Name: _____

Honors Chemistry Unit 4 Practice Sheet

*Chapter 11:

1. Write the word equations for the following chemical reactions.
   a. $NH_{3(g)} + O_{2(g)} \rightarrow NO_{(g)} + H_2O_{(g)}$
   b. $H_2SO_{4(aq)} + BaCl_{2(aq)} \rightarrow BaSO_{4(s)} + HCl_{(aq)}$
2. Write the chemical equations for the following word equations.
   a. Carbon dioxide gas and water react to form oxygen gas and solid glucose.
   b. Hydrogen gas and aqueous sodium hydroxide are formed when sodium metal is dropped into water.
3. Balance the following equations.

   a. ___ $PbO_2 \rightarrow$ ___ $PbO +$ ___ O_2
   b. ___ $Fe(OH)_3 \rightarrow$ ___ $Fe_2O_3 +$ ___ H_2O
   c. ___ $(NH_4)_2CO_3 \rightarrow$ ___ $NH_3 +$ ___ $H_2O +$ ___ CO_2
   d. ___ $NaCl +$ ___ $H_2SO_4 \rightarrow$ ___ $Na_2SO_4 +$ ___ HCl

4. Write the type of each reaction and predict the products. Be sure to balance the equation. (Hint: Zinc has a +2 charge.)

   a. ___ $Zn +$ ___ $AgNO_3 \rightarrow$
   b. ___ $Mg +$ ___ $O_2 \rightarrow$
   c. ___ $C_2H_6 +$ ___ $O_2 \rightarrow$
   d. ___ $H_2C_2O_4 +$ ___ $KOH \rightarrow$
   e. ___ $Ag_2O \rightarrow$

5. Write the complete ionic equation for the following reaction:

$$Ba(NO_3)_{2(aq)} + Na_2SO_{4(aq)} \rightarrow NaNO_{3(aq)} + BaSO_{4(s)}$$

6. Write the net ionic equation for the following reactions:
   a. $Pb(NO_3)_{2(aq)} + NH_4Cl_{(aq)} \rightarrow PbCl_{2(s)} + NH_4NO_{3(aq)}$
   b. $Al_2(SO_4)_{3(aq)} + Mg(OH)_{2(aq)} \rightarrow MgSO_{4(aq)} + Al(OH)_{3(s)}$

7. Predict the precipitates for the following reactions:
   a. $Zn(NO_3)_{2(aq)} + SnCl_{2(aq)} \rightarrow$
   b. $Cu(NO_3)_{2(aq)} + Na_2S_{(aq)} \rightarrow$

*Chapter 10:

8. What is the molar mass of iron (II) phosphate?

9. How many moles is 7.2×10^{25} molecules of carbon dioxide?

10. What is the percent composition of calcium nitrate?

11. What is the empirical formula of a compound that is 50.7%C, 4.2%H, and 45.1%O?

12. What is the molecular formula for a compound that has a molar mass of 90 g/mol and an empirical formula of CH_2O?

*Chapter 12:

$$5F_2 + 2NH_3 \rightarrow N_2F_4 + 6HF$$

Use this reaction for #13-14.

13. How many moles of fluorine are needed to react with 13.8 mol of nitrogen trihydride?

14. How many liters of hydrofluoric acid are produced when 5.55×10^{19} molecules of fluorine react?

$$5C + 2SO_2 \rightarrow CS_2 + 4CO$$

Use this reaction for #15-16.

15. If 70g of carbon reacts with 100g of sulfur dioxide, then how many grams of carbon disulfide are produced?

16. A student reacts 100g of carbon in the lab and gets a 75% yield of carbon monoxide. What is the actual yield in grams?

*Additional Exercises:

17. The reaction between reactant A (blue spheres) and reactant B (red spheres) is shown in the following diagram. Based on this diagram, which equation best describes the reaction?

a. $A_2 + B \rightarrow A_2B$
b. $A_2 + 4B \rightarrow 2AB_2$
c. $2A + B_4 \rightarrow 2AB_2$
d. $A + B_2 \rightarrow AB_2$
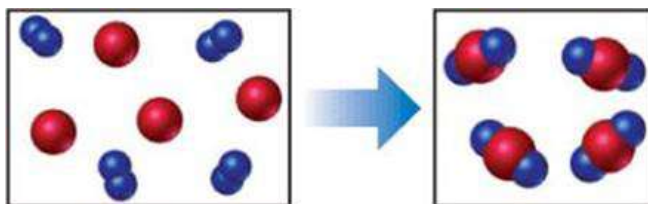
18. Under appropriate experimental conditions, H_2 and CO undergo a combination reaction to form CH_3OH. The drawing below represents a sample of H_2. Make a corresponding drawing of the CO needed to react completely with the H_2.
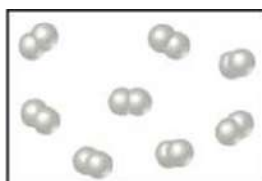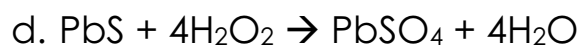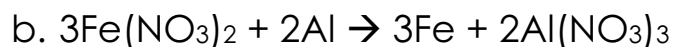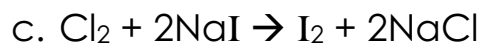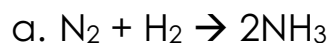
19. Which of the following schematic drawings best describes a solution of Li_2SO_4 in water (water molecules are not shown for simplicity)?
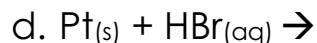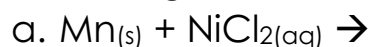

(a)   (b)   (c)
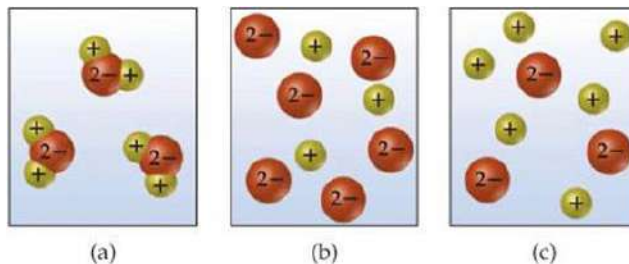
20. The labels have fallen off two bottles, one containing $Mg(NO_3)_2$ and the other containing $Pb(NO_3)_2$. You have a bottle of dilute H_2SO_4. How could you use it to test a portion of each solution to identify which solution is which?

21. Which element is oxidized and which is reduced in the following reactions?

a. $N_2 + H_2 \rightarrow 2NH_3$

b. $3Fe(NO_3)_2 + 2Al \rightarrow 3Fe + 2Al(NO_3)_3$

c. $Cl_2 + 2NaI \rightarrow I_2 + 2NaCl$

d. $PbS + 4H_2O_2 \rightarrow PbSO_4 + 4H_2O$

22. Based on the activity series, what is the outcome (if any) of each of the following reactions?

a. $Mn_{(s)} + NiCl_{2(aq)} \rightarrow$

b. $Cu_{(s)} + Cr(CH_3COO)_{3(aq)} \rightarrow$

c. $Cr_{(s)} + NiSO_{4(aq)} \rightarrow$

d. $Pt_{(s)} + HBr_{(aq)} \rightarrow$

e. $H_{2(g)} + CuCl_{2(aq)} \rightarrow$

23. The following diagram represents the collection of elements formed by a decomposition reaction.

a. If the blue spheres represent N atoms and the red ones represent O atoms, what was the empirical formula of the original compound?

b. Could you draw a diagram representing the molecules of the compound that had been decomposed? Why or why not?
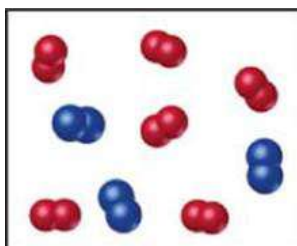
24. The following diagram represents the collection of CO_2 and H_2O molecules formed by the complete combustion of a hydrocarbon. What is the empirical formula of the hydrocarbon?
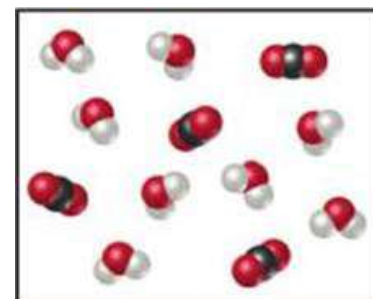
25. The following diagram represents a high-temperature reaction between CH_4 and H_2O. Based on this reaction, how many moles of each product can be obtained starting with 4.0 mol CH_4?
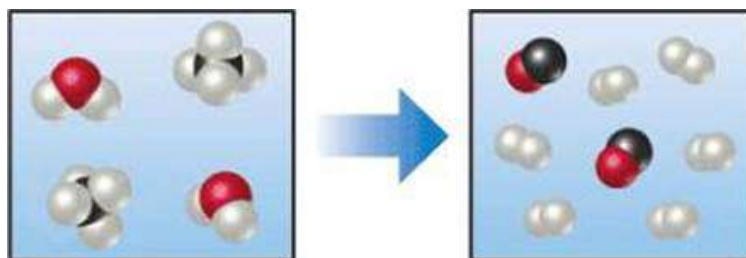
26. Nitrogen (N_2) and hydrogen (H_2) react to form ammonia (NH_3). Consider the mixture of N_2 and H_2 shown in the accompanying diagram. The blue spheres represent N, and the white ones represent H. Draw a representation of the product mixture, assuming that the reaction goes to completion. What is the limiting reagent in this case?
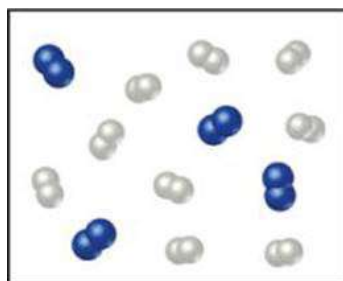
27. Vanillan, the dominant flavoring in vanilla, contains C, H, and O. When 1.05g of this substance is completely combusted, 2.43g of CO_2 and 0.50g of H_2O are produced. What is the empirical formula of vanillan? (Hint: Carry all math answers out to 3 decimal places, and look for 2/3 as a decimal.)

28. Nitrogen monoxide and oxygen react to form nitrogen dioxide. Consider the mixture of NO and O_2 shown in the accompanying diagram. The blue spheres represent N, and the red ones represent O.
   a. Draw a representation of the product mixture, assuming that the reaction goes to completion. What is the limiting reactant in this case?
   b. How many NO_2 molecules would you draw as products if the reaction had a percent yield of 75%?