Name: _____ Date: _____

Stoichiometry – Test Review

Moles and Molar Mass

1. How many "things" are in one mole? What is this number called?
2. Find the molar mass of each of the following:
   a. Fe b. H_3PO_4 c. $Ca(OH)_2$ d. $C_6H_5NH_2$
3. Why does one mole of oxygen weigh less than one mole of iron? If you have one gram of each, which one has more particles?
4. Write the three equations used to convert between mass, moles and molar mass.
5. How many moles of NaI are in 2.53 g?
6. How many grams of $(NH_4)_3PO_4$ are in 4.98 mol?

Concentration

1. Write the three equations used to convert between concentration, moles and volume.
2. How many moles are in a 0.575 mol/L solution if you have 350 mL?
3. What is the concentration of a solution that has 0.470 mol dissolved in 1.85 L?
4. If you make 500.0 mL of a 0.10 mol/L solution of calcium hydroxide, what mass of solid do you need?
5. If you add 1.00 g of silver carbonate to 3.50 L of water, what concentration is the resulting solution?

Stoichiometry and Mole Ratios

1. A recipe calls for ½ cup of sugar, 1 cup of butter and ¼ cup of milk. If you have 3 ¼ cup of sugar, and you want to use it all, how much butter and milk do you need?

Solve questions 2-4 for the reaction: $4\ P_3 + 15\ O_2 \rightarrow 6\ P_2O_5$.

2. List all three mole ratios in the reaction.
3. If 3.50 mol of phosphorus completely reacts, how many moles of diphosphorus pentoxide will be produced?
4. If 5.62 g of diphosphorus pentoxide is produced, what mass of oxygen needs to react?
5. You mix 200.0 mL of 0.037 mol/L silver nitrate with excess sulfuric acid (H_2SO_4). What is the balanced equation, including states? What mass of solid will be produced?

Limiting Reactants and Percent Yield

1. A gardener plants 56 tulips bulbs in her garden. In the spring, she has 41 tulips grow. What is her percent yield?
2. A rubber band manufacturer considers their elastics to be acceptable if they are within a certain thickness and are unbroken. Their minimum daily percent yield target is 75%, meaning that many of their rubber bands are within tolerance. If they can produce 450 000 rubber bands per day, how many need to be acceptable to meet their percent yield?
3. In the reaction:

   $$2\ Al(OH)_3\ (s) + 3\ H_2SO_4\ (aq) \rightarrow Al_2(SO_4)_3\ (aq) + 6\ H_2O\ (l)$$

   If you mix 4.00 g of aluminum hydroxide and 275.0 mL of 0.20 mol/L sulfuric acid, which reactant is limiting?
4. In a reaction to produce acrylonitrile, propylene and nitrogen monoxide are mixed:

   $$4\ C_3H_6 + 6\ NO \rightarrow 4\ C_3H_3N + 6\ H_2O + N_2$$

   If 10.0 g of both propylene and nitrogen monoxide are mixed:
   a. What is the limiting reactant?
   b. What mass of acrylonitrile can be produced?
   c. If the actual amount of acrylonitrile produced is 10.1 g, what is the percent yield?

Solutions

Moles and Molar Mass

1. 6.02×10^{23}; Avogadro's number
2. A. 55.85 g/mol B. 98.00 g/mol C. 74.10 g/mol D. 93.14 g/mol
3. Oxygen is a smaller atom. Since one mole is a fixed number of atoms, the mole of the substance with lighter atoms will weigh less. If you have one gram of each, you will have more of the oxygen atoms.
4. n = m/M m = nM M = m/n
5. 0.0169 mol
6. 743 g

Concentration

1. n = CV C = n/V V = n/C
2. 0.201 mol
3. 0.254 mol/L
4. 3.71 g
5. 0.00104 mol/L

Stoichiometry and Mole Ratios

1. 6 ½ cup butter; 1 $^{5}/_{8}$ cup milk
2. $\frac{4 \text{ mol } P_3}{15 \text{ mol } O_2}$ $\frac{4 \text{ mol } P_3}{6 \text{ mol } P_2O_5}$ $\frac{15 \text{ mol } O_2}{6 \text{ mol } P_2O_5}$
3. 5.25 mol P_2O_5
4. 1.58 g O_2
5. $2\ AgNO_3\ (aq) + H_2SO_4\ (aq) \rightarrow 2\ HNO_3\ (aq) + Ag_2SO_4\ (s)$; 1.15 g

Limiting Reactants and Percent Yield

1. 73%
2. 337 500
3. H_2SO_4
4. A. NO is limiting B. 11.8 g C_3H_3N C. 85.6%