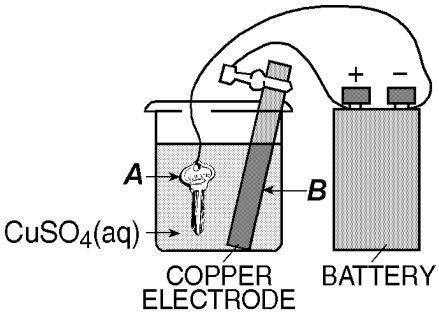
109) A voltaic cell spontaneously converts

A) chemical energy to electrical energy
B) electrical energy to chemical energy
C) electrical energy to nuclear energy
D) nuclear energy to electrical energy

110) Which energy transformation occurs when an electrolytic cell is in operation?

A) light energy ⟶ chemical energy
B) electrical energy ⟶ chemical energy
C) light energy ⟶ heat energy
D) chemical energy ⟶ electrical energy

111) The diagram below shows a key being plated with copper in an electrolytic cell.



Given the reduction reaction for this cell:

$$Cu^{2+}(aq) + 2e^- \longrightarrow Cu(s)$$

This reduction occurs at

A) *B*, which is the cathode
B) *A*, which is the cathode
C) *A*, which is the anode
D) *B*, which is the anode

112) Which pair of formulas represents two compounds that are electrolytes?

A) HCl and NaOH
B) HCl and CH_3OH
C) C_5H_{12} and NaOH
D) C_5H_{12} and CH_3OH

113) According to the *Common Acid-Base Indicators* chemistry reference table, what is the color of the indicator methyl orange in a solution that has a pH of 2?

A) yellow
B) red
C) blue
D) orange

114) Which of these pH numbers indicates the *highest* level of acidity?

A) 5
B) 8
C) 10
D) 12

115) Which pH indicates a basic solution?

A) 12
B) 5
C) 1
D) 7

116) According to the *Activity Series* chemistry reference table, which of these metals will react most readily with 1.0 M HCl to produce $H_2(g)$?

A) Mg
B) K
C) Ca
D) Zn

117) An Arrhenius acid has

A) hydrogen ions as the only negative ions in solution
B) hydrogen ions as the only positive ions in solution
C) only hydroxide ions in solution
D) only hydrogen ions in solution

118) Which ion is produced when an Arrhenius base is dissolved in water?

A) H^-, as the only negative ion in solution
B) H^+, as the only positive ion in solution
C) H_3O^+, as the only positive ion in solution
D) OH^-, as the only negative ion in solution

119) Given the reaction:

$$NH_3 + HCl \longrightarrow NH_4Cl$$

In this reaction, ammonia molecules (NH_3) act as a base because they

A) accept hydroxide ions (OH^-)
B) accept hydrogen ions (H^+)
C) donate hydrogen ions (H^+)
D) donate hydroxide ions (OH^-)

120) Given the reaction:

$$HCl(aq) + LiOH(aq) \longrightarrow HOH(\ell) + LiCl(aq)$$

The reaction is *best* described as

A) neutralization
B) oxidation-reduction
C) synthesis
D) decomposition

121) What is the molarity of an HCl solution if 20. milliliters of this acid is needed to neutralize 10. milliliters of a 0.50 M NaOH solution?

A) 1.0 M
B) 0.50 M
C) 0.75 M
D) 0.25 M

122) *All* organic compounds must contain the element

A) nitrogen
B) oxygen
C) phosphorus
D) carbon

123) In saturated hydrocarbons, carbon atoms are bonded to each other by

A) alternating single and double covalent bonds
B) double covalent bonds, only
C) single covalent bonds, only
D) alternating double and triple covalent bonds

124) Which formula represents an unsaturated hydrocarbon?

A) C_5H_8
B) C_3H_8
C) C_6H_{14}
D) C_2H_6

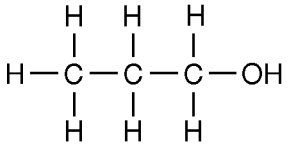
125) Which compound is classified as a hydrocarbon?

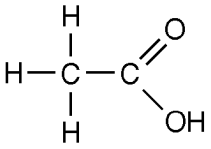
A) chloroethane
B) ethanol
C) ethanoic acid
D) ethane

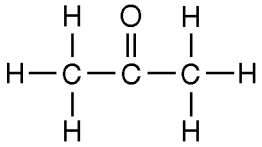
126) What is the total number of electron pairs that are shared between the two carbon atoms in a molecule of ethyne?

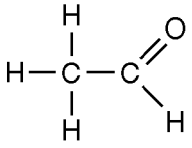
A) 1
B) 2
C) 3
D) 4

127) Which structural formula represents an alcohol?

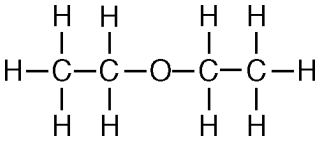
A) 

B) 

C) 

D) 

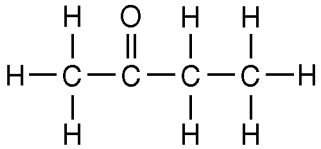
128) Given the structural formula:



The compound represented by this formula can be classified as an

A) organic acid
B) ester
C) aldehyde
D) ether

129) What is the IUPAC name of the compound with the following structural formula?

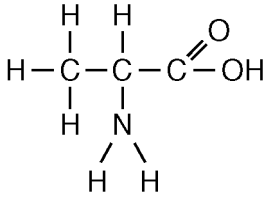


A) butanal
B) propanone
C) propanal
D) butanone

130) Which of the following compounds has chemical properties *most* similar to the chemical properties of ethanoic acid?

A) C_2H_5OH
B) $C_2H_5COOC_2H_5$
C) $C_2H_5OC_2H_5$
D) C_3H_7COOH

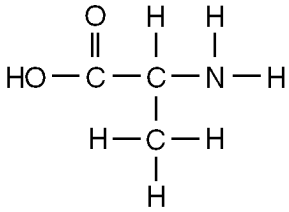
131) Given the structural formula:



This structural formula represents a molecule of

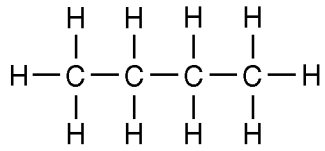
A) an aldehyde
B) an ester
C) a ketone
D) an amino acid

132) The molecule below belongs to which class of compounds?



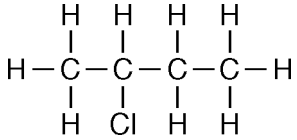
A) alcohol
B) aldehyde
C) ester
D) amino acid

133) Given the structural formula for butane:



In the box below, draw the structural formula of an isomer of butane.

134) The formula below represents a product formed when HCl reacts with $CH_3CH_2CHCH_2$.



What is an IUPAC name for this product?

135) Given the equation:

$$X + Cl_2 \longrightarrow C_2H_5Cl + HCl$$

Which molecule is represented by *X*?

A) C_3H_8 C) C_2H_6

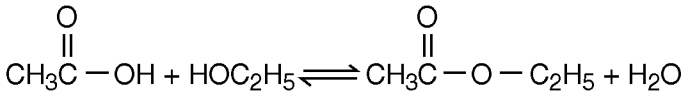
B) C_3H_6 D) C_2H_4

136) Which formula correctly represents the product of an addition reaction between ethene and chlorine?

A) CH_2Cl_2 C) CH_3Cl

B) C_2H_3Cl D) $C_2H_4Cl_2$

137) Given the reaction:



This reaction is an example of

A) fermentation B) esterification C) saponification D) hydrogenation

138) The process of joining many small molecules into larger molecules is called

A) polymerization C) neutralization

B) substitution D) saponification

139) In which reaction is soap a product?

A) saponification C) addition

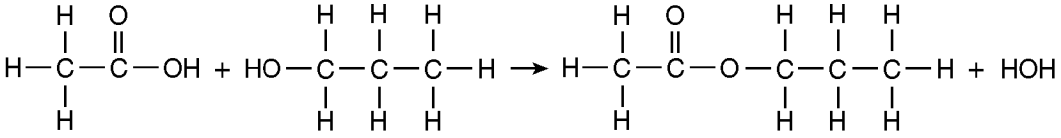
B) polymerization D) substitution

140) Given the unbalanced equation:

$$\_\_C_6H_{12}O_6 \xrightarrow{\text{enzyme}} \_\_C_2H_5OH + \_\_CO_2$$

Identify the type of reaction represented by the given equation.

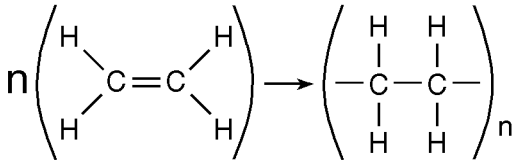
141) Many artificial flavorings are prepared using the type of organic reaction shown below.



Reactant 1 Reactant 2

To what class of organic compounds does reactant 2 in the given diagram belong?

142) Which type of reaction is represented by the equation below? *[NOTE: n and n are very large numbers equal to about 2,000.]*



A) saponification
B) polymerization
C) fermentation
D) esterification

143) Which type of radioactive emission has a positive charge and weak penetrating power?

A) alpha particle
B) neutron
C) gamma ray
D) beta particle

144) Alpha particles and beta particles differ in

A) mass, only
B) neither mass nor charge
C) charge, only
D) both mass and charge

145) What does *X* represent in the following reaction?

$$^{239}_{93}\mathrm{Np} \longrightarrow {}^{239}_{94}\mathrm{Pu} + X$$

A) a neutron
B) a beta particle
C) a proton
D) an alpha particle

146) Which equation represents nuclear fusion?

A) $^{27}_{13}\mathrm{Al} + {}^{4}_{2}\mathrm{He} \longrightarrow {}^{30}_{15}\mathrm{P} + {}^{1}_{0}\mathrm{n}$

B) $^{14}_{6}\mathrm{C} \longrightarrow {}^{14}_{7}\mathrm{N} + {}^{0}_{-1}\mathrm{e}$

C) $^{235}_{92}\mathrm{U} + {}^{1}_{0}\mathrm{n} \longrightarrow {}^{139}_{56}\mathrm{Ba} + {}^{94}_{36}\mathrm{Kr} + 3\,{}^{1}_{0}\mathrm{n}$

D) $^{2}_{1}\mathrm{H} + {}^{3}_{1}\mathrm{H} \longrightarrow {}^{4}_{2}\mathrm{He} + {}^{1}_{0}\mathrm{n}$

147) Given the nuclear equation:

$$^{235}_{92}\mathrm{U} + {}^{1}_{0}\mathrm{n} \longrightarrow {}^{142}_{56}\mathrm{Ba} + {}^{91}_{36}\mathrm{Kr} + 3\,{}^{1}_{0}\mathrm{n} + \text{energy}$$

(a) State the type of nuclear reaction represented by the equation.

(b) The sum of the masses of the products is slightly less than the sum of the masses of the reactants. Explain this loss of mass.

(c) This process releases greater energy than an ordinary chemical reaction does. Name another type of nuclear reaction that releases greater energy than an ordinary chemical reaction.

148) Which radioisotope undergoes beta decay and has a half-life of less than 1 minute?

A) K-42
B) Fr-220
C) N-16
D) P-32

149) As a sample of the radioactive isotope $^{131}\mathrm{I}$ decays, its half-life

A) decreases
B) increases
C) remains the same

150) According to the *Selected Radioisotopes* chemistry reference table, which radioactive isotope is *best* for determining the actual age of Earth?

A) $^{238}\mathrm{U}$
B) $^{90}\mathrm{Sr}$
C) $^{60}\mathrm{Co}$
D) $^{14}\mathrm{C}$

151) Which isotope is most commonly used in the radioactive dating of the remains of organic materials?

A) $^{14}\mathrm{C}$
B) $^{16}\mathrm{N}$
C) $^{32}\mathrm{P}$
D) $^{37}\mathrm{K}$

152) (a) State *one* possible advantage of using nuclear power instead of burning fossil fuels.

(b) State *one* possible risk of using nuclear power.

(c) If animals feed on plants that have taken up Sr-90, the Sr-90 can find its way into their bone structure. Explain *one* danger to the animals.