

Stoichiometry I, II, & III Review

Name:

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Key

Show all steps and calculations in the space provided below.

1. Consider the following reaction:



- a. Predict the products and balance the chemical reaction ✓
- b. What is the mole ratio between magnesium and copper?



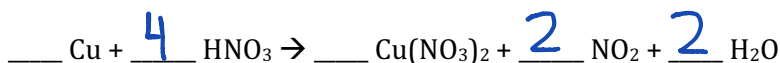
- c. If 12.7g of magnesium reacted, how many grams of copper were produced?

$$12.7 \text{ g Mg} \times \frac{1 \text{ mol Mg}}{24.31 \text{ g Mg}} \times \frac{1 \text{ mol Cu}}{1 \text{ mol Mg}} \times \frac{63.55 \text{ g Cu}}{1 \text{ mol Cu}} = \boxed{33.2 \text{ g Cu}}$$

- d. What volume of 1.72M copper (II) sulphate was needed for this reaction?

$$12.7 \text{ g Mg} \times \frac{1 \text{ mol Mg}}{24.31 \text{ g Mg}} \times \frac{1 \text{ mol CuSO}_4}{1 \text{ mol Mg}} \times \frac{1 \text{ L CuSO}_4}{1.72 \text{ mol CuSO}_4} = \boxed{0.304 \text{ L CuSO}_4}$$

2. Consider the following reaction that occurs at STP:



- a. What is the mole ratio between nitric acid and water?



- b. If 5.0g of copper reacted, how many liters of nitrogen dioxide gas were produced? - At STP

$$5.0 \text{ g Cu} \times \frac{1 \text{ mol Cu}}{63.55 \text{ g Cu}} \times \frac{2 \text{ mol NO}_2}{1 \text{ mol Cu}} \times \frac{22.4 \text{ L NO}_2}{1 \text{ mol NO}_2} = \boxed{3.5 \text{ L NO}_2}$$

- c. How many grams of water were produced?

$$5.0 \text{ g Cu} \times \frac{1 \text{ mol Cu}}{63.55 \text{ g Cu}} \times \frac{2 \text{ mol H}_2\text{O}}{1 \text{ mol Cu}} \times \frac{18.02 \text{ g H}_2\text{O}}{1 \text{ mol H}_2\text{O}} = \boxed{2.8 \text{ g H}_2\text{O}}$$

d. How many molecules of copper (II) nitrate were produced?

$$5.0 \text{ g Cu} \times \frac{1 \text{ mol Cu}}{63.55 \text{ g Cu}} \times \frac{1 \text{ mol Cu(NO}_3)_2}{1 \text{ mol Cu}} \times \frac{6.022 \times 10^{23} \text{ molecules Cu(NO}_3)_2}{1 \text{ mol Cu(NO}_3)_2} = \boxed{4.7 \times 10^{22} \text{ molecules Cu(NO}_3)_2}$$

3. Consider the following reaction: copper (II) nitrate reacts with sodium hydroxide to produce copper (II) hydroxide and sodium nitrate

a. Write a balanced chemical formula to describe the reaction.



b. If 0.059g of copper (II) nitrate were used for this reaction, what mass of sodium nitrate would be produced?

$$0.059 \text{ g Cu(NO}_3)_2 \times \frac{1 \text{ mol Cu(NO}_3)_2}{187.57 \text{ g Cu(NO}_3)_2} \times \frac{2 \text{ mol NaNO}_3}{1 \text{ mol Cu(NO}_3)_2} \times \frac{85.00 \text{ g NaNO}_3}{1 \text{ mol NaNO}_3} = \boxed{0.053 \text{ g NaNO}_3}$$

c. How many mL of 0.10M sodium hydroxide would be needed for this reaction?

$$0.059 \text{ g Cu(NO}_3)_2 \times \frac{1 \text{ mol Cu(NO}_3)_2}{187.57 \text{ g Cu(NO}_3)_2} \times \frac{2 \text{ mol NaOH}}{1 \text{ mol Cu(NO}_3)_2} \times \frac{1 \text{ L NaOH}}{0.10 \text{ mol NaOH}} \times \frac{1000 \text{ mL}}{1 \text{ L}} = \boxed{6.3 \text{ mL NaOH}}$$

d. How many atoms of hydrogen would be produced?

$$0.059 \text{ g Cu(NO}_3)_2 \times \frac{1 \text{ mol Cu(NO}_3)_2}{187.57 \text{ g Cu(NO}_3)_2} \times \frac{1 \text{ mol Cu(OH)}_2}{1 \text{ mol Cu(NO}_3)_2} \times \frac{6.022 \times 10^{23} \text{ molecules Cu(OH)}_2}{1 \text{ mol Cu(OH)}_2} \times \frac{2 \text{ atoms H}}{1 \text{ molecule Cu(OH)}_2} = \boxed{3.8 \times 10^{20} \text{ atoms H}}$$

1a. $\text{MgSO}_4 + \text{Cu}$ 1b. 1:1 1c. 33.2g Cu 1d. 0.304 L CuSO_4 2a. 4:2 2b. 3.5L NO_2 2c. 2.8g H_2O 2d. 4.7×10^{22} molecules $\text{Cu(NO}_3)_2$
 3a. $\text{Cu(NO}_3)_2 + 2\text{NaOH} \rightarrow \text{Cu(OH)}_2 + 2\text{NaNO}_3$ 3b. 0.053g NaNO_3 3c. 6.3mL NaOH 3d. 3.8×10^{20} atoms H