Name: _____ **Class:** _____ **Date:** _____ **ID: A**

Summer Questions

Multiple Choice
Identify the choice that best completes the statement or answers the question.

____ 1. A tentative explanation for a set of observations that can be tested by further experimentation is referred to as
A. a hypothesis.
B. a law.
C. a theory.
D. none of the above.

____ 2. Which one of the following is an example of a *physical* property?
A. dynamite explodes
B. meat rots if it is not refrigerated
C. gasoline burns
D. ice floats on top of liquid water

____ 3. Which one of the following represents a *physical* change?
A. water, when heated to 100°C, forms steam
B. bleach turns hair yellow
C. sugar, when heated, becomes brown
D. milk turns sour

____ 4. All of the following are properties of sodium. Which one is a *physical* property of sodium?
A. It's surface turns black when first exposed to air.
B. It is a solid at 25°C and changes to a liquid when heated to 98°C.
C. When placed in water it sizzles and a gas is formed.
D. When placed in contact with chlorine it forms a compound that melts at 801°C.

____ 5. All of the following are properties of tin. Which one is a *chemical* property of tin?
A. Tin can be hammered into a thin sheet.
B. Tin erodes when added to hydrochloric acid, and a clear gas forms.
C. Tin melts at 231.9°C.
D. When a bar of tin is bent, it emits an audible "cry".

____ 6. A centimeter corresponds to:
A. 10^{-2} meters.
B. 10^{-3} meters.
C. 10^{-6} meters.
D. 10^{-9} meters.

____ 7. The highest temperature ever recorded in Phoenix, Arizona, was 122°F. Express this temperature in °C.

A. 50.0°C
B. 64.4°C
C. 67.8°C
D. 162.0°C

____ 8. Which of the following represents the largest mass?

A. 2.0×10^2 mg
B. 0.0010 kg
C. 1.0×10^5 ng
D. 2.0×10^2 cg

____ 9. After carrying out the following operations, how many significant figures are appropriate to show in the result?

$$(13.7 + 0.027) \div 8.221$$

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

____ 10. How many significant figures does the result of the following operation contain?

$$8.52010 \times 7.90$$

A. 2
B. 3
C. 4
D. 5

____ 11. How many significant figures does the result of the following sum contain?

$$8.520 + 2.7$$

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

____ 12. How many significant figures does the difference 218.7201 – 218.63 contain?

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

____ 13. Using the arithmetic problem below, determine the correct number of significant figures.

$(1.5 \times 10^{-4} \times 61.3) + 2.01 =$

A. 2.0192
B. 2.0
C. 2.019
D. 2.02

____ 14. Convert 2.340×10^{-4} to decimal format.

A. 23,400
B. 2,340
C. 0.000234
D. 0.0002340

____ 15. If a car has an EPA mileage rating of 30 miles per gallon, what is this rating in kilometers per liter? (1 L = 1.06 qt)

A. 200 km/L
B. 180 km/L
C. 70 km/L
D. 13 km/L

____ 16. If the price of gasoline is $3.85 per U.S. gallon, what is the cost per liter? (1 L = 1.06 qt)

A. $1.02/L
B. $14.60/L
C. $0.96/L
D. $3.85/L

____ 17. The Hope diamond weighs 44.0 carats. Determine the volume occupied by the diamond, given that its density is 3.5 g/cm^3 at 20°C, and that 1 carat = 0.200 g.

A. 2.5 cm^3
B. 0.40 cm^3
C. 0.016 cm^3
D. 63 cm^3

____ 18. The "escape velocity" from Earth (the speed required to escape Earth's gravity) is 2.5×10^4 miles per hour. What is this speed in m/s? (1 mile = 1609 m)

A. 4.2×10^{-3} m/s
B. 6.9 m/s
C. 4.2×10^2 m/s
D. 1.1×10^4 m/s

____ 19. Which of the following speeds is the greatest? (1 mile = 1609 m)
A. 40 mi/h
B. 2.0×10^5 mm/min
C. 40 km/h
D. 0.74 km/min

____ 20. A cyclist averages 18.5 miles per hour. How many minutes will it take for him to complete a 125 kilometer race?
A. 252 min
B. 652 min
C. 420 min
D. 1440 min

____ 21. One of the common intravenous fluids, called physiological saline, is a homogeneous mixture of NaCl in water. In this mixture, 0.89% of the mass is contributed by the NaCl. What mass of NaCl is found in 450. mL of physiological saline?
(Given: density of physiological saline = 1.005 g/cm^3)
A. 2.0 g
B. 4.0 g
C. 5.1 g
D. 508 g

____ 22. A particular flask has a mass of 17.4916 g when empty. When filled with ordinary water at 20.0°C (density = 0.9982 g/mL), the mass of the flask is now 43.9616 g. The density of so-called "heavy water" at 20.0°C is 1.1053 g/mL. What will the mass of the flask be when filled with heavy water at 20.0°C?
A. 29.2573 g
B. 46.8016 g
C. 46.7489 g
D. 29.3100 g

____ 23. In a cathode ray tube
A. electrons pass from the anode to the cathode.
B. electrons pass from the cathode to the anode.
C. protons pass from the anode to the cathode.
D. protons pass from the cathode to the anode.

____ 24. The scientist who determined the magnitude of the electric charge of the electron was
A. John Dalton.
B. Robert Millikan.
C. J. J. Thomson.
D. Henry Moseley.

____ 25. Which of the following scientists developed the nuclear model of the atom?
A. John Dalton
B. Ernest Rutherford
C. J. J. Thomson
D. Henry Moseley

____ 26. Which of the following elements is chemically similar to potassium?
A. calcium
B. arsenic
C. phosphorus
D. cesium

____ 27. A magnesium ion, Mg^{2+}, has
A. 12 protons and 13 electrons.
B. 24 protons and 26 electrons.
C. 12 protons and 10 electrons.
D. 24 protons and 22 electrons.

____ 28. How many protons and electrons are present in one Br^- ion?
A. 35 p, 35 e
B. 80 p, 81 e
C. 35 p, 34 e
D. 35 p, 36 e

____ 29. What are the two different ions present in the compound CaS ?
A. Ca^{+}, S^{-}
B. Ca^{2-}, S^{2+}
C. Ca^{-}, S^{+}
D. Ca^{2+}, S^{2-}

____ 30. What are the two different ions present in the compound Li_3N?
A. Li^{+}, N^{3-}
B. Li_3^{+}, N^{-}
C. Li_3^{3+}, N^{3-}
D. Li^{+}, N^{-}

____ 31. What are the two different ions present in the compound $FeCl_3$?
A. Fe^{2+}, Cl_3^{-}
B. Fe^{3+}, Cl^{3-}
C. Fe^{+}, Cl^{-}
D. Fe^{3+}, Cl^{-}

____ 32. Which of the following is an example of an empirical formula?
A. C_9H_{12}
B. $C_9H_{18}Cl_2$
C. C_6H_6
D. N_2O_4

____ 33. What is the empirical formula for $C_{10}H_{22}O_2$?
A. $C_{10}H_{22}O_2$
B. $C_5H_{11}O$
C. $C_{20}H_{44}O_4$
D. $C_2H_{11}O$

____ 34. What is the formula for the ionic compound containing calcium ions and nitrate ions?
A. Ca_3N_2
B. $Ca(NO_3)_2$
C. Ca_2NO_3
D. Ca_2NO_2

____ 35. What is the formula for the ionic compound containing iron (III) ions and iodide ions?
A. FeI
B. Fe_2I
C. FeI_2
D. FeI_3

____ 36. What is the formula for the ionic compound containing barium ions and sulfate ions?
A. $BaSO_4$
B. Ba_2SO_4
C. BaS
D. $Ba(SO_4)_2$

____ 37. What are the two different ions present in the compound $Al(NO_3)_3$?
A. Al^{3+}, $(NO_3)_3^-$
B. Al^+, NO_3^-
C. Al^{3+}, NO_3^-
D. Al^{3+}, NO_3^{3-}

____ 38. Which of the following is the formula for hydroiodic acid?
A. HIO_4
B. HIO_3
C. HIO_2
D. HI

____ 39. The formula for magnesium sulfate is
A. MnS
B. MgS
C. $MnSO_3$
D. $MgSO_4$

____ 40. The formula for sodium sulfide is
A. NaS.
B. K_2S.
C. NaS_2.
D. Na_2S.

____ 41. Give the formula for cobalt(II) chlorate dihydrate
A. $CoCl_2 \cdot 2H_2O$
B. $CoClO_3(H_2O)_2$
C. $Co(ClO_3)_2(H_2O)_2$
D. $Co(ClO_3)_2 \cdot 2H_2O$

____ 42. Which is the formula for lead(IV) chloride?
A. Pb_4Cl
B. $PbCl_2$
C. $PbCl_3$
D. $PbCl_4$

____ 43. What type of compound is $HBrO_2$?
A. Ionic
B. Binary
C. Acid
D. Base

____ 44. What type of compound is NaOH?
A. Binary
B. Molecular
C. Acid
D. Base

____ 45. Name the acid H_3PO_4 (dissolved in water).
A. Phosphoric acid
B. Phosphorous acid
C. Hydrogen phosphate acid
D. Hydrophosphate acid

____ 46. Name the acid H_2SO_3 (dissolved in water).
A. Sulfuric acid
B. Sulfurous acid
C. Hydrosulfuric acid
D. Persulfuric acid

____ 47. Name the compound $Co_2(SO_3)_3$.
A. cobalt sulfate
B. cobalt(II) sulfite
C. cobalt(II) sulfate
D. cobalt(III) sulfite

____ 48. Name the compound CrO_3.
A. chromium oxide
B. chromium(II) oxide
C. chromium(III) trioxide
D. chromium(VI) oxide

____ 49. Name the compound NO_2.
A. mononitrogen dioxygen
B. nitrogen dioxide
C. dinitrogen monoxide
D. nitrogen oxide

____ 50. Name the compounds SO_3.
A. sulfur trioxide
B. sulfate
C. sulfite
D. sulfur trioxygen

____ 51. What is the molecular mass of Br_2 ?
A. 79.90 amu
B. 79.90 g
C. 159.8 amu
D. 159.8 g

____ 52. What is the mass of 3.50×10^{24} Ti atoms?
A. 47.9 amu
B. 47.9 g
C. 5.81 g
D. 278 g

____ 53. What is the mass of 4.50×10^{22} Cu atoms?
A. 7.47×10^{-2} g
B. 7.47×10^{-2} amu
C. 4.75 g
D. 63.55 amu

____ 54. If 0.274 moles of a substance weighs 62.5 g, what is the molar mass of the substance, in units of g/mol?
A. 2.28×10^{2} g/mol
B. 1.71×10^{1} g/mol
C. 4.38×10^{-3} g/mol
D. 2.17×10^{2} g/mol

____ 55. Which one of the following does *not* represent 1.000 mol of the indicated substance?
A. 6.022×10^{23} C atoms
B. 26.00 g Fe
C. 12.01 g C
D. 65.39 g Zn

____ 56. Which of the following samples contains the greatest number of atoms?
A. 100 g of Pb
B. 2.0 mole of Ar
C. 0.1 mole of Fe
D. 5 g of He

____ 57. Which of the following CO_2 samples contains the greatest number of moles of CO_2?
A. 3.5 moles CO_2
B. 3.21×10^{23} CO_2 molecules
C. 4.50×10^{22} CO_2 molecules
D. 5.60 g CO_2

____ 58. Calculate the molecular mass of menthol, $C_{10}H_{20}O$.
A. 156.26 amu
B. 140.26 amu
C. 29.02 amu
D. 48.17 amu

____ 59. Calculate the mass of 0.00456 moles of $(NH_4)_2SO_4$
A. 132 g
B. 3.45×10^{-5} g
C. 114 g
D. 0.603 g

____ 60. How many moles of O are in 2.45 moles of H_2CO_3?
A. 2.45 moles O
B. 39.2 moles O
C. 118 moles O
D. 7.35 moles O

____ 61. How many O atoms are there in 51.4 g $CaSO_4$?
A. 4.00
B. 2.40×10^{24}
C. 1.13
D. 9.09×10^{23}

____ 62. How many grams of nitrogen are there in 7.5 g of $Ca(NO_3)_2$?
A. 0.64 g
B. 1.3 g
C. 0.15 g
D. 1.2 g

____ 63. What is the mass of 0.55 mole of C_6H_6?
A. 78.11 g
B. 78.11 amu
C. 42.96 g
D. 42.96 amu

____ 64. A compound with an empirical formula of C_2H_4Br has a molar mass of 215.90 g/mol. What is the molecular formula?
A. $C_4H_8Br_2$
B. C_2H_4Br
C. CHBr
D. $C_6H_{12}Br_3$

____ 65. The empirical formula of a compound of uranium and fluorine that is composed of 67.6% uranium and 32.4% fluorine is
A. U_2F
B. U_3F_4
C. UF_4
D. UF_6

____ 66. What is the coefficient for O_2 when the following combustion reaction of a hydrocarbon is balanced?

___ C_7H_{14} + ___ O_2 → ___ CO_2 + ___ H_2O

A. 42
B. 21
C. 11
D. 10

____ 67. What is the coefficient for O_2 when the following combustion reaction of a fatty acid is properly balanced?

$$\_\_\ C_{18}H_{36}O_2 + \_\_\ O_2 \rightarrow \_\_\ CO_2 + \_\_\ H_2O$$

A. 1
B. 8
C. 9
D. 26

____ 68. What is the coefficient of O_2 when the following equation is properly balanced?

$$\_\_\_\ CH_3OH + \_\_\_\ O_2 \rightarrow \_\_\_\ CO_2 + \_\_\_\ H_2O$$

A. 1
B. 2
C. 3
D. 7

____ 69. Lithium metal reacts with nitrogen gas to form lithium nitride. Identify the balanced reaction that describes this process.

A. $Li + N \rightarrow LiN$
B. $Li + N_2 \rightarrow LiN_2$
C. $2Li + N_2 \rightarrow Li_2N_2$
D. $6Li + N_2 \rightarrow 2Li_3N$

____ 70. When 22.0 g NaCl and 21.0 g H_2SO_4 are mixed and react according to the equation below, which is the limiting reagent?

$$2NaCl + H_2SO_4 \rightarrow Na_2SO_4 + 2HCl$$

A. NaCl
B. H_2SO_4
C. Na_2SO_4
D. HCl.

____ 71. Chlorine gas reacts with phosphorus to produce phosphorus pentachloride. How many grams of PCl_5 are produced from 3.5 g of Cl_2 and excess P?

$$5Cl_2(g) + 2P(s) \rightarrow 2PCl_5(s)$$

A. 1.4 g
B. 4.1 g
C. 8.2 g
D. 0.020 g

____ 72. How many grams of Cl_2 can be prepared from the reaction of 16.0 g of MnO_2 and 30.0 g of HCl according to the following chemical equation?

$$MnO_2 + 4HCl \rightarrow MnCl_2 + Cl_2 + 2H_2O$$

A. 0.82 g
B. 5.8 g
C. 13.0 g
D. 14.6 g

____ 73. Ammonia reacts with oxygen to form nitric oxide and water vapor:

$$4NH_3 + 5O_2 \rightarrow 4NO + 6H_2O$$

What is the theoretical yield of water, in moles, when 40.0 g NH_3 and 50.0 g O_2 are mixed and allowed to react?

A. 1.30 mol
B. 1.57 mol
C. 1.87 mol
D. 3.53 mol

____ 74. The first step in the Ostwald process for producing nitric acid is

$$4NH_3(g) + 5O_2(g) \rightarrow 4NO(g) + 6H_2O(g).$$

If the reaction of 150. g of ammonia with 150. g of oxygen gas yields 87. g of nitric oxide (NO), what is the percent yield of this reaction?

A. 33%
B. 49%
C. 62%
D. 77%

____ 75. When octane (C_8H_{18}) is burned in a particular internal combustion engine, the yield of products (carbon dioxide and water) is 93%. What mass of carbon dioxide will be produced in this engine when 15.0 g of octane is burned with 15.0 g of oxygen gas?

A. 12. g
B. 13. g
C. 21 g
D. 43. g

____ 76. The Hall process for the production of aluminum involves the reaction of aluminum oxide with elemental carbon to give aluminum metal and carbon monoxide. If the yield of this reaction is 75%, what mass of aluminum metal can be produced from the reaction of 1.65×10^6 g of aluminum oxide with 1.50×10^6 g of carbon?

A. 1.6×10^5 g
B. 1.7×10^6 g
C. 3.3×10^5 g
D. 6.6×10^5 g

____ 77. Identify the *major* ionic species present in an aqueous solution of NH_4ClO_4.

A. NH_4^+, Cl^-, $4O^{2-}$

B. N^{3-}, $4H^+$, Cl^-, $4O^{2-}$

C. $4NH^+$, $4ClO^-$

D. NH_4^+, ClO_4^-

____ 78. Identify the *major* ionic species present in an aqueous solution of $FeCl_3$.

A. Fe^+, Cl_3^-

B. Fe^{3+}, Cl_3^{3-}

C. Fe^{3+}, 3 Cl^-

D. Fe^{2+}, 3 Cl^-

____ 79. Based on the solubility rules, which one of the following compounds should be *insoluble* in water?

A. NaCl

B. $MgBr_2$

C. $FeCl_2$

D. AgBr

____ 80. Based on the solubility rules, which of the following should be *soluble* in water?

A. $CaSO_4$

B. $BaSO_4$

C. $PbSO_4$

D. KK_2SO_4

____ 81. Which of the following will occur when solutions of $CuSO_4(aq)$ and $BaCl_2(aq)$ are mixed?

A. A precipitate of $CuCl_2$ will form; Ba^{2+} and SO_4^{2-} are spectator ions.

B. A precipitate of $CuSO_4$ will form; Ba^{2+} and Cl^- are spectator ions.

C. A precipitate of $BaSO_4$ will form; Cu^{2+} and Cl^- are spectator ions.

D. A precipitate of $BaCl_2$ will form; Cu^{2+} and SO_4^{2-} are spectator ions.

____ 82. Identify the precipitate(s) formed when solutions of $Ca(ClO_4)_2(aq)$, $K_2CO_3(aq)$, and $NaNO_3(aq)$ are mixed.

A. $CaCO_3$

B. Na_2CO_3

C. $Ca(NO_3)_2$ and $NaClO_4$

D. $CaCO_3$ and Na_2CO_3

____ 83. Identify the correct *net ionic equation* for the reaction that occurs when solutions of $Pb(NO_3)_2$ and NH_4Cl are mixed.

A. $Pb(NO_3)_2(aq) + 2NH_4Cl(aq) \rightarrow NH_4NO_3(aq) + PbCl_2(s)$

B. $Pb^{2+}(aq) + 2Cl^-(aq) \rightarrow PbCl_2(s)$

C. $Pb^{2+}(aq) + 2NO_3^-(aq) + 2NH_4^+(aq) + 2Cl^-(aq) \rightarrow 2NH_4^+(aq) + 2NO_3^-(aq) + PbCl_2(s)$

D. $NH_4^+(aq) + NO_3^-(aq) \rightarrow 2NH_4NO_3(s)$

____ 84. The common constituent in all acid solutions is

A. H_2

B. H^+

C. OH^-

D. H_2SO_4

____ 85. Which of the following compounds is a *strong acid*?

A. HF

B. HI

C. $HClO_2$

D. H_2SO_3

____ 86. Identify the correct *net ionic equation* for the reaction that occurs when solutions of HNO_3 and KOH are mixed?

A. $HNO_3(aq) + KOH(aq) \rightarrow H_2O(l) + KNO_3(aq)$

B. $K^+(aq) + NO_3^-(aq) \rightarrow KNO_3(aq)$

C. $HNO_3(aq) + KOH(aq) \rightarrow H_2O(l) + KNO_3(s)$

D. $H^+(aq) + OH^-(aq) \rightarrow H_2O(l)$

____ 87. The oxidation number of Fe in $K_3Fe(CN)_6$ is

A. +3

B. +2

C. +1

D. –3

____ 88. For which one of the following acids is chlorine in the +5 oxidation state?

A. HCl

B. HClO

C. $HClO_2$

D. $HClO_3$

____ 89. What element is *reduced* in the following chemical reaction?

$Cu + 2H_2SO_4 \rightarrow CuSO_4 + SO_2 + 2H_2O$

A. Cu

B. H

C. S

D. O

____ 90. Predict the products of the following single replacement reaction.

$Fe(s) + CuSO_4(aq) \rightarrow$

A. $Cu(s) + FeSO_4(aq)$

B. $Fe(s) + Cu(s) + SO_4(aq)$

C. $CuS(s) + Fe_2SO_4(aq)$

D. $FeCuSO_4(aq)$

____ 91. Which of the following represents a *precipitation reaction*?

A. $2H_2(g) + O_2(g) \rightarrow 2H_2O(l)$

B. $CaBr_2(aq) + H_2SO_4(aq) \rightarrow CaSO_4(s) + 2HBr(g)$

C. $2KNO_3(s) \rightarrow 2KNO_2(s) + O_2(g)$

D. $2KBr(aq) + Cl_2(g) \rightarrow 2KCl(aq) + Br_2(l)$

____ 92. Which of the following represents an *acid-base neutralization reaction*?

A. $2Al(s) + 3H_2SO_4(aq) \rightarrow Al_2(SO_4)_3(aq) + 3H_2(g)$

B. $SO_2(g) + H_2O(l) \rightarrow H_2SO_3(g)$

C. $LiOH(aq) + HNO_3(aq) \rightarrow LiNO_3(aq) + H_2O(l)$

D. $2KBr(aq) + Cl_2(g) \rightarrow 2KCl(aq) + Br_2(l)$

____ 93. Which of the following represents a *combustion reaction*?

A. $2C_2H_6(g) + 7O_2(g) \rightarrow 4CO_2(g) + 6H_2O(l)$

B. $LiOH(aq) + HNO_3(aq) \rightarrow LiNO_3(aq) + H_2O(l)$

C. $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$

D. $2Na(s) + 2H_2O(l) \rightarrow 2NaOH(aq) + H_2(g)$

____ 94. What type of reaction is the following?

$Ca(OH)_2(s) + 2\ HNO_3(aq) \rightarrow Ca(NO_3)_2(aq) + 2\ H_2O(l)$

A. Combination reaction

B. Acid-base neutralization reaction

C. Hydrogen displacement reaction

D. Disproportionation reaction

____ 95. What mass of $C_6H_{12}O_6$ (glucose) is needed to prepare 450. mL of a 0.650 M solution of glucose in water?

A. 0.293 g

B. 293 g

C. 0.692 g

D. 52.7 g

____ 96. What mass of K_2CO_3 is needed to prepare 200. mL of a solution having a potassium ion concentration of 0.150 M?

A. 4.15 g

B. 10.4 g

C. 13.8 g

D. 2.07 g

____ 97. A 50.0 mL sample of 0.436 M NH_4NO_3 is diluted with water to a total volume of 250.0 mL. What is the ammonium nitrate concentration in the resulting solution?

A. 21.8 M

B. 0.459 M

C. 2.18×10^{-2} M

D. 8.72×10^{-2} M

____ 98. When 38.0 mL of 0.1250 M H_2SO_4 is added to 100. mL of a solution of PbI_2, a precipitate of PbSO4 forms. The $PbSO_4$ is then filtered from the solution, dried, and weighed. If the recovered $PbSO_4$ is found to have a mass of 0.0471 g, what was the concentration of iodide ions in the original solution?

A. 3.10×10^{-4} M

B. 1.55×10^{-4} M

C. 6.20×10^{-3} M

D. 3.11×10^{-3} M

____ 99. Lithium metal dissolves in water to yield hydrogen gas and aqueous lithium hydroxide. What is the final concentration of hydroxide ions when 5.500 g of lithium metal is dropped into 750. mL of water?

A. 1.06 M

B. 0.528 M

C. 2.11 M

D. 0.792 M

____100. A 250. mL sample of 0.0328M HCl is partially neutralized by the addition of 100. mL of 0.0245M NaOH. Find the concentration of hydrochloric acid in the resulting solution.

A. 0.00700 M

B. 0.0164 M

C. 0.0383 M

D. 0.0230 M