

Mole Relationships in a Chemical Reaction

Prelab Discussion

In this experiment, you will let aluminum metal react with a copper(II) chloride solution. After observing the results of this chemical reaction, you will determine the mass of aluminum used and the mass of product formed. These data will then be presented in a more useful form, i.e. the ratio of moles of aluminum used to moles of product formed. Once mole ratio is determined, it may be converted to a whole number ratio and the numbers placed in front of the symbols for aluminum and copper. The result should be a balanced chemical equation with the atoms of the product equal in number and kind to the atoms of reactant. Stoichiometric calculations are based on the coefficients in a correctly balanced equation.

Prelab Assignment

From the Prelab discussion, formulate a statement to:

- a) experimentally determine the mole ratio between the participants in a chemical reaction.
- b) Experimentally determine the coefficients in an equation for a reaction.

Materials

You will be provide with aluminum metal, and solid copper (II) chloride.

Procedure

Before coming to the laboratory, you should plan what you are to do. In this experiment, you will need to determine the mass changes which occur during the reaction, and hence devise a suitable procedure to determine these.

Data Table(s)

Record you observations and data accurately and neatly in two suitable data tables. Take special care to record the units as an important part of each measurement. Express each measurement using the correct number of significant figures.

Data Analysis

1. Determine the mass of Al used, and hence the moles of Al used.
2. Determine the mass of dry product.
3. Assuming the product to be copper, determine the moles of copper produced.
4. Determine the moles ratio: moles of Al : moles of Cu.
5. Convert the fractional coefficient to a whole number ratio coefficient in the reaction.
6. Hence, write a balanced chemical equation for the reaction of Al with copper (II) chloride.

Conclusion

Provide a valid conclusion to your Prelab assignment.

Discussion

1. List some of the sources of experimental error which you think may have influenced the accuracy of your results in this experiment. Wherever possible, indicate whether each error would have made your result high or low, and suggest methods of improving your procedure.
2. What evidence did you observe that would suggest some of the copper in the solution was not used up?
3. What caused the color in the solution to appear as the reaction proceeded?
4. If the copper produced in the experiment contained water during your last weighing, how would this affect your results?
5. What type of reaction is being studied here? Why can a metal such as Al be used for this reaction? (Hint: think of the Activity Series!)
6. How many atoms of Al were consumed in your experiment?
7. How many atoms of copper metal were formed in your experiment?
8. Assume that gallium metal would act atom-for-atom exactly the same as aluminum in this experiment. How many grams of gallium, Ga, would have been used in the reaction if one gram of copper were produced?
9. From the balanced equation for the reaction of aluminum with copper (II)chloride solution, calculate the theoretical mass of copper that should have been obtained. Show mathematical calculations in your report.
10. Determine the percentage yield.