

## Exam 5 - Review Questions

### Mole Conversion

1. Determine the number of moles of iron in a block containing  $9.54 \times 10^{25}$  iron atoms.
2. Find the volume of 7.54 moles of an ideal gas at STP.
3. Find the mass of 654.3 liters of xenon difluoride gas at STP.

### Empirical and Molecular Formulas

1. A certain sample of a salt is known to contain 48.7% fluorine and 51.3% calcium. Determine its empirical formula.
2. A 9.50 g sample of a certain compound containing carbon, hydrogen, and oxygen was analyzed and found to contain 5.18 g of carbon and 0.86 g of hydrogen. (a) Determine the empirical formula of the compound. (b) Given that the compound was separately determined to have a molar mass of 88.1 g/mol, determine its molecular formula.

### Basic Stoichiometry

1. Calcium chloride and silver nitrate solutions react as shown below. Determine the mass of silver chloride produced when 78.9 g of calcium chloride is mixed with an excess of silver nitrate.  $\text{CaCl}_2 + 2 \text{AgNO}_3 \rightarrow \text{Ca}(\text{NO}_3)_2 + 2 \text{AgCl}$
2. Find the volume of carbon dioxide gas produced, at STP, when 45 moles of butane ( $\text{C}_4\text{H}_{10}$ ) is completely burned.  $2 \text{C}_4\text{H}_{10} + 13 \text{O}_2 \rightarrow 8 \text{CO}_2 + 10 \text{H}_2\text{O}$
3. Sodium metal (75.5g) is dropped into a solution of lead(II) nitrate. How much lead metal could be recovered if the solution was in excess?

### Stoichiometry with Molarity and Ideal Gas Law

1. If 650.0 mL of a 0.78M solution of hydrochloric acid (HCl) is mixed with sufficient potassium hydroxide to fully neutralize it then how much water is produced in the process?  
 $\text{HCl} + \text{KOH} \rightarrow \text{H}_2\text{O} + \text{KCl}$
2. A sample of sulfur with a mass of 67.3 g is burned in excess oxygen to produce sulfur trioxide gas. The sulfur trioxide is captured in a 23.5 L tank with a temperature of 97.0°C. Determine the pressure of the sulfur trioxide gas formed.  $2 \text{S} + 3 \text{O}_2 \rightarrow 2 \text{SO}_3$
3. What volume of 1.32 M NaI solution is needed to fully react with 9.08 L of chlorine gas measured at 76.3°C and 6.87 kPa?  $\_\_ \text{NaI} + \_\_ \text{Cl}_2 \rightarrow \_\_ \text{NaCl} + \_\_ \text{I}_2$

### Limiting and Excess Reactant Stoichiometry

1. I mix 98.0 g of gold is reacted with 15.0 g of fluorine gas at STP. (a) Determine the limiting and excess reactants. (b) Determine the theoretical yield of gold(III) fluoride produced. (c) Determine the mass of excess reactant remaining.
2. If 500.0 mL of 0.897 M hexacyanogoldate(III),  $[\text{Ag}(\text{CN})_6]^{3-}$ , is mixed with 100.0 g of oxalic acid,  $\text{H}_2\text{C}_2\text{O}_4$ , then what volume of hydrogen cyanide gas, HCN, could be recovered as measured at 35.2°C and a pressure of 2.45 atm? Also, if the yield of the process is known to be 45.7% then what volume of HCN was actually recovered?  $3 \text{H}_2\text{C}_2\text{O}_4 + [\text{Ag}(\text{CN})_6]^{3-} \rightarrow 6 \text{HCN} + \text{Ag}^{3+} + 3 \text{C}_2\text{O}_4^{2-}$

### Gas Laws and KMT

1. A balloon has a volume of 5.3 L at a pressure of 7.8 atm. Determine the volume needed to achieve a pressure of 110 kPa. Which gas law is this?

2. A sample of carbon dioxide is collected over water at  $20.5^{\circ}\text{C}$  and has a pressure of 800.0 torr. Determine the pressure of dry carbon dioxide at this temperature. (Hint: you may need to look up water vapor pressures.) Which gas law is this?
3. What will the volume of a chip bad at  $65.0^{\circ}\text{C}$  be if it is known to occupy 450.0 mL at  $23.0^{\circ}\text{C}$ ? Which gas law is this? Explain this relationship using KMT.
4. What is the mass of 894.3 mL of oxygen gas at 0.98 atm and  $150.0^{\circ}\text{C}$ ?

## Solutions

1. If you dilute 175 mL of a 1.6 M solution of LiCl to 1.0 L, determine the new concentration of the solution.
2. To what volume should you dilute 133 mL of an 7.90 M  $\text{CuCl}_2$  solution so that 51.5 mL of the diluted solution contains 4.49 g  $\text{CuCl}_2$ ?
3. What is the molarity of 5.00 g of NaOH in 750.0 mL of solution?
4. What volume (in mL) of 18.0 M  $\text{H}_2\text{SO}_4$  is needed to contain 2.45 g  $\text{H}_2\text{SO}_4$ ?