Gen Chem I            Exam 1 Review (Chapters 1 & 2)

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

___ 1. All of the following are properties of antimony. Which one is not a physical property?
   a. It is a solid at room temperature.
   b. It has both yellow and gray forms (allotropes) in the solid state.
   c. It burns in an atmosphere of chlorine.
   d. It is one of the few substances that expands upon freezing.
   e. The gray form melts at 631°C.

___ 2. The following properties describe zinc. Which one(s) is (are) chemical properties?
   I. It is bluish-white metal.
   II. It corrodes upon prolonged contact with moist air.
   III. Its density is 7.14 g/cm³.
   IV. It melts at 419°C.
   V. It conducts electricity.
   a. IV and V               d. II, IV, and V
   b. IV                     e. II
   c. V

___ 3. Identify which of the following properties of methane would be observed only with a change in composition.
   a. The melting point is −182.5°C.
   b. The density is $6.67 \times 10^{-4}$ g/cm³.
   c. Carbon dioxide forms when it burns.

___ 4. Which of these physical changes would require the liberation of energy?
   a. condensation of steam to form liquid water
   b. melting of ice
   c. boiling of water
   d. all of the above
   e. none of the above

___ 5. Which answer lists all the substances below that are compounds and not any elements or mixtures?
   I. ethyl alcohol
   II. neon
   III. sulfur
   IV. water
   V. crude oil
   a. I, II, and III          d. II, III, and V
   b. I, IV, and V           e. I and IV
   c. IV and V
6. A sample of matter that can be decomposed into three different elements
   a. must be a solution.
   b. must be a compound.
   c. must be a heterogeneous mixture.
   d. must be a homogeneous mixture.
   e. could be any of the preceding four answers.

7. Below is a list of common prefixes used in the SI and metric systems. Included with each is an abbreviation and meaning. Which set contains an **error**?
   a. mega- M 10^6
   b. deci- d 10^-1
   c. centi- c 10^-2
   d. micro- m 10^-6
   e. kilo- k 10^3

8. Which of the following is equivalent to 10 cm?
   a. 1 m
   b. 0.1 dm
   c. 100 mm
   d. 1000 µm
   e. 1 mm

9. The answer to the following calculation, rounded to the proper number of significant digits, is:
   \[ 23.413 \text{ g} \div (2.15 \text{ cm} \times 1.1 \text{ cm} \times 3.73 \text{ cm}) \]
   a. 2.7 g/cm^3
   b. 2.65 g/cm^3
   c. 2.7 g/cm^3
   d. 2.654 g/cm^3
   e. 2.66 g/cm^3

10. If \( 5.76 \times 10^{13} \) neon atoms (spherical) were laid in a line, each touching the next, the line would measure 2.54 miles. What is the diameter of a neon atom in Å?
    a. 0.92 Å
    b. 0.71 Å
    c. 1.86 Å
    d. 1.44 Å
    e. 1.74 Å

11. What is the area (in mm^2) of a rectangular surface that is 0.640 inch wide and 1.14 inches long?
    a. 471 mm^2
    b. 328 mm^2
    c. 84.2 mm^2
    d. 242 mm^2
    e. 680 mm^2

12. Assuming a magnesium atom is spherical, calculate its volume in nm^3. The **diameter** of a magnesium atom is 3.20 Å. The volume of a sphere is \( V = \frac{4}{3} \pi r^3 \).
    1 Å = 1 \times 10^{-10} m and 1 nm = 1 \times 10^{-9} m (Both of these relationships are exact.) \( \pi = 3.14 \)
    a. 5.57 \times 10^{3} \text{ nm}^3
    b. 2.34 \times 10^{-22} \text{ nm}^3
    c. 5.57 \times 10^{-24} \text{ nm}^3
    d. 1.71 \times 10^{-2} \text{ nm}^3
    e. 5.57 \times 10^{-3} \text{ nm}^3
13. The 1970 standard established by the U.S. government for carbon monoxide emission for automobiles limited exhaust to 23.0 grams of CO per vehicle-mile. Assume that in a given metropolitan area there are 82,700 automobiles, driven an average of 13.5 miles per 24-hour period. How many tons/day of CO could legally be discharged into the area's atmosphere?
   a. 270 tons/day  
   b. 0.155 tons/day  
   c. 28.3 tons/day  
   d. 0.0535 tons/day  
   e. 39.0 tons/day

14. Caffeine, a stimulant in coffee and some cola drinks, is 49.47% carbon, 5.19% H, 28.8% N, 16.48% O. What is the mass of carbon contained in 37.1 g of caffeine?
   a. 18.4 g  
   b. 36.8 g  
   c. 6.11 g  
   d. 1840 g  
   e. 24.3 g

15. A metal cube having a mass of 112 grams is dropped into a graduated cylinder containing 30.00 mL of water. This causes the water level to rise to 39.50 mL. What is the density of the cube?
   a. 2.86 g/mL  
   b. 11.8 g/mL  
   c. 10.8 g/mL  
   d. 3.74 g/mL  
   e. 10.6 g/mL

16. A gold ring has a mass of 15.37 g. If this ring is pure gold (density = 16.1 g/mL), what would the volume of the ring be?
   a. 15.37 mL  
   b. 1.04 mL  
   c. 0.955 mL  
   d. 16.1 mL  
   e. 8.05 mL

17. Liquid propane boils at 231K. What is its boiling point in °C?
   a. 42°C  
   b. 315°C  
   c. −42°C  
   d. 504°C  
   e. −231°C

18. How much heat is released as the temperature of 25.2 grams of iron is decreased from 72.1°C to 9.8°C? The specific heat of iron is 0.444 J/g•°C.
   a. 113 J  
   b. 566.1 J  
   c. 1.11 kJ  
   d. 0.697 kJ  
   e. 957 J

19. If 10.0 g of copper cools from 35.0°C to 28.8°C and loses 23.6 joules of heat, what is the specific heat of copper?
   a. 0.076 J/g•°C  
   b. 3.8 × 10^2 J/g•°C  
   c. 0.38 J/g•°C  
   d. 0.62 J/g•°C  
   e. 76 J/g•°C
20. A 10.0 kg piece of metal at 50.0°C is placed in 1000. g of water at 10.0°C in an insulated container. The metal and water come to the same temperature at 30.6°C. What is the specific heat of metal? The specific heat of water is 4.18 J/g°C.
   a. 0.0686 J/g°C  
   b. 0.444 J/g°C  
   c. 0.721 J/g°C

   d. 0.124 J/g°C  
   e. 0.0216 J/g°C

21. Which one of the following types of matter **MUST** be composed of 2 or more physically separable substances?
   a. a gas  
   b. a mixture  
   c. a homogeneous sample  
   d. a metal

22. Convert −53°C to kelvins.
   a. 220 K  
   b. −53 K  
   c. −326 K  
   d. 273 K

23. How many **significant figures** are there in the measured number 0.0020?
   a. 1  
   b. 2  
   c. 3  
   d. 4

24. If a sample of propane, C₃H₈, contains a total of 6.0 × 10³ atoms of carbon, how many molecules of propane are in the sample?
   a. 6.0 × 10³  
   b. 3.0 × 10³  
   c. 8.0 × 10³  
   d. 1.1 × 10⁴  
   e. 2.0 × 10³

25. A compound contains only calcium and fluorine. A sample of the compound is determined to contain 2.00 g of calcium and 1.90 g of fluorine. According to the Law of Definite Proportions, how much calcium should another sample of this compound contain if it contains 2.85 g of fluorine?
   a. 2.71 g  
   b. 4.00 g  
   c. 3.00 g  
   d. 4.50 g  
   e. 6.00 g

26. Which of the following statements is **incorrect**?
   a. A molecule of potassium chloride, KCl, consists of one K⁺ ion and one Cl⁻ ion.
   b. Ions that possess a positive charge are called cations.
   c. Polyatomic ions are groups of atoms that have an electric charge.
   d. It is acceptable to use formula unit to refer to either an ionic compound or a molecular compound.
   e. Ions that possess a negative charge are called anions.

27. Each response below lists an ion by name and by chemical symbol or formula. Also each ion is classified as monatomic or polyatomic and as a cation or anion. Which response contains an **error**?
   a. hydroxide     OH⁻     monatomic     anion
   b. carbonate      CO₃²⁻    polyatomic    anion
   c. ammonium       NH₄⁺     polyatomic    cation
   d. magnesium      Mg²⁺     monatomic    cation
   e. sulfite        SO₃²⁻    polyatomic    anion
28. What is the formula for aluminum fluoride?
   a. AlF
   b. Al₂F₃
   c. Al₃F
   d. Al₃F₂
   e. AlF₃

29. What is the formula for manganese(III) oxide?
   a. MgO
   b. MnO
   c. MnO₄
   d. Mg₂O₃
   e. Mn₂O₃

30. What is the name of Fe(OH)₃?
   a. iron hydroxide
   b. iron trihydroxide
   c. iron (III) hydroxide
   d. iron (II) hydroxide
   e. none of these

31. What is the formula for copper(II) nitrate?
   a. CuNO₃
   b. Cu₂NO₃
   c. CuNO₂
   d. Cu₂NO₂
   e. Cu(NO₃)₂

32. Determine the number of sulfur atoms in 27.1 g of molecular sulfur (S₈).
   a. 0.845
   b. 5.27 × 10²³
   c. 5.09 × 10²³
   d. 2.07 × 10²³
   e. 0.106

33. Determine the formula weight of calcium phosphate.
   a. 230 amu
   b. 279 amu
   c. 215 amu
   d. 310 amu
   e. 135 amu

34. What is the mass of 2.2 × 10⁹ CO₂ molecules?
   a. 9.7 × 10¹⁰ g
   b. 1.0 × 10⁻¹² g
   c. 1.2 × 10⁶ g
   d. 4.4 × 10⁻¹⁴ g
   e. 1.6 × 10⁻¹³ g

35. What is the mass in grams of 5.00 × 10¹² water molecules?
   a. 1.50 × 10¹⁰ g
   b. 1.67 × 10¹⁵ g
   c. 2.17 × 10¹² g
   d. 6.69 × 10⁹ g
   e. 4.61 × 10⁻¹³ g

36. A sample of ethane, C₂H₆, contains a total of 16N atoms, where N = 6.02 × 10²³. How much C₂H₆ is in the sample?
   a. 2.0 g
   b. 30 g
   c. 60 g
   d. 16 mol
   e. 4 mol
37. Calculate the percent by mass of nitrogen in ammonium carbonate.
   a. 14.5%  
   b. 27.8%  
   c. 29.2%  
   d. 33.3%  
   e. 17.1%

38. A compound contains carbon, oxygen, and hydrogen. Analysis of a sample showed that it contained by mass 68.9% carbon and 4.92% hydrogen. What is the simplest formula for this compound?
   a. C₆H₆O₂  
   b. C₇H₆O₂  
   c. C₈H₆O₂  
   d. C₆H₄O₃  
   e. C₇H₈O

39. A compound is known to contain only carbon, hydrogen, and oxygen. If the complete combustion of a 0.150-g sample of this compound produces 0.225 g of CO₂ and 0.0614 g of H₂O, what is the empirical formula of this compound?
   a. C₃H₄  
   b. CH₄O  
   c. C₃HO₃

40. A compound contains, by mass, 87.5% nitrogen and 12.5% hydrogen. Its molecular weight is found to be 32 g/mol. What is its molecular formula?
   a. N₂H₆  
   b. N₂H₄  
   c. N₂H₅

41. A compound contains, by mass, 26.7% carbon, 71.1% oxygen and the remainder hydrogen. A 0.23 mole sample of this compound weighs 20.7 g. What is the molecular formula of this compound?
   a. C₃H₆O₂  
   b. C₂H₂O₄  
   c. C₂H₄O

42. What mass of calcium metal could be obtained from one kg of limestone that is 50.0% pure CaCO₃? (No other calcium-containing compounds are present.)
   a. 0.05 kg  
   b. 0.2 kg  
   c. 0.4 kg  
   d. 0.5 kg

43. How do nonmetals form negative ions?
   a. by losing one or more electrons  
   b. by sharing electrons  
   c. by gaining one or more protons  
   d. by gaining one or more electrons

44. What is the formula for the ionic compound formed by calcium and bromine?
   a. CaBr  
   b. Ca₂Br  
   c. CaBr₂  
   d. Ca₃Br₂

45. The empirical formula of a compound is CHBr and its molecular weight is 185. What is its molecular formula? (atomic weights: C = 12.01, H = 1.008, Br = 79.90)
   a. CH₂Br  
   b. C₂H₂Br₂  
   c. C₃H₃Br₃  
   d. C₂HBr
MULTIPLE CHOICE

1. ANS: C  PTS: 1  TOP: Chemical and Physical Properties
2. ANS: C  PTS: 1  TOP: Chemical and Physical Properties
3. ANS: E  PTS: 1  TOP: Chemical and Physical Properties
4. ANS: C  PTS: 1  TOP: Chemical and Physical Properties
5. ANS: E  PTS: 1  TOP: Mixtures, Substances, Compounds, and Elements
6. ANS: E  PTS: 1  TOP: Mixtures, Substances, Compounds, and Elements
7. ANS: D  PTS: 1  TOP: Measurements in Chemistry
8. ANS: C  PTS: 1  TOP: Measurements in Chemistry
9. ANS: C  PTS: 1  TOP: Use of Numbers
10. ANS: C  PTS: 1  TOP: The Unit Factor Method (Dimensional Analysis)
11. ANS: A  PTS: 1  TOP: The Unit Factor Method (Dimensional Analysis)
12. ANS: C  PTS: 1  TOP: The Unit Factor Method (Dimensional Analysis)
13. ANS: A  PTS: 1  TOP: Percentage
14. ANS: D  PTS: 1  TOP: Density and Specific Gravity
15. ANS: C  PTS: 1  TOP: Density and Specific Gravity
16. ANS: C  PTS: 1  TOP: Heat and Temperature
19. ANS: A  PTS: 1  TOP: Additional Questions
20. ANS: A  PTS: 1  TOP: Additional Questions
21. ANS: E  PTS: 1  TOP: Chemical Formulas
22. ANS: C  PTS: 1  TOP: Chemical Formulas
23. ANS: A  PTS: 1  TOP: Ions and Ionic Compounds
24. ANS: A  PTS: 1  TOP: Ions and Ionic Compounds
25. ANS: B  PTS: 1  TOP: Names and Formulas of Some Ionic Compounds
26. ANS: E  PTS: 1  TOP: Names and Formulas of Some Ionic Compounds
27. ANS: E  PTS: 1  TOP: Names and Formulas of Some Ionic Compounds
28. ANS: C  PTS: 1  TOP: Names and Formulas of Some Ionic Compounds
29. ANS: B  PTS: 1  TOP: The Mole
30. ANS: D  PTS: 1  TOP: Formula Weights, Molecular Weights, and Moles
31. ANS: E  PTS: 1  TOP: Formula Weights, Molecular Weights, and Moles
32. ANS: C  PTS: 1  TOP: Formula Weights, Molecular Weights, and Moles
33. ANS: C  PTS: 1  TOP: Percent Composition and Formulas of Compounds
34. ANS: B  PTS: 1  TOP: Derivation of Formulas from Elemental Composition
35. ANS: A  PTS: 1  TOP: Derivation of Formulas from Elemental Composition
36. ANS: B  PTS: 1  TOP: Determination of Molecular Formulas
37. ANS: B  PTS: 1  TOP: Determination of Molecular Formulas
42. ANS: B  PTS: 1  TOP: Purity of Samples
43. ANS: D  PTS: 1  TOP: Additional Questions
44. ANS: C  PTS: 1  TOP: Additional Questions
45. ANS: B  PTS: 1  TOP: Purity of Samples