Section 10.2 Mass and the Mole

Objectives

- **Relate** the mass of an atom to the mass of a mole of atoms.
- **Convert** between number of moles and the mass of an element.
- **Convert** between number of moles and number of atoms of an element.

Review Vocabulary

conversion factor: a ratio of equivalent values used to express the same quantity in different units

New Vocabulary

molar mass

MAIN Idea **A mole always contains the same number of particles; however, moles of different substances have different masses.**

The Mass of a Mole

- 1 mol of copper and 1 mol of carbon have different masses.
- One copper atom has a different mass than 1 carbon atom.
- The mass of each element is found on the P.T. under the element's symbol (known as molar mass)

The Mass of a Mole (cont.)

- **Molar mass** is the mass in grams of one mole of any pure substance.
- The molar mass of any element is numerically equivalent to its atomic mass and has the units g/mol.

1 mol of iron

$=$ 6.02×10^{23} atoms of iron

Concepts In Motion
Click here to view an animated version of this graphic.

Using Molar Mass

- Moles to mass

$$\text{number of moles} \times \frac{\text{mass in grams}}{1\ \text{mole}} = \text{mass}$$

$$3.00\ \cancel{\text{mol Cu}} \times \frac{63.546\ \text{g Cu}}{1\ \cancel{\text{mol Cu}}} = 191\ \text{g Cu}$$

3.00 moles of copper has a mass of 191 g.

Using Molar Mass (cont.)

- Convert mass to moles with the inverse molar mass conversion factor.

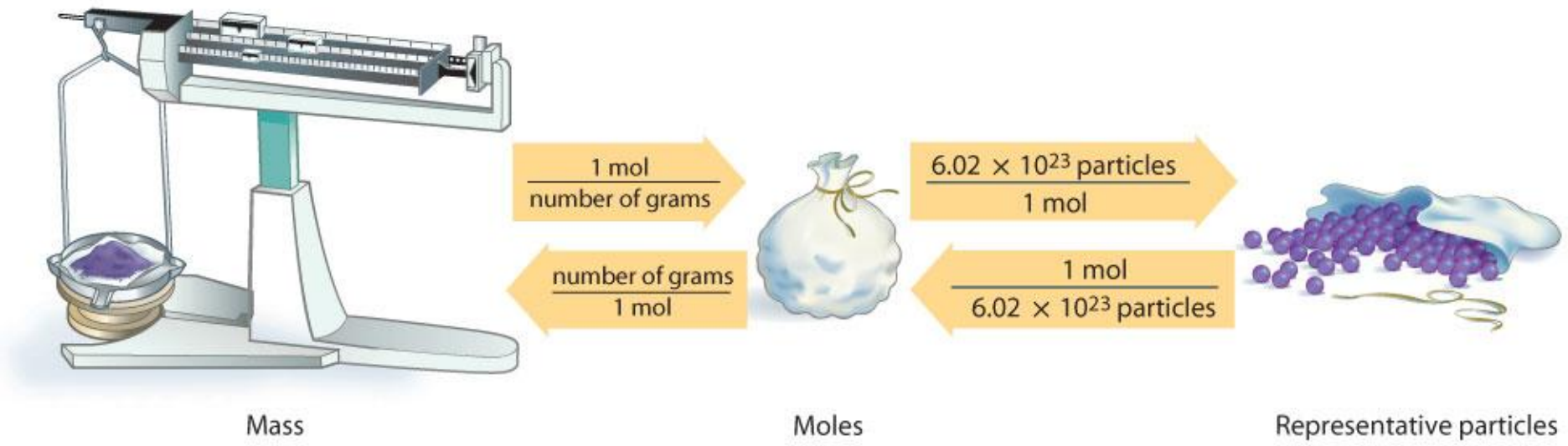
Ex) Convert 110 g Ca to moles

$$110\ \text{g} \times \frac{1\ \text{mol}}{40.1\ \text{g}} = 2.74\ \text{moles}$$

- Convert moles to atoms/molecules/formula units with Avogadro's number as the conversion factor.

Using Molar Mass (cont.)

- This figure shows the steps to complete conversions between mass and atoms.



- What is the mass of 3.6 moles of Fe?

- How many moles are in 98.5 grams of Sodium?

- What is the mass of 2.25 moles of Carbon?

- How many moles are in 125.8 grams of aluminum?

Section 10.2 Assessment

CheckPoint

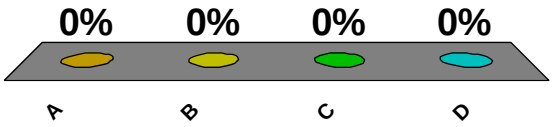
The mass in grams of 1 mol of any pure substance is:

A. molar mass

B. Avogadro's number

C. atomic mass

D. 1 g/mol



Section 10.2 Assessment

CheckPoint

Molar mass is used to convert what?

A. mass to moles

B. moles to mass

C. atomic weight

D. particles