

Molar Display



Introduction

Every mole contains Avogadro's number of items. For elements, every mole contains the same number of atoms but may have a dramatically different mass and volume.

Concepts

- Avogadro's number
- Mole
- Molar mass

Materials

Labeling or marking pen

ParaFilm®

Plastic bottles with caps, beakers, or zipper-lock plastic bags

Various samples of compounds (optional)

Various samples of elements, e.g., sulfur; aluminum foil or shot; copper shot; carbon or graphite; lead shot; iron filings; calcium turnings; zinc, mossy; magnesium ribbon or turnings; and tin, mossy or shot.

Safety Precautions

The safety hazards depend on the materials chosen. Keep the caps on the bottles or cover the beakers with ParaFilm®. If mercury is used, be sure it is placed in a plastic bottle with a taped cap. Wear chemical splash goggles, chemical-resistant gloves, and a chemical-resistant apron. Please review current Material Safety Data Sheets for additional safety, handling, and disposal information.

Preparation

1. Mass the bottle, beaker, or plastic bag and record the mass on the container.
2. Fill the container with exactly one mole of material. To add exactly one mole, find the atomic mass of the element using a periodic table and add this amount in grams to the container.
3. Cover the container or seal the bag.

Procedure

1. Display the containers and explain that each one contains the same number of atoms.
2. Discuss the concepts of Avogadro's number, mole, and molar mass.
3. Mass each container and mole of material and subtract out the mass of the container. Record the mass of the substance on the board.
4. Use the periodic table to identify the element in each container.
5. *Optional:* Repeat the demonstration using different compounds or mole fractions.

Disposal

Please consult your current *Flinn Scientific Catalog/Reference Manual* for general guidelines and specific procedures governing the disposal of laboratory waste. Seal the containers with ParaFilm or electrical tape and save them for next year. Be sure to label each container with the element, hazard, and mass of the container.

Connecting to the National Standards

This laboratory activity relates to the following National Science Education Standards (1996):

Unifying Concepts and Processes: Grades K–12

- Systems, order, and organization
- Evidence, models, and explanation
- Constancy, change, and measurement

Content Standards: Grades 5–8

- Content Standard A: Science as Inquiry
- Content Standard B: Physical Science, properties and changes of properties in matter

Content Standards: Grades 9–12

- Content Standard A: Science as Inquiry
- Content Standard B: Physical Science, structure of atoms, structure and properties of matter

Tips

- There are many possible variations of this demonstration—be creative. Some teachers give each student group one container and ask the group to identify the element. If this is done, use partial moles and provide the students with the following information: 0.20 moles of X, container weighs 63.0 g. What element is it?
- Use elements that are finely divided solids so the observed volume will approximate the volume of the solid. Powders, small shot pieces, or foils work well.
- A common misconception is that equal volumes of chemicals contain equal number of atoms or equal moles. This is true only for ideal gases. For liquids and solids, the number of atoms is directly related only to their molar mass.
- Stress to students that a mole is simply a defined number (Avogadro's number) of items just like a dozen or gross is a prescribed number of items. Because the number of atoms in any measurable quantity of an element is extremely large, scientists use Avogadro's number to define a convenient number of atoms or molecules. One mole of a substance contains the same number of units as one mole of any other substance.

A variety of teaching aids to further illustrate the mole concept are available from Flinn Scientific, Inc.

Catalog No.	Description
AP6255	Flinn ChemTopic™ Labs, Volume 7, Molar Relationships and Stoichiometry
AP6213	Mole Banner
AP6159	Make-a-Mole, Hands-on Student Kit
AP4587	Mole Balloon Activity Kit
AP6174	Celebrate the Molennium CD

Consult your *Flinn Scientific Catalog/Reference Manual* for current prices.