**CH30S Chemical Reactions Part 2**

**Unit Review**

1. Classify the following reactions as single replacement, double replacement, synthesis, decomposition or combustion.
   1. H2 + O2 🡪 2H2O
   2. Cl2 + 2NaBr 🡪 2NaCl + Br2
   3. 2H2O 🡪 2H2 + O2
   4. RbBr + AgCl 🡪 AgBr + RbCl
   5. C3H8 + 5O2 🡪 3CO2 + 4H2O
   6. N2 + 3H2 🡪 2NH3
2. Balance the following reactions:
   1. Na + HCl 🡪 NaCl + H2
   2. Al2(SO4)3 + Ca(OH)2 🡪 Al(OH)3 + CaSO4
   3. K + H2O 🡪 KOH + H2
   4. CaO + P4O10 🡪 Ca3(PO4)2
   5. C2H6 + O2 🡪 CO2 + H2O
3. Write the completed, balanced reaction for each of the following:
   1. Ammonium phosphate is mixed with magnesium hydroxide.
   2. Pentane (C5H12) is burned.
   3. Potassium iodide is mixed with lead (II) nitrite.
   4. Mercury (I) sulphide is reacted with nitrogen.
4. Determine the mass of 0.150 mol of sulphur atoms. ***(4.82g)***
5. How many moles are there in 16.1g of nitrogen dioxide molecules?***(0.35mol)***
6. Calculate the number of moles in 2.17x1023atoms of magnesium. ***(0.36mol)***
7. How many moles in 32.1g of calcium atoms? ***(0.80mol)***
8. How many moles in 2.25g of water? ***(0.13mol)***
9. Find the mass of 1.50mol of H3PO4. ***(147.05g)***
10. Find the number of moles in 2.46g of calcium nitrate. ***(0.015mol)***
11. How many moles of fluorine atoms are in 7.6g of fluorine gas? ***(0.2mol)***
12. Calculate the total number of atoms in 0.60mol of sodium sulphate molecules. ***(2.53x1024 atoms in total)***
13. Determine the number of moles in 58.5g of ammonium sulphate. ***(0.44mol)***
14. Calculate the number of molecules in 179.1g of iron(III) hydrogen carbonate. ***(4.51x1023 molecules)***
15. What volume is occupied by 1.25mol of He gas at STP? ***(28L)***
16. Determine the density of hydrogen gas in g/ml. Hint: use molar mass and molar volume. ***(9.02x10-5g/mL)***
17. Calculate the mass of 8.96L of sulphur dioxide at STP.***(25.64g)***
18. How many molecules of methane gas (CH4) would be found in 6.4g of methane at STP? ***(2.4x1023molecules)***
19. A student placed 8.25g of aluminum metal into excess hydrochloric acid (HCl) solution. All of the aluminum reacted to form solid aluminum chloride and hydrogen gas.
    1. Write the balanced equation for the above reaction. Include states for the reactants and products.
    2. Calculate the moles of aluminum that the student used. ***(0.31mol)***
    3. Determine how many grams of hydrogen gas should be produced. ***(0.94g)***
    4. How many grams of aluminum chloride should be produced. ***(41.49g)***
    5. If the student actually collected 38.15g of aluminum chloride, what was his percent yield? ***(92%)***
20. Determine the moles of each product formed when 0.50mol of magnesium oxide decomposes into oxygen gas and magnesium metal. ***(0.5mol Mg, 0.25mol O2)***
21. Calculate the moles of H2O that are required and the mass of each product generated from the reaction of 0.75mol of propane gas according to the following reaction:

C3H8 + 6H2O 🡪 3CO2 + 10H2 ***(99g CO2, 15.15g H2)***

1. If 8.05g of sodium reacts with an excess of oxygen gas, calculate the mass of product formed and the amount of energy released according to the following reaction:

4Na + O2 🡪 2Na2O + 5.0KJ ***(10.85g Na2O, 0.438KJ)***

1. The following reaction is exothermic and releases 7.5KJ of energy **per mole** of hydrogen gas consumed. Calculate the amount of energy released when 50.9g of iron(IV) oxide reacts with an excess of hydrogen gas according to the following **unbalanced** reaction.

H2 + Fe2O4 🡪 Fe + H2O ***(8.7KJ)***

1. Calculate the volume of sulphur dioxide at STP that can be generated from 19.2g of iron (III) oxide reacting with excess sulphur according to the **unbalanced** reaction:

S + Fe2O3 🡪 SO2 + Fe ***(4.0L SO2)***

1. Calculate the volume of ammonia gas that could be produced from 9.5L of hydrogen gas and and excess of nitrogen gas. Assume STP conditions. ***(6.27L NH3)***
2. Given 160.5g of sulphur and 8.4 mol of oxygen gas, calculate the mass of SO3 that will be produced in a synthesis reaction. Hint: think Liming Reactant!!! ***(400.5g SO3)***
3. Silver nitrate and sodium phosphate are reacted in equal amounts of 200g each. How many grams of silver phosphate will be produced? ***(163.3g)***
4. How many grams of the excess reactant will be left over in question 27? ***(136.12g)***
5. What volume of hydrogen gas will be produced from the reaction of 50.0g of Mg and 75g of HCl? ***(23.1L)***
6. How much of the excess reactant will be left over in question 29? ***(25.03g)***
7. Determine the empirical formula for an organic compound that contains 19.8% carbon, 2.5% hydrogen, 11.6% nitrogen, and 66.1% oxygen. ***(C2H3NO5)***
8. If molar mass of the compound in question 31 is approximately 242 g/mol, determine the **molecular formula** for the compound. ***(C4H6N2O10)***
9. A compound has 82.66% carbon atoms and 17.34% hydrogen atoms. Determine the simplest formula. ***(C2H5)***