

Chem 151 Drilling Question Set #5
Molarity Calculations, Limiting reagents, Percentage Yield

1. Sodium bromate reacts with sodium bromide according to the reaction:



A procedure calls for 5.00 mL of 0.300 M NaBr solution (in 1.0 M H₂SO₄) added to 1.00 mL of 0.250 M NaBrO₃ solution to produce Br₂.

- a) How many moles of each reactant have been mixed together?

- b) Which reagent is the limiting reagent of this reaction, NaBr or NaBrO₃?

Limiting reagent is the reagent that limits the amount of product produced from a reaction.

Limiting reagent is the reagent that is insufficient to react with all of the other reagents.

- c) How much Br₂ can be produced?

Always use the limiting reagent to predict for the amount of product formed from a reaction.

- d) How much excess reagent remains after the reaction?

- e) If the Br₂ produced from reaction reacts with the Br⁻ remains in solution to form Br₃⁻, assuming the reaction goes to completeness, how much Br₃⁻ can be produced?

2. Joan followed the procedures in Question 1 and obtained 0.100 g of Br₂.

a) What was the percentage yield of Joan's procedure?

$$\text{Percentage yield} = \frac{\text{Actual Yield}}{\text{Theoretical Yield}} \times 100\%$$

b) If Joan extracted all the Br₂ produced into cyclohexane to make 10.0 mL of cyclohexane solution, what is the molarity of Br₂ in the solution?

3. 20.0 mL of 0.050 M BaCl₂ solution is mixed with 30.0 mL of 0.050 M Na₂SO₄ solution and BaSO₄ precipitates. Assume the reaction goes to completeness.

a) How many moles of BaSO₄ are formed from the reaction?

b) What is the molarity of SO₄²⁻ ions in the resultant solution?

c) What is the molarity of Na⁺ ions in the resultant solution?

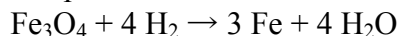
4. Cobalt(II) sulfate can be converted to $\text{Co}(\text{NH}_3)_6\text{Cl}_3$ by a series of reactions. What mass of this compound can be obtained from the complete conversion of 5.30 g of CoSO_4 ? If a student uses 5.30 g of CoSO_4 and produces 5.30 g of $\text{Co}(\text{NH}_3)_6\text{Cl}_3$, what is the percentage yield of this student's synthesis?

Molar masses:

$\text{CoSO}_4 = 155.0 \text{ g/mol}$

$\text{Co}(\text{NH}_3)_6\text{Cl}_3 = 267.5 \text{ g/mol}$

5. A sample containing 75% (by mass) Fe_3O_4 reacted with an excess amount of hydrogen gas at high temperature. The water vapor formed from the reaction below was condensed and found to weigh 8.0 g.



- a) How many grams of iron metal were produced from the reaction?

- b) How many grams of the Fe_3O_4 sample had reacted?

6. Consider the reaction: $2 \text{Al} + 3 \text{Br}_2 \rightarrow 2 \text{AlBr}_3$

a) For a reaction mixture that contains 10.0 g of Al and 20.0 g of Br_2 , if the reaction goes to completeness, how many grams of AlBr_3 is formed?

b) How many grams of excess reagent remains after the reaction?