

PRE-LAB DISCUSSION

The atomic mass (or atomic weight) of an element is the average value of the masses of the isotopes in a natural sample of that element. Atomic masses of all the elements are based on the mass of an atom of carbon-12, which has been assigned the value of 12 atomic mass units. An atomic mass unit (represented by the symbol u) is defined as 1/12 the mass of a carbon-12 atom.

In their work, chemists do not deal with individual atoms or molecules. Rather, they deal with relatively large numbers of atoms and molecules. To make their calculations easier, chemists often use units of measure that are made up of large numbers of atoms or molecules. One such quantity is called the *gram atomic mass*, or *gram-atom*. A gram-atom is the mass in grams of 1 mole of atoms. A gram-atom of an element is, therefore, the mass of 6.02×10^{23} atoms of that element. The mass in grams of 1 gram-atom of an element is numerically equal to the atomic mass of that element. For example, 1 gram-atom of carbon-12 has a mass of 12 grams.

There are several methods for determining the gram atomic mass of an element. In this experiment, the gram atomic mass of silver will be calculated using a compound (silver oxide) of known composition (Ag_2O).

PURPOSE

From measurements of a binary compound of known composition, determine the gram atomic mass of one of the elements in the compound when the atomic mass of the other element is known.

EQUIPMENT

crucible and cover	microspatula
ring stand	burner
iron ring	balance
clay triangle	safety goggles
crucible tongs	lab apron or coat

MATERIALS

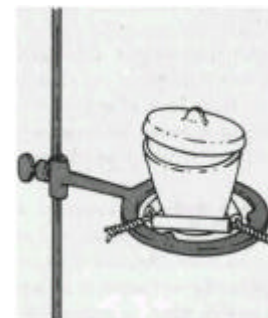
silver oxide (Ag_2O)

SAFETY

Tie back long hair and secure loose clothing when working with an open flame. Do not touch the hot crucible or its cover with your fingers. Be sure to wear safety goggles and a lab apron or coat when working in the lab.

PROCEDURE

1. Clean a crucible and cover. Place the crucible in the clay triangle as shown in the figure. Heat the crucible and cover in the hottest part of the burner flame for about 5 minutes. Be sure to tilt the cover as illustrated. Balance it carefully to avoid breakage. Put out the flame and allow the crucible and cover to cool.
2. Measure the mass of the crucible + cover. Record this mass as (a) in your data table.
3. Measure out exactly 1.75 g of dry silver oxide (Ag_2O). Add this compound to the crucible. With the cover on the crucible, measure the mass of the crucible and its contents. Record this mass as (b).
4. To remove oxygen gas from the silver oxide, tilt the cover as before and strongly heat the crucible, cover, and contents in the hottest part of the flame for 15 minutes. Allow the crucible to cool. Measure and record the mass of the crucible, cover, and contents (c).
5. If time permits, reheat strongly for 5 minutes. After cooling, again measure the mass of the crucible, cover, and contents to check for constancy of mass (d).



OBSERVATION AND DATA

- | | |
|---|---------|
| a) Mass of crucible + cover | _____ g |
| b) Mass of crucible + cover + Ag_2O | _____ g |
| c) Mass of crucible + cover + Ag | _____ g |
| d) Mass after reheating | _____ g |

CALCULATIONS

1. Find the mass of the Ag = c — a

$$= \text{_____ g}$$

2. Find the mass of the O = b — c

$$= \text{_____ g}$$

3. Find the number of g-atoms of O: g-atoms O:

$$\text{g-atoms O} = \frac{\text{mass of O in g}}{16 \text{ g O} / \text{g-atom O}}$$

$$= \text{_____ g}$$

4. Find the number of g-atoms of Ag:

$$\begin{aligned} \text{g-atoms Ag} &= \frac{2 \text{ g-atoms Ag}}{1 \text{ g-atom O}} \times \text{no. of g-atoms O} \\ &= \text{_____ g} \end{aligned}$$

5. Find g-atom mass of Ag:

$$\begin{aligned} \text{g-atomic mass Ag} &= \frac{\text{mass of Ag in g}}{\text{no. of g-atoms of Ag}} \\ &= \text{_____ g} \end{aligned}$$

CONCLUSION AND QUESTIONS

1. Write a balanced equation for the decomposition of Ag_2O by heating.
2. What are the most likely sources of error in this experiment?
3. Define a mole. What is the relationship between the mole and the gram-atom?