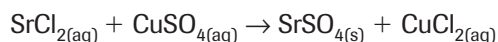


2.11 Investigation

The Limiting Reagent in a Chemical Reaction

When conducting experiments, it is necessary to determine which substance is the limiting reagent and which substance is the excess reagent. In this investigation, you will predict the mass of the precipitate that forms in a double displacement reaction, based on the quantities of reactants used and the balanced chemical equation. Then you will design and conduct an experiment to test your prediction and determine which reagent is in excess.

Strontium chloride, $\text{SrCl}_{2(\text{aq})}$, reacts with copper(II) sulfate, $\text{CuSO}_{4(\text{aq})}$, to produce strontium sulfate, $\text{SrSO}_{4(\text{s})}$, as a precipitate. The other product is copper(II) chloride, $\text{CuCl}_{2(\text{aq})}$, which remains in solution. The balanced chemical equation is



Question

What is the mass of the precipitate that is produced by the reaction of 2.00 g of strontium chloride with excess copper(II) sulfate in 75 mL of water?



Strontium chloride is moderately toxic. Copper(II) sulfate is a strong irritant and is toxic if ingested. Lab aprons and eye protection must be worn.

Prediction

- Determine which reactant is the limiting reagent, and predict the mass of the precipitate that will form.

Experimental Design

- Design an experiment in which you will determine the limiting reagent in the reaction of strontium chloride with copper(II) sulfate from the mass of the precipitate, strontium sulfate.

Inquiry Skills

- | | | |
|---|---|--|
| <input type="radio"/> Questioning | <input checked="" type="radio"/> Planning | <input checked="" type="radio"/> Analyzing |
| <input type="radio"/> Hypothesizing | <input checked="" type="radio"/> Conducting | <input checked="" type="radio"/> Evaluating |
| <input checked="" type="radio"/> Predicting | <input type="radio"/> Recording | <input checked="" type="radio"/> Communicating |

Materials

- List any necessary chemicals and equipment.

Procedure

- Write a step-by-step Procedure, including safety precautions. Also include disposal instructions, which you can obtain from your teacher. Have your Procedure approved by your teacher before carrying it out.

Observations

- Design a table that you can use to record both qualitative and quantitative observations.

Analysis

- Analyze your Observations.
- Answer the Question.

Evaluation

- Discuss sources of experimental error. Suggest changes to the Procedure that may help to reduce these sources of error.
- Evaluate your Prediction based on your Observations and on an analysis of the Experimental Design and your Procedure.
- Evaluate the stoichiometric method, as used to predict the masses of reactants and products.