***\*Be sure you understand the concepts involved in each question. Do not simply memorize facts!\****

**Chapter 1: Chemistry**

1. What is chemistry?

2. What is the difference between a physical and chemical change? Give an example of each.

3. What are 4 indications of a chemical change?

**Chapter 2: Matter**

4. What is matter?

5. What is the Law of Conservation of Matter?

6. Describe in words and make particle view drawings of the following.

|  |  |
| --- | --- |
| Cation | Anion |
| Element | Compound |
| Mixture | Pure substance |
| Heterogeneous Mixture | Homogenous Mixture |
| Molecular Compound | Ionic Compound |

7. Classify the following listed below.

paraffin, C25H52 table Salt, NaCl carbon dioxide, CO2

oxygen, O2  salt water air in the room

graphite, C water, H2O homogenized milk

phosphorous, P4 aluminum, Al sand and water

iced tea magnesium, Mg chicken noodle soup

|  |  |
| --- | --- |
| **Pure Substances** | **Mixtures** |
| *Element* | *Compound* | *Homogenous* | *Heterogeneous* |
| Atomic | Molecular | Ionic | Molecular |

**Chapter 19.1: Nuclear Chemistry and Radioactivity**

8. Define radioactivity.

9. Fill in the following table:

|  |  |  |  |
| --- | --- | --- | --- |
| Particle Type | Description | Symbol | Example Decay Equation |
| Alpha |  |  |  |
| Beta |  |  |  |

10. Write an equation for the beta decay of strontium-90

11. Write an equation for the alpha decay of uranium-238

12. Define half-life.

13. A given isotope has a half-life of 5.0 minutes. If the initial mass is 280 grams, how many

 grams will be left after 15 minutes? How many half-lives is this?

**Chapter 3: Elements, Atoms, and Ions; Atomic Theory**

14. Compare the parts of an atom based on location, charge and mass:

|  |  |  |  |
| --- | --- | --- | --- |
|  | location | charge | mass |
| proton |  |  |  |
| neutron |  |  |  |
| electron |  |  |  |

15. Look at the two atoms listed: **12C and 13C**

 a. Why are these considered isotopes of carbon?

 b. What is the atomic number? \_\_\_\_ Write it into the isotope notation above. How did

 you find the atomic number? What does it represent? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 c. What are the mass numbers? \_\_\_\_\_\_\_\_\_ How did you find them? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 What do they represent? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 d. What is an atomic mass unit? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

16. How many neutrons does U-238 have?

17. Write the isotope notation for the particle that contains 17 neutrons and 15 protons.

18. Fill in the following table:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Name** | **Symbol** | **Atomic #** | **Mass #** | **# protons** | **#neutrons** | **# electrons** |
| sodium | Na | 11 |  |  | 11 |  |
| silver | Ag |  | 108 |  |  |  |
| copper(II) (cation) | Cu2+ |  |  | 29 | 34 |  |
| chloride (anion) | Cl- |  |  |  | 18 |  |
| uranium  | U |  | 238 |  |  | 92 |

19. The atomic mass of carbon as displayed on the periodic table is 12.011 amu. However, no

 single carbon atom in nature has this mass. Explain.

20. If element Z (fictitious) has two isotopes: Z-20 (20.00 amu), and Z-21 (21.00 amu). If the

 average atomic mass for element Z is 20.40 amu, which isotope has the greatest natural

 abundance? Explain how you know this.

21. Show the location of each of the following on the periodic table:

****

- periods

- groups or families

- main group elements

- metals

- non-metals

- metalloids

- alkali metals

- alkali earth metals

- transition metals

- halogens

- noble gases

- lanthanides

- actinides

- diatomic elements

- common ionic charges for groups 1, 2, 13, 14, 15, 16, 17

22. Describe 4 properties of metals, and 4 properties of non-metals:

23. What is a metalloid? What is another name for a metalloid?

24. Where are elements with similar properties found on the periodic table (in horizontal rows,

 or in vertical columns?) Why?

**Chapter 4: Chemical Formulas**

25. Write the formula, give the matter classification and indicate the type of bonding found in the following:

 Formula Classification Type of bonding

a. dinitrogen pentoxide \_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

b. lead \_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

c. diamond \_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

d. ammonium nitrate \_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

e. tin (II) chloride \_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

f. oxygen \_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

26. Write the name of the following, give the matter classification and indicate the type of bonding found in the following:

 Name Classification Type of bonding

a. KMnO4 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

b. HNO2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

c. PCl3 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

e. FeBr3 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

f. Na2S \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

g. FeO \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

27. Hydrates can be described as \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 Epsom salt is a common hydrate, it can be described chemically as magnesium sulfate

 heptahydrate. What is the chemical formula for Epsom salt? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

28. Describe how you can recognize, from the formulas or names, each of the following:

|  |  |
| --- | --- |
| ionic compounds |  |
| molecular compounds |  |
| acids |  |
| hydrates |  |

29. Complete the information below:

|  |  |  |  |
| --- | --- | --- | --- |
| **Reaction****Balance the Reaction** | **Chemical or Physical Change** | **Reactant(s)****Use the name** | **Product(s)****Use the name** |
| \_\_\_Fe (s) + \_\_\_O2 (g) →\_\_\_Fe2O3 (s) Rust☺  |  |  |  |

Describe what is happening by:

 a. Classify the reactant or product as an atomic element, molecular element, ionic compound

 or a molecular compound.

 \_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ → \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 b. Describe the state of each reactant and product.

 \_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ → \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 c. Discuss the ratio between each of the reactants and product in the balanced equation.

 \_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ → \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Draw a particle view of what is happening in this reaction when 10 moles Fe2O3 are formed.

→

**Chapter 5: Measurements and Calculations**

Significant Figures/Measurements/Conversions

30. How many significant figures does each of the following measurements have?

 a. 2300 m

 b. 20040 m

 c. 260.00 m

 d. 0.00205 m

 e. 4.65 x 10-4 m

31. Answer the following with the correct number of significant figures.

 a. 4.535 m + 0.0251 m

 b. 274 m - 254 m

 c. 6.54 m / 3.4215 m

 d. 30.67 m x 23 m

 32. Convert -25°C to Kelvin \_\_\_\_\_\_\_ Convert 300. Kelvin to °Celsius \_\_\_\_\_\_

**Chapter 6: Chemical Composition (Calculations Involving the Mole)**

33. Distinguish between the following:

|  |  |
| --- | --- |
| empirical formula |  |
| molecular formula |  |

Questions 34-37 refer to the compound:

**Caffeine - Molecular Formula:** **C8H10N4O2**

34. What is the empirical formula for caffeine? \_\_\_\_\_\_\_\_\_\_\_

35. Calculate the molar mass for caffeine: \_\_\_\_\_\_\_\_\_\_ grams/mole

36. Calculate the percent composition of each element in the formula

 % C = \_\_\_\_\_\_\_ % N = \_\_\_\_\_\_\_

 % H = \_\_\_\_\_\_\_ % O = \_\_\_\_\_\_\_

37. Will Caffeine have the same percent composition if you calculated the percentage from the empirical formula or the molecular formula? Explain how you know, you may include a drawing or calculation.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

38. A compound is 35.0% nitrogen, 5.0% hydrogen, and 60.0% oxygen. What is the empirical formula of the compound?

39. What is a mole?

40. What is the mass of a mole of calcium atoms?

41. What is the mass of a mole of Mg(OH)2?

42. What is the percentage of silver in silver sulfide, Ag2S?

43. How many atoms are in 10.0 grams of aluminum?

44. How many grams is 3.4 x 1024 carbon atoms?

45. How much copper can be purified from 750 grams of copper (I) sulfide?

**Chapter 7: Types of Chemical Reactions**

46. a. In a chemical equation, what are the:

 - reactants?

 - products?

 - subscripts?

 - coefficients?

 b. What do the following symbols represent?

 (s) (aq)

 (l) → (yield sign)

 (g) ∆ (delta sign)

47. When balancing equations, which can you change: the subscripts, or the coefficients?

 Explain why.

**Chapter 8: Reactions in Aqueous Solution**

48. Describe each type of chemical reaction:

 - synthesis:

 - decomposition:

 - single-replacement:

 - precipitation (double-replacement):

 **-** combustion:

 - acid/base neutralization:

 - oxidation/reduction reaction

49. What are the 4 driving forces for chemical reactions?

50. Use the solubility rules to label each of the following compounds as soluble or insoluble. **(S) = Soluble or (I) = Insoluble in water**

 \_\_\_\_\_ a. magnesium hydroxide \_\_\_\_\_\_g. (NH4)3PO4

 \_\_\_\_\_ b. silver chloride \_\_\_\_\_\_h. Al2S3

 \_\_\_\_\_ c. barium sulfate \_\_\_\_\_\_ i. HgSO4

 \_\_\_\_\_ d. potassium nitrate \_\_\_\_\_\_ j. Fe(OH)3

 \_\_\_\_\_ e. lead (II) nitrate \_\_\_\_\_\_ k. CaCO3

 \_\_\_\_\_ f. sodium carbonate \_\_\_\_\_\_ l. Co(NO­­­3)3

51. Write the molecular, ionic, and net ionic equations for the reaction between:

 barium chloride and sodium sulfate

 a. molecular equation \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 b. ionic equation \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 c. net ionic equation \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

52. Balance, then identify the type of reaction:

 A = acid/base reaction

 B = precipitation reaction

 C = oxidation/reduction reaction

 C1 = synthesis, C2 = decomposition, C3 = single replacement, C4 = combustion

\_\_\_\_ 1. \_\_CdCO3(s) ------------> \_\_CdO(s) + \_\_CO2(g)

\_\_\_\_ 2. \_\_Mg(s) + \_\_HCl(aq) --------> \_\_H2(g) + \_\_MgCl2(aq) ­

\_\_\_\_ 3. \_\_CaBr2(aq) + \_\_AgNO3(aq) -----> \_\_Ca(NO3)2(aq) + \_\_AgBr(s)

\_\_\_\_ 4. \_\_HCl(aq) + \_\_\_NaOH(aq) ----------> \_\_\_H2O(l) + \_\_\_NaCl(aq)

\_\_\_\_ 5. \_\_PbCl2(aq) + \_\_Li2SO4(aq) --------> \_\_LiCl(aq) + \_\_PbSO4(s)

\_\_\_\_ 6. \_\_As(s) + \_\_O2(g) --------> \_\_As2O5(s)

\_\_\_\_ 7. \_\_CH4(g) + \_\_O2(g) ---------> \_\_CO2(g) + \_\_H2O(g)