

10.1

THE MOLE: A MEASUREMENT OF MATTER

Section Review

Objectives

- Relate Avogadro's number to a mole of a substance
- Calculate the mass of a mole of any substance
- Describe methods of measuring the amount of something
- Compare and contrast the atomic mass of an element and its molar mass

A.N. = Avogadro's Number

Vocabulary

- mole (mol)
- Avogadro's number
- representative particle
- molar mass

Key Equations

- moles = representative particles $\times \frac{1 \text{ mole}}{6.02 \times 10^{23} \text{ representative particles}}$
- representative particles = moles $\times \frac{6.02 \times 10^{23} \text{ representative particles}}{1 \text{ mole}}$

Part A Completion

Use this completion exercise to check your knowledge of the terms and your understanding of the concepts introduced in this section. Each blank can be completed with a term, short phrase, or number.

Chemists relate units of counting, of mass, and of volume to a single quantity called the 1. The number of representative particles in a mole of a substance is 2.

To find the mass of a mole of a compound, scientists add together the 3 of the atoms making up the compound. When you substitute the unit *grams* for amu, you obtain the 4 of the compound. There are 5 representative particles in a mole of any substance.

1. Mole
2. 6.02×10^{23} / A.N.
3. Atomic Mass
4. Molar Mass
5. 6.02×10^{23}

Part B True-False

Classify each of these statements as always true, AT; sometimes true, ST; or never true, NT.

ST 6. A mole of a pure substance contains 6.02×10^{23} atoms.

ST 7. The representative particle of a compound is the molecule.

NT 8. A mole of CCl_4 is composed of one atom of carbon and four atoms of chlorine.

AT 9. A mole of carbon atoms has a mass approximately three times as great as the mass of a mole of helium atoms.

NT 10. The molar mass of nitrogen gas is 14.0 g. $\Rightarrow \text{N}_2$ not just N

Part C Matching

Match each description in Column B to the correct term in Column A.

Column A

Column B

B 11. Avogadro's number

a. the atoms, molecules, or ions present in a substance

C 12. molar mass

b. 6.02×10^{23}

D 13. mole

c. the mass of one mole of a substance

A 14. representative particles

d. SI unit that measures the amount of a substance

Part D Problems

Solve the following problems in the space provided. Show your work.

15. How many moles of Pb is 9.3×10^{15} atoms of Pb?

$$\frac{9.3 \times 10^{15} \text{ atoms Pb}}{1} \times \frac{1 \text{ mol}}{6.02 \times 10^{23} \text{ atoms Pb}} = 1.5 \times 10^{-8} \text{ mol Pb}$$

16. What is the molar mass of ethane, C_2H_6 ?

$$\text{Atomic Mass of C} = \frac{12 \text{ g C}}{1 \text{ mol}} \quad \text{Atomic Mass H} = \frac{1 \text{ g H}}{1 \text{ mol}} \quad \left. \vphantom{\frac{12 \text{ g C}}{1 \text{ mol}}} \right\} [(12) \times 2] + [(1) \times 6] = \frac{30 \text{ g}}{\text{mol}}$$

17. Find the mass of 3.65×10^{-2} mol K_2SO_4 .

$$\text{Molar Mass } \text{K}_2\text{SO}_4 = \frac{174.3 \text{ g } \text{K}_2\text{SO}_4}{1 \text{ mol } \text{K}_2\text{SO}_4} \left. \vphantom{\frac{174.3 \text{ g } \text{K}_2\text{SO}_4}{1 \text{ mol } \text{K}_2\text{SO}_4}} \right\} \frac{3.65 \times 10^{-2} \text{ mol } \text{K}_2\text{SO}_4}{1} \times \frac{174.3 \text{ g } \text{K}_2\text{SO}_4}{1 \text{ mol } \text{K}_2\text{SO}_4} =$$

18. How many representative particles are in 2.5 mol H_2O_2 ?

$$\frac{2.5 \text{ mol. } \text{H}_2\text{O}_2}{1} \times \frac{6.02 \times 10^{23} [\text{H}_2\text{O}_2]}{1 \text{ mol. } \text{H}_2\text{O}_2} =$$

1.5×10^{24} rep. particles $[\text{H}_2\text{O}_2]$

6.36 g K_2SO_4