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

Final Exam Review2014

Matching

Match each item with the correct statement below.

a. actual yield
b. percent yield
c. theoretical yield
d. excess reagent
e. limiting reagent
f. mass
g. number of molecules
h. volume

____ 1. This is conserved only in reactions where the temperature is constant and the number of moles of gaseous reactants is the same as that of gaseous products.

____ 2. the ratio of the actual yield to the theoretical yield

____ 3. the reactant that determines the amount of product that can be formed in a reaction

____ 4. This quantity can always be used in the same way as moles when interpreting balanced chemical equations.

____ 5. the maximum amount of product that could be formed from given amounts of reactants

____ 6. the amount of product formed when a reaction is carried out in the laboratory

____ 7. This is conserved in every ordinary chemical reaction.

____ 8. the reactant that is not completely used up in a reaction

Match each item with the correct statement below.

a. halide ion
b. octet rule
c. ionic bond
d. electron dot structure
e. valence electron
f. coordination number
g. metallic bond

____ 9. the number of ions of opposite charge surrounding each ion in a crystal

____ 10. Atoms react so as to acquire the stable electron structure of a noble gas.

____ 11. the attraction of valence electrons for metal ions

____ 12. a depiction of valence electrons around the symbol of an element

____ 13. an electron in the highest occupied energy level of an atom

____ 14. an anion of chlorine or other halogen

____ 15. the force of attraction binding oppositely charged ions together

Match each item with the correct statement below.

a. coordinate covalent bond
b. double covalent bond
c. structural formula
d. single covalent bond
e. polar bond
f. hydrogen bond

____ 16. a depiction of the arrangement of atoms in molecules and polyatomic ions

____ 17. a covalent bond between two atoms of significantly different electronegativities

____ 18. a type of bond that is very important in determining the properties of water and of important biological molecules such as proteins and DNA

____ 19. a covalent bond in which two pairs of electrons are shared

____ 20. a covalent bond in which the shared electron pair comes from only one of the atoms

____ 21. a covalent bond in which only one pair of electrons is shared

Match each item with the correct statement below.

a. monatomic ion
b. acid
c. base
d. law of definite proportions
e. law of multiple proportions
f. cation
g. binary compound
h. anion
i. polyatomic ion

____ 22. produces a hydroxide ion when dissolved in water

____ 23. In any chemical compound, the masses of elements are always in the same proportion by mass.

____ 24. when two elements form more than one compound, the masses of one element that combine with the same mass of the other element are in the ratio of small, whole numbers

____ 25. atom or group of atoms having a negative charge

____ 26. tightly-bound group of atoms that behaves as a unit and carries a net charge

____ 27. atom or group of atoms having a positive charge

____ 28. produces a hydrogen ion when dissolved in water

____ 29. consists of a single atom with a positive or negative charge

____ 30. compound composed of two different elements

Match each item with the correct statement below.

a. representative particle
b. mole
c. Avogadro's number
d. percent composition
e. standard temperature and pressure
f. empirical formula

____ 31. the number of representative particles of a substance present in 1 mole of that substance

____ 32. the SI unit used to measure amount of substance

____ 33. 0°C and 1 atm

____ 34. an atom, an ion, or a molecule, depending upon the way a substance commonly exists

____ 35. the smallest whole number ratio of the atoms in a compound

____ 36. the percent by mass of each element in a compound

Match each item with the correct statement below.

a. molar volume
b. molar mass
c. atomic mass

____ 37. the number of grams of an element that is numerically equal to the atomic mass of the element in amu

____ 38. the mass of a mole of any element or compound

____ 39. the volume occupied by a mole of any gas at STP

Match each item with the correct statement below.

a. network solid
b. bonding orbital
c. dipole interaction
d. bond dissociation energy
e. tetrahedral angle
f. VSEPR theory
g. sigma bond

____ 40. 109.5°

____ 41. molecular orbital that can be occupied by two electrons of a covalent bond

____ 42. shapes adjust so valence-electron pairs are as far apart as possible

____ 43. crystal in which all the atoms are covalently bonded to each other

____ 44. energy needed to break a single bond between two covalently bonded atoms

____ 45. symmetrical bond along the axis between the two nuclei

____ 46. attraction between polar molecules

Match each item with the correct statement below.

a. product
b. reactant
c. chemical equation
d. balanced equation
e. skeleton equation

____ 47. a chemical equation that does not indicate relative amounts of reactants and products

____ 48. a new substance formed in a chemical reaction

____ 49. a starting substance in a chemical reaction

____ 50. a concise representation of a chemical reaction

____ 51. an equation in which each side has the same number of atoms of each element

Match each item with the correct statement below.

a. activity series of metals
b. single-replacement reaction
c. combustion reaction
d. decomposition reaction

____ 52. a reaction in which oxygen reacts with another substance, often producing heat or light

____ 53. a reaction in which a single compound is broken down into simpler substances

____ 54. a reaction in which the atoms of one element replace the atoms of a second element in a compound

____ 55. a list of metals in order of decreasing reactivity

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

____ 56. What are the weakest attractions between molecules?
a. covalent forces
b. ionic forces
c. hydrogen forces
d. Van der Waals forces

____ 57. What is the percent composition of carbon, in heptane, C_7H_{16}?
a. 19%
b. 68%
c. 84%
d. 12%

____ 58. What is the formula unit of sodium nitride?
a. NaN
b. Na_2N
c. Na_3N
d. NaN_3

____ 59. When glucose is consumed, it reacts with oxygen in the body to produce carbon dioxide, water, and energy. How many grams of carbon dioxide would be produced if 45 g of $C_6H_{12}O_6$ completely reacted with oxygen?
a. 11 g
b. 1.8 g
c. 1.5 g
d. 66 g

____ 60. How many moles of $CaBr_2$ are in 5.0 grams of $CaBr_2$?
a. 4.2×10^{-2} mol
b. 2.5×10^{-2} mol
c. 1.0×10^{3} mol
d. 4.0×10^{1} mol

____ 61. When naming a transition metal ion that can have more than one common ionic charge, the numerical value of the charge is indicated by a ____.
a. suffix
b. Roman numeral following the name
c. superscript after the name
d. prefix

____ 62. The reaction $2Fe + 3Cl_2 \rightarrow 2FeCl_3$ is an example of which type of reaction?
a. combination reaction
b. single-replacement reaction
c. decomposition reaction
d. combustion reaction

____ 63. If 20.0 grams of Ca combines completely with 16.0 grams of S to form a compound, what is the percent composition of Ca in the compound?
a. 44.4%
b. 20.0%
c. 55.6%
d. 1.25%

____ 64. How many moles of tungsten atoms are in 4.8×10^{25} atoms of tungsten?
a. 1.3×10^{-1} moles
b. 8.0×10^{2} moles
c. 1.3×10^{-2} moles
d. 8.0×10^{1} moles

____ 65. How does calcium obey the octet rule when reacting to form compounds?
a. It gains electrons.
b. Calcium does not obey the octet rule.
c. It gives up electrons.
d. It does not change its number of electrons.

____ 66. Which of the following formulas represents an ionic compound?
a. CS_2
b. N_2O_4
c. PCl_3
d. BaI_2

____ 67. What are the coefficients that will balance the skeleton equation below?
$N_2 + H_2 \rightarrow NH_3$
a. 1, 3, 2
b. 1, 1, 2
c. 1, 3, 3
d. 3, 1, 2

____ 68. When 0.1 mol of calcium reacts with 880 g of water, 2.24 L of hydrogen gas form (at STP). How would the amount of hydrogen produced change if the volume of water was decreased to 440 mL (440 g)?
a. Only one half the volume of hydrogen would be produced.
b. The volume of hydrogen produced would double.
c. The volume of hydrogen produced would be the same.
d. No hydrogen would be produced.

____ 69. Which set of chemical name and chemical formula for the same compound is correct?
a. ammonium sulfite, $(NH_4)_2S$
b. magnesium dichromate, $MgCrO_4$
c. iron(III) phosphate, $FePO_4$
d. lithium carbonate, $LiCO_3$

____ 70. Which of the following correctly represents an ion pair and the ionic compound the ions form?
a. Pb^{4+}, O^{2-}; Pb_2O_4
b. Na^+, Cl^-; $NaCl_2$
c. Ba^{2+}, O^{2-}; Ba_2O_2
d. Ca^{2-}, F^-; CaF_2

____ 71. If you rewrite the following word equation as a balanced chemical equation, what will the coefficient and symbol for fluorine be?
nitrogen trifluoride → nitrogen + fluorine
a. $3F_2$
b. 6F
c. $6F_2$
d. F_3

____ 72. In order for the reaction $2Al + 6HCl \rightarrow 2AlCl_3 + 3H_2$ to occur, which of the following must be true?
a. Al must be above Cl on the activity series.
b. A precipitate must be formed.
c. Heat must be supplied for the reaction.
d. Al must be above H on the activity series.

____ 73. Symbols used in equations, together with the explanations of the symbols, are shown below. Which set is correct?
a. (*aq*), dissolved in water
b. (*g*), grams
c. (*l*), liters
d. (*s*), solid product

____ 74. The equation $Mg(s) + 2HCl(aq) \rightarrow MgCl_2(aq) + H_2(g)$ is an example of which type of reaction?
a. combination reaction
b. double-replacement reaction
c. decomposition reaction
d. single-replacement reaction

____ 75. Molecular compounds are usually ____.
a. composed of two or more transition elements
b. composed of positive and negative ions
c. exceptions to the law of definite proportions
d. composed of two or more nonmetallic elements

____ 76. What is the maximum charge an ion is likely to have?
a. 2
b. 5
c. 4
d. 3

____ 77. A molecule with a single covalent bond is ____.
a. CO
b. Cl_2
c. CO_2
d. N_2

____ 78. Which of the following is true about the total number of reactants and the total number of products in the reaction shown below?
$C_5H_{12}(l) + 8O_2(g) \rightarrow 5CO_2(g) + 6H_2O(g)$
a. 9 grams of reactants chemically change into 11 grams of product.
b. 9 atoms of reactants chemically change into 11 atoms of product.
c. 9 moles of reactants chemically change into 11 moles of product.
d. 9 liters of reactants chemically change into 11 liters of product.

____ 79. What is the ending for the names of all binary compounds, both ionic and molecular?
a. *-ite*
b. *-ade*
c. *-ate*
d. *-ide*

____ 80. What characteristic of metals makes them good electrical conductors?
a. They have mobile protons.
b. They have mobile cations.
c. They have mobile valence electrons.
d. Their crystal structures can be rearranged easily.

____ 81. What is conserved in the reaction shown below?
$H_2(g) + Cl_2(g) \rightarrow 2HCl(g)$
a. mass and moles only
b. mass only
c. mass, moles, molecules, and volume
d. mass, moles, and molecules only

____ 82. Which of the following is true about an ionic compound?
a. It is a salt.
b. It is held together by ionic bonds.
c. It is composed of anions and cations.
d. all of the above

____ 83. What information is needed to calculate the percent composition of a compound?
a. the formula of the compound and its density
b. the weight of the sample to be analyzed and its molar volume
c. the formula of the compound and the atomic mass of its elements
d. the weight of the sample to be analyzed and its density

____ 84. Why are systematic names preferred over common names?
a. Common names are derived from the method used to obtain the compound.
b. Common names do not provide information about the chemical composition of the compound.
c. Common names were assigned by the scientist who discovered the compound.
d. Common names are not very descriptive.

____ 85. Which of the following is true about the composition of ionic compounds?
a. They are composed of anions only.
b. They are composed of anions and cations.
c. They are composed of cations only.
d. They are formed from two or more nonmetallic elements.

____ 86. The nonmetals in Groups 6A and 7A ____.
a. end in *-ate*
b. have a numerical charge that is found by subtracting 8 from the group number
c. all have ions with a $^{-}1$ charge
d. lose electrons when they form ions

____ 87. When Group 2A elements form ions, they ____.
a. lose two electrons
b. lose two protons
c. gain two electrons
d. gain two protons

____ 88. How does oxygen obey the octet rule when reacting to form compounds?
a. It gains electrons.
b. Oxygen does not obey the octet rule.
c. It gives up electrons.
d. It does not change its number of electrons.

____ 89. The molar mass of a gas can be determined from which of the following?
a. Avogadro's number
b. the density of the gas at STP
c. the volume of a mole of the gas
d. none of the above

____ 90. Which of the following is the correctly balanced equation for the incomplete combustion of heptene, C_7H_{14}?
a. $C_7H_{14} + 7O_2 \rightarrow 7CO + 7H_2O$
b. $C_7H_{14} + O_2 \rightarrow C_7O_2 + 7H_2$
c. $C_7H_{14} + 14O \rightarrow 7CO + 7H_2O$
d. $2C_7H_{14} + 21O_2 \rightarrow 14CO_2 + 14H_2O$

____ 91. What is the net charge of the ionic compound calcium fluoride?
a. 0
b. 1+
c. 1−
d. 2−

____ 92. What is the electron configuration of the oxide ion (O^{2-})?

a. $1s^2 2s^2$
c. $1s^2 2s^2 2p^2$
b. $1s^2 2s^2 2p^6$
d. $1s^2 2s^2 2p^4$

____ 93. How many grams of H_3PO_4 are produced when 10.0 moles of water react with an excess of P_4O_{10}?

$P_4O_{10}(s) + 6H_2O(l) \rightarrow 4H_3PO_4(aq)$

a. 6.7 g
c. 653 g
b. 1.22 g
d. 147 g

____ 94. In which of the following is the name and formula given correctly?

a. sodium oxide, NaO
c. cobaltous chloride, $CoCl_3$
b. barium nitride, BaN
d. stannic fluoride, SnF_4

____ 95. Methane and hydrogen sulfide form when hydrogen reacts with carbon disulfide. Identify the excess reagent and calculate how much remains after 36 L of H_2 reacts with 12 L of CS_2.

$4H_2(g) + CS_2(g) \rightarrow CH_4(g) + 2H_2S(g)$

a. 6 L CS_2
c. 9 L CS_2
b. 3 L CS_2
d. 12 L H_2

____ 96. Which type of stoichiometric calculation does not require the use of the molar mass?

a. mass-mass problems
c. mass-volume problems
b. mass-particle problems
d. volume-volume problems

____ 97. What is the mass in grams of 5.90 mol C_8H_{18}?

a. 19.4 g
c. 389 g
b. 673 g
d. 0.0512 g

____ 98. What causes water molecules to have a bent shape, according to VSEPR theory?

a. interaction between the fixed orbitals of the unshared pairs of oxygen
b. the unusual location of the free electrons
c. repulsive forces between unshared pairs of electrons
d. ionic attraction and repulsion

____ 99. Given 1.00 mole of each of the following gases at STP, which gas would have the greatest volume?

a. SO_3
c. O_2
b. He
d. All would have the same volume.

____ 100. Aluminum reacts with sulfuric acid to produce aluminum sulfate and hydrogen gas. How many grams of aluminum sulfate would be formed if 250 g H_2SO_4 completely reacted with aluminum?

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

a. 290 g
c. 450 g
b. 870 g
d. 0.85 g

____101. Glucose, $C_6H_{12}O_6$, is a good source of food energy. When it reacts with oxygen, carbon dioxide and water are formed. How many liters of CO_2 are produced when 126 g of glucose completely react with oxygen?
$C_6H_{12}O_6(s) + 6O_2(g) \rightarrow 6CO_2(g) + 6H_2O(l) + 673$ kcal

a. 15.7 L
b. 5.33 L
c. 94.1 L
d. 4.21 L

____102. The mass of a mole of NaCl is the ____.

a. gram atomic mass
b. molecular mass
c. molar mass
d. atomic mass

____103. Which of the following is NOT an empirical formula?

a. $C_2N_2H_8$
b. C_3H_8O
c. $BeCr_2O_7$
d. Sb_2S_3

____104. How many electrons can occupy a single molecular orbital?

a. 0
b. 1
c. 2
d. 4

____105. What is the correct name for the compound $CoCl_2$?

a. cobalt(I) chloride
b. cobalt(II) chlorate
c. cobalt(I) chlorate
d. cobalt(II) chloride

____106. Which element, when combined with fluorine, would most likely form an ionic compound?

a. chlorine
b. lithium
c. carbon
d. phosphorus

____107. How many moles of H_3PO_4 are produced when 71.0 g P_4O_{10} reacts completely to form H_3PO_4?
$P_4O_{10}(s) + 6H_2O(l) \rightarrow 4H_3PO_4(aq)$

a. 16.0 mol
b. 1.00 mol
c. 0.063 5 mol
d. 4.00 mol

____108. Which of the following pairs of elements is most likely to form an ionic compound?

a. nitrogen and sulfur
b. oxygen and chlorine
c. magnesium and fluorine
d. sodium and aluminum

____109. When iron rusts in air, iron(III) oxide is produced. How many moles of oxygen react with 2.4 mol of iron in the rusting reaction?
$4Fe(s) + 3O_2(g) \rightarrow 2Fe2O_3(s)$

a. 3.2 mol
b. 2.4 mol
c. 1.2 mol
d. 1.8 mol

____110. What does an *-ite* or *-ate* ending in a polyatomic ion mean?

a. Sulfur is in the formula.
b. Bromine is in the formula.
c. Nitrogen is in the formula.
d. Oxygen is in the formula.

____111. What is the percent composition of chromium in $BaCrO_4$?

a. 4.87%
b. 9.47%
c. 20.5%
d. 25.2%

____112. If 60.2 grams of Hg combines completely with 24.0 grams of Br to form a compound, what is the percent composition of Hg in the compound?

a. 39.9%
b. 28.5%
c. 60.1%
d. 71.5%

____113. Which of the following compounds contains the lead(II) ion?

a. Pb_2O
b. Pb_2S
c. PbO
d. $PbCl_4$

____114. Which of the following is NOT true about limiting and excess reagents?

a. Some of the excess reagent is left over after the reaction is complete.
b. The reactant that has the smallest given mass is the limiting reagent.
c. A balanced equation is necessary to determine which reactant is the limiting reagent.
d. The amount of product obtained is determined by the limiting reagent.

____115. What is the charge on the cation in the ionic compound sodium sulfide?

a. 0
b. 2+
c. 3+
d. 1+

____116. What is the correct formula for calcium dihydrogen phosphate?

a. $Ca(H_2PO_4)_2$
b. $Ca_2H_2PO_4$
c. $Ca(H_2HPO_4)_2$
d. CaH_2PO_4

____117. What determines that an element is a metal?

a. its position in the periodic table
b. when it is a Group A element
c. the molecules that it forms
d. the magnitude of its charge

____118. Identify the limiting reagent and the volume of CO_2 formed when 11 L CS_2 reacts with 18 L O_2 to produce CO_2 gas and SO_2 gas at STP.

$CS_2(g) + 3O_2(g) \rightarrow CO_2(g) + 2SO_2(g)$

a. O_2; 27 L CO_2
b. CS_2; 11 L CO_2
c. O_2; 6.0 L CO_2
d. CS_2; 5.5 L CO_2

____119. What type of ions have names ending in *-ide*?

a. only gaseous ions
b. only anions
c. only cations
d. only metal ions

____120. Which of the following correctly shows a prefix used in naming binary molecular compounds with its corresponding number?

a. *hexa-*, 8
b. *octa-*, 4
c. *deca-*, 7
d. *nona-*, 9

____121. How many liters of NH_3, at STP, will react with 5.3 g O_2 to form NO_2 and water?

$4NH_3(g) + 7O_2(g) \rightarrow 4NO_2 + 6H_2O(g)$

a. 3.03 L
b. 0.004 23 L
c. 2.12 L
d. 6.49 L

____122. A skeleton equation does NOT show which of the following?

a. an arrow connecting the reactants to the products
b. the relative amounts of reactants and products
c. the correct formulas of the reactants and products
d. the reactants on the left, the products on the right

____123. What SI unit is used to measure the number of representative particles in a substance?

a. kilogram
b. kelvin
c. ampere
d. mole

____124. Iron(III) oxide is formed when iron combines with oxygen in the air. How many grams of Fe_2O_3 are formed when 16.7 g of Fe reacts completely with oxygen?

$4Fe(s) + 3O_2(g) \rightarrow 2Fe_2O_3(s)$

a. 12.0 g
b. 47.8 g
c. 23.9 g
d. 95.6 g

____125. Which of the following statements is NOT true about double-replacement reactions?

a. The product may precipitate from solution.
b. The product may be a gas.
c. The product may be a molecular compound.
d. The reactant may be a solid metal.

____126. Which of the following correctly provides the name of the element, the symbol for the ion, and the name of the ion?

a. copper, Cu^+, cuprous ion
b. sulfur, S^{2-}, sulfurous ion
c. fluorine, F^+, fluoride ion
d. zinc, Zn^{2+}, zincate ion

____127. A 22.4-L sample of which of the following substances, at STP, would contain 6.02×10^{23} representative particles?

a. oxygen
b. gold
c. cesium iodide
d. sulfur

____128. Chemical reactions ____.

a. create and destroy atoms
b. occur only in living organisms
c. only occur outside living organisms
d. produce new substances

____129. What is the correct formula for barium chlorate?

a. $BaCl_2$
b. $Ba(ClO_2)_2$
c. $Ba(ClO)_2$
d. $Ba(ClO_3)_2$

____130. How many valence electrons are transferred from the nitrogen atom to potassium in the formation of the compound potassium nitride?

a. 3
b. 0
c. 1
d. 2

____131. The equation below shows the decomposition of lead nitrate. How many grams of oxygen are produced when 11.5 g NO_2 is formed?

$2Pb(NO_3)_2(s) \rightarrow 2PbO(s) + 4NO_2(g) + O_2(g)$

a. 2.88 g
b. 1.00 g
c. 32.0 g
d. 2.00 g

____132. Which of the following is a binary molecular compound?

a. AgI
b. $BeHCO_3$
c. PCl_5
d. MgS

____133. At STP, how many liters of oxygen are required to react completely with 3.6 liters of hydrogen to form water?

$2H_2(g) + O_2(g) \rightarrow 2H_2O(g)$

a. 2.4 L
b. 3.6 L
c. 2.0 L
d. 1.8 L

____134. Use the activity series of metals to complete a balanced chemical equation for the following single replacement reaction.

$Ag(s) + KNO_3(aq) \rightarrow$

a. $AgK + NO_3$
b. $AgKNO_3$
c. No reaction takes place because silver is less reactive than potassium.
d. $AgNO_3 + K$

____135. Under what conditions can potassium bromide conduct electricity?

a. only when it is in crystal form
b. only when melted
c. only when dissolved
d. only when melted or dissolved in water

____136. An *-ate* or *-ite* at the end of a compound name usually indicates that the compound contains ____.

a. neutral molecules
b. fewer electrons than protons
c. a polyatomic anion
d. only two elements

____137. What is the number of moles in 9.63 L of H_2S gas at STP?

a. 14.7 mol
b. 0.104 mol
c. 0.430 mol
d. 3.54 mol

____138. Which of the following compounds has the formula KNO_3?

a. potassium nitrite
b. potassium nitride
c. potassium nitrate
d. potassium nitrogen oxide

____139. How many valence electrons does a helium atom have?
a. 3
b. 2
c. 4
d. 5

____140. Hydrogen gas can be produced by reacting aluminum with sulfuric acid. How many moles of sulfuric acid are needed to completely react with 15.0 mol of aluminum?
$2Al(s) + 3H_2SO_4(aq) \rightarrow Al_2(SO_4)_3(aq) + 3H_2(g)$
a. 22.5 mol
b. 15.0 mol
c. 10.0 mol
d. 0.100 mol

____141. In a combustion reaction, one of the reactants is ____.
a. oxygen
b. hydrogen
c. nitrogen
d. a metal

____142. Which of the following statements is NOT true about what happens in all chemical reactions?
a. The bonds of the reactants are broken and new bonds of the products are formed.
b. The ways in which atoms are joined together are changed.
c. The starting substances are called reactants.
d. New atoms are formed as products.

____143. Which of the following is the correct name for N_2O_5?
a. dinitrogen pentoxide
b. nitrogen dioxide
c. nitrate oxide
d. nitrous oxide

____144. How many grams of chromium are needed to react with an excess of $CuSO_4$ to produce 27.0 g Cu?
$2Cr(s) + 3CuSO_4(aq) \rightarrow Cr_2(SO_4)_3(aq) + 3Cu(s)$
a. 33.2 g
b. 81.5 g
c. 18.0 g
d. 14.7 g

____145. How many liters of hydrogen gas are needed to react with CS_2 to produce 2.50 L of CH_4 at STP?
$4H_2(g) + CS_2(l) \rightarrow CH_4(g) + 2H_2S(g)$
a. 10.0 L
b. 5.00 L
c. 2.50 L
d. 7.50 L

____146. In every chemical reaction, ____.
a. mass and atoms are conserved
b. mass and molecules are conserved
c. moles and liters are conserved
d. moles and molecules are conserved

____147. What is the empirical formula of a substance that is 53.5% C, 15.5% H, and 31.1% N by weight?
a. CH_4N_7
b. C_3HN_2
c. C_2H_8N
d. $C_4H_{14}N_2$

____148. The products of a combustion reaction do NOT include ____.
a. carbon dioxide
b. water
c. hydrogen
d. carbon monoxide

____149. Which of the following statements is true about the following reaction?
$3NaHCO_3(aq) + C_6H_8O_7(aq) \rightarrow 3CO_2(g) + 3H_2O(s) + Na_3C_6H_5O_7(aq)$

a. 22.4 L of $CO_2(g)$ are produced for every liter of $C_6H_8O_7(aq)$ reacted.

b. 6.02×10^{23} molecules of $Na_3C_6H_5O_7(aq)$ are produced for every mole of $NaHCO_3(aq)$ used.

c. 1 mole of water is produced for every mole of carbon dioxide produced.

d. 54 g of water are produced for every mole of $NaHCO_3(aq)$ produced.

____150. What is the correct name for the N^{3-} ion?

a. nitrate ion
b. nitrite ion
c. nitride ion
d. nitrogen ion

____151. What is the density at STP of the gas sulfur hexafluoride, SF_6?

a. 0.153 g/L
b. 3.93×10^{24} g/L
c. 3270 g/L
d. 6.52 g/L

____152. What is the percent by mass of carbon in acetone, C_3H_6O?

a. 30.0%
b. 1.61%
c. 20.7%
d. 62.1%

____153. What is the name of the ionic compound formed from lithium and bromine?

a. lithium bromide
b. lithium bromine
c. lithium bromium
d. lithium bromate

____154. What is the correct formula for potassium sulfite?

a. K_2SO_4
b. $KHSO_4$
c. $KHSO_3$
d. K_2SO_3

____155. Which of the following is NOT a cation?

a. mercurous ion
b. Ca^{2+}
c. sulfate
d. iron(III) ion

____156. Calculate the number of moles of Al_2O_3 that are produced when 0.60 mol of Fe is produced in the following reaction.
$2Al(s) + 3FeO(s) \rightarrow 3Fe(s) + Al_2O_3(s)$

a. 0.90 mol
b. 0.60 mol
c. 0.20 mol
d. 0.40 mol

____157. If the density of an unknown gas Z is 4.50 g/L at STP, what is the molar mass of gas Z?

a. 26.9 g/mol
b. 0.201 g/mol
c. 101 g/mol
d. 5.00 g/mol

____158. What is the number of moles in 432 g $Ba(NO_3)_2$?

a. 3.66 mol
b. 0.237 mol
c. 0.605 mol
d. 1.65 mol

____159. What is the electron configuration of the iodide ion?

a. $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^6 4d^{10} 5s^2$
b. $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^6 4d^{10}$
c. $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^6 4d^{10} 5s^2 5p^6$
d. $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^6$

____160. Which of the following particles are free to drift in metals?

a. cations
b. neutrons
c. protons
d. electrons

____161. Mercury can be obtained by reacting mercury(II) sulfide with calcium oxide. How many grams of calcium oxide are needed to produce 36.0 g of Hg?
$4HgS(s) + 4CaO(s) \rightarrow 4Hg(l) + 3CaS(s) + CaSO_4$

a. 13.4 g
b. 10.1 g
c. 7.56 g
d. 1.80 g

____162. In order to predict whether or not a single-replacement reaction takes place, you need to consult a chart that shows the ____.

a. ionic charges of representative elements
b. common polyatomic ions
c. periodic table
d. activity series of metals

____163. In which of the following are the formula of the ionic compound and the charge on the metal ion shown correctly?

a. IrS_2, Ir^{2+}
b. ThO_2, Th^{4+}
c. UCl_5, U^+
d. NiO, Ni^+

____164. What is the number of moles in 500 L of He gas at STP?

a. 22 mol
b. 0.2 mol
c. 0.05 mol
d. 90 mol

____165. Which of the following is NOT a reason why actual yield is less than theoretical yield?

a. loss of product during purification
b. competing side reactions
c. conservation of mass
d. impure reactants present

____166. How many valence electrons are in an atom of phosphorus?

a. 3
b. 2
c. 4
d. 5

____167. What is the volume, in liters, of 0.500 mol of C_3H_8 gas at STP?

a. 16.8 L
b. 22.4 L
c. 0.0335 L
d. 11.2 L

____168. Which of the following elements exists as a diatomic molecule?
a. sulfur
b. neon
c. lithium
d. nitrogen

____169. What is the formula unit of aluminum oxide?
a. Al_3O
b. Al_2O_3
c. AlO_3
d. AlO

____170. In a particular reaction between copper metal and silver nitrate, 12.7 g Cu produced 38.1 g Ag. What is the percent yield of silver in this reaction?
$Cu + 2AgNO_3 \rightarrow Cu(NO_3)_2 + 2Ag$
a. 56.7%
b. 77.3%
c. 88.2%
d. 176%

____171. Which of the following would be the limiting reagent in the reaction shown below?
$2H_2(g) + O_2(g) \rightarrow 2H_2O(g)$
a. 50 molecules of H_2
b. 50 molecules of O_2
c. Neither a nor b is limiting.
d. Both a and b are considered limiting reagents.

____172. Chemical equations must be balanced to satisfy ____.
a. the law of multiple proportions
b. Avogadro's principle
c. the law of definite proportions
d. the law of conservation of mass

____173. Which of the following correctly provides the names and formulas of polyatomic ions?
a. sulfite: S^{2-}; sulfate: SO_3^-
b. nitrite: NO^-; nitrate: NO_2^-
c. carbonate: HCO_3^-; bicarbonate: CO_3^{2-}
d. chromate: CrO_4^{2-}; dichromate: $Cr_2O_7^{2-}$

____174. If 1 egg and 1/3 cup of oil are needed for each bag of brownie mix, how many bags of brownie mix do you need if you want to use up all 3 eggs and 1 cup of oil?
a. 4
b. 2
c. 1
d. 3

____175. How many valence electrons are in a silicon atom?
a. 2
b. 4
c. 8
d. 6

____176. What is conserved in the reaction shown below?
$N_2(g) + 3F_2(g) \rightarrow 2NF_3(g)$
a. atoms only
b. moles only
c. mass only
d. mass and atoms only

____177. Which type of solid has the highest melting point?
a. nonmetallic solid
b. network solid
c. metal
d. ionic solid

____178. Which set of chemical name and chemical formula for the same compound is correct?
a. aluminum fluorate, AlF_3
b. potassium chloride, K_2Cl_2
c. iron(II) oxide, Fe_2O_3
d. tin(IV) bromide, $SnBr_4$

____179. How are chemical formulas of binary ionic compounds generally written?
a. subscripts first, then ions
b. Roman numeral first, then anion, then cation
c. anion on left, cation on right
d. cation on left, anion on right

____180. A catalyst is ____.
a. one of the reactants in single-replacement reactions
b. not used up in a reaction
c. the product of a combustion reaction
d. a solid product of a reaction

____181. What is the molar mass of $(NH_4)_2CO_3$?
a. 78 g
b. 144 g
c. 96 g
d. 138 g

____182. The equation $2C_3H_7OH + 9O_2 \rightarrow 6CO_2 + 8H_2O$ is an example of which type of reaction?
a. decomposition reaction
b. single-replacement reaction
c. double-replacement reaction
d. combustion reaction

____183. When the following equation is balanced, what is the coefficient for HCl?
$Mg(s) + HCl(aq) \rightarrow MgCl_2(aq) + H_2(g)$
a. 3
b. 1
c. 6
d. 2

____184. What is the maximum number of grams of PH_3 that can be formed when 6.2 g of phosphorus reacts with 4.0 g of hydrogen to form PH_3?
$P_4(g) + 6H_2(g) \rightarrow 4PH_3(g)$
a. 0.43 g
b. 45 g
c. 6.8 g
d. 270 g

____185. Which statement is true if 12 mol CO and 12 mol Fe_2O_3 are allowed to react?
$3CO(g) + Fe_2O_3(s) \rightarrow 2Fe(s) + 3CO_2(g)$
a. The limiting reagent is Fe_2O_3 and 24 mol Fe will be formed.
b. The limiting reagent is Fe_2O_3 and 36 mol CO_2 will be formed.
c. The limiting reagent is CO and 3.0 mol CO_2 will be formed.
d. The limiting reagent is CO and 8.0 mol Fe will be formed.

____186. How many valence electrons are in an atom of magnesium?
a. 5
b. 4
c. 2
d. 3

____187. The ratio of carbon atoms to hydrogen atoms to oxygen atoms in a molecule of dicyclohexyl maleate is 4 to 6 to 1. What is its molecular formula if its molar mass is 280 g?
a. $C_8H_{12}O_2$
b. $C_{12}H_{18}O_3$
c. $C_{16}H_{24}O_4$
d. $C_4H_6O_1$

____188. All of the following are equal to Avogadro's number EXCEPT ____.
a. the number of atoms of bromine in 1 mol Br_2
b. the number of molecules of nitrogen in 1 mol N_2
c. the number of atoms of gold in 1 mol Au
d. the number of molecules of carbon monoxide in 1 mol CO

____189. How many grams of beryllium are needed to produce 36.0 g of hydrogen? (Assume an excess of water.)
$Be(s) + 2H_2O(l) \rightarrow Be(OH)_2\ (aq) + H_2(g)$
a. 162 g
b. 4.00 g
c. 36.0 g
d. 324 g

____190. To determine the formula of a new substance, one of the first steps is to find the ____.
a. volume at STP
b. percent composition
c. number of particles per mole
d. molar mass

____191. What is the molar mass of $AuCl_3$?
a. 303.6 g
b. 96 g
c. 130 g
d. 232.5 g

____192. Which of the following is an INCORRECT interpretation of the balanced equation shown below?
$2S(s) + 3O_2(g) \rightarrow 2SO_3(g)$
a. 2 atoms S + 3 molecules $O_2 \rightarrow$ 2 molecules SO_3
b. 2 mol S + 3 mol $O_2 \rightarrow$ 2 mol SO_3
c. 2 g S + 3 g $O_2 \rightarrow$ 2 g SO_3
d. none of the above

____193. Metallic copper is formed when aluminum reacts with copper(II) sulfate. How many grams of metallic copper can be obtained when 54.0 g of Al react with 319 g of $CuSO_4$?
$Al + 3CuSO_4 \rightarrow Al_2(SO_4)_3 + 3Cu$
a. 381 g
b. 21.2 g
c. 127 g
d. 162 g

____194. A double-replacement reaction takes place when aqueous Na_2CO_3 reacts with aqueous $Sn(NO_3)_2$. You would expect one of the products of this reaction to be ____.
a. $NaNO_3$
b. NaSn
c. CNO_3
d. $Sn(CO_3)_2$

____195. The first step in most stoichiometry problems is to ____.
a. convert given quantities to masses
b. add the coefficients of the reagents
c. convert given quantities to volumes
d. convert given quantities to moles

____196. Everyday equations describe ____.
a. biological chemistry
b. everyday processes
c. chemical reactions
d. thermonuclear reactions

____197. What is the electron configuration of the calcium ion?
a. $1s^2 2s^2 2p^6 3s^2 3p^5 4s^1$
b. $1s^2 2s^2 2p^6 3s^2 3p^6$
c. $1s^2 2s^2 2p^6 3s^2$
d. $1s^2 2s^2 2p^6 3s^2 3p^4 4s^2$

____198. Which conversion factor do you use first to calculate the number of grams of CO_2 produced by the reaction of 50.6 g of CH_4 with O_2? The equation for the complete combustion of methane is:
$CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(l)$
a. 2 mol O_2/1 mol CO_2
b. 1 mol CH_4/16.0 g CH_4
c. 16.0 g CH_4/1 mol CO_4
d. 44.0 g CO_2/2 mol CO_2

____199. When the equation $KClO_3(s) \rightarrow KCl(s) + O_2(g)$ is balanced, the coefficient of $KClO_3$ is ____.
a. 2
b. 1
c. 4
d. 3

____200. Where are the electrons most probably located in a molecular bonding orbital?
a. in stationary positions between the two atomic nuclei
b. between the two atomic nuclei
c. anywhere in the orbital
d. in circular orbits around each nucleus

____201. Calcium oxide, or lime, is produced by the thermal decomposition of limestone in the reaction $CaCO_3(s) \xrightarrow{\Delta} CaO(s) + CO_2(g)$. What mass of lime can be produced from 1.5×10^3 kg of limestone?
a. 8.4×10^5 kg
b. 8.4 kg
c. 8.4×10^2 kg
d. none of the above

____202. Which of the following is the correct skeleton equation for the reaction that takes place when solid phosphorus combines with oxygen gas to form diphosphorus pentoxide?
a. $P(s) + O_2(g) \rightarrow P_2O_5(s)$
b. $P(s) + O(g) \rightarrow P_5O_2(g)$
c. $P_2O_5(s) \rightarrow P_2(s) + O_2(g)$
d. $P(s) + O_2(g) \rightarrow PO_2(g)$

____203. Which polyatomic ion forms a neutral compound when combined with a group 1A monatomic ion in a 1:1 ratio?
a. phosphate
b. nitrate
c. carbonate
d. ammonium

____204. How many liters of chlorine gas can be produced when 0.98 L of HCl react with excess O_2 at STP?

$4HCl(g) + O_2(g) \rightarrow 2Cl_2(g) + 2H_2O(g)$

a. 0.49 L
c. 0.98 L
b. 3.9 L
d. 2.0 L

____205. How many atoms are in 3.5 moles of arsenic atoms?

a. 7.5×10^{1} atoms
c. 2.1×10^{24} atoms
b. 5.8×10^{-24} atoms
d. 1.7×10^{23} atoms

____206. How many moles of aluminum are needed to react completely with 1.2 mol of FeO?

$2Al(s) + 3FeO(s) \rightarrow 3Fe(s) + Al_2O_3(s)$

a. 1.2 mol
c. 1.6 mol
b. 2.4 mol
d. 0.8 mol

____207. Which of the following occurs in an ionic bond?

a. Oppositely charged ions attract.
b. Two atoms share two electrons.
c. Like-charged ions attract.
d. Two atoms share more than two electrons.

____208. A double-replacement reaction takes place when aqueous cobalt(III) chloride reacts with aqueous lithium hydroxide. One of the products of this reaction is ____.

a. $LiCl_3$
c. $Co(OH)_3$
b. $Co(OH)_2$
d. $LiCo_3$

____209. What is the number of moles of beryllium atoms in 36 g of Be?

a. 45.0 mol
c. 4.0 mol
b. 320 mol
d. 0.25 mol

____210. When the equation $Fe + Cl_2 \rightarrow FeCl_3$ is balanced, what is the coefficient for Cl_2?

a. 2
c. 3
b. 4
d. 1

____211. How many molecules are in 2.10 mol CO_2?

a. 3.79×10^{24} molecules
c. 2.53×10^{24} molecules
b. 3.49×10^{-24} molecules
d. 1.26×10^{24} molecules

____212. Lead nitrate can be decomposed by heating. What is the percent yield of the decomposition reaction if 9.9 g $Pb(NO_3)_2$ are heated to give 5.5 g of PbO?

$2Pb(NO_3)_2(s) \rightarrow 2PbO(s) + 4NO_2(g) + O_2(g)$

a. 44%
c. 82%
b. 56%
d. 67%

____213. In which of the following are the symbol and name for the ion given correctly?

a. $C_2H_3O_2^-$: acetate; $C_2O_4^-$: oxalite
b. NH_4^+: ammonia; H^+: hydride
c. OH^-: hydroxide; O^{2-}: oxide
d. PO_3^{3-}: phosphate; PO_4^{3-}: phosphite

____214. In any chemical reaction, the quantities that are preserved are ____.

a. mass and moles
b. the number of moles and the volumes
c. mass and number of atoms
d. the number of molecules and the volumes

____215. In the reaction $2CO(g) + O_2(g) \rightarrow 2CO_2(g)$, what is the ratio of moles of oxygen used to moles of CO_2 produced?

a. 2:2
b. 1:1
c. 1:2
d. 2:1

____216. How many liters of NH_3 are needed to react completely with 30.0 L of NO (at STP)?

$4NH_3(g) + 6NO(g) \rightarrow 5N_2(g) + 6H_2O(g)$

a. 120.0 L
b. 20.0 L
c. 5.0 L
d. 7.5 L

____217. Which of the following is a balanced equation representing the decomposition of lead(IV) oxide?

a. $Pb_2O \rightarrow 2Pb + O$
b. $PbO \rightarrow Pb + O_2$
c. $PbO_2 \rightarrow Pb + O_2$
d. $PbO_2 \rightarrow Pb + 2O$

____218. What is the formula for sodium sulfate?

a. $Na_2(SO_4)_2$
b. Na_2SO_4
c. $NaSO_4$
d. $Na(SO_4)_2$

____219. Which of the following is NOT true about "yield"?

a. The percent yield is the ratio of the actual yield to the theoretical yield.
b. The value of the actual yield must be given in order for the percent yield to be calculated.
c. The actual yield may be different from the theoretical yield because reactions do not always go to completion.
d. The actual yield may be different from the theoretical yield because insufficient limiting reagent was used.

____220. The complete combustion of which of the following substances produces carbon dioxide and water?

a. NO
b. $CaHCO_3$
c. K_2CO_3
d. C_8H_{18}

____221. The molar mass of a certain gas is 49 g. What is the density of the gas in g/L at STP?

a. 3.6×10^{-24} g/L
b. 2.2 g/L
c. 71 g/L
d. 0.46 g/L

____222. How many atoms are in 0.075 mol of titanium?

a. 6.4×10^{2}
c. 1.2×10^{-25}
b. 2.2×10^{24}
d. 4.5×10^{22}

____223. Which of the following compounds contains the Mn^{3+} ion?

a. Mn_2O_3
c. MnO
b. $MnBr_2$
d. MnS

____224. Hydrogen gas is produced when zinc reacts with hydrochloric acid. If the actual yield of this reaction is 85%, how many grams of zinc are needed to produce 112 L of H_2 at STP?

$Zn(s) + 2HCl(aq) \rightarrow ZnCl_2(s) + H_2(g)$

a. 380 g
c. 280 g
b. 95 g
d. 180 g

____225. How many moles of glucose, $C_6H_{12}O_6$, can be "burned" biologically when 10.0 mol of oxygen is available?

$C_6H_{12}O_6(s) + 6O_2(g) \rightarrow 6CO_2(g) + 6H_2O(l)$

a. 60.0 mol
c. 53.3 mol
b. 1.67 mol
d. 0.938 mol

____226. Which of the following shows correctly an ion pair and the ionic compound the two ions form?

a. Sn^{4+}, N^{3-}; Sn_4N_3
c. Fe^{3+}, O^{2-}; Fe_2O_3
b. Cu^{2+}, O^{2-}; Cu_2O_2
d. Cr^{3+}, I^{-}; CrI

____227. In a chemical reaction, the mass of the products ____.

a. has no relationship to the mass of the reactants
b. is equal to the mass of the reactants
c. is greater than the mass of the reactants
d. is less than the mass of the reactants