

THE MOLE

Avogadro's Hypothesis: Equal volumes of gases at the same temperature and pressure have the same number of molecules.

1 Mole (mol) = is equal to the number of carbon atoms in 12.01 g of carbon = 6.02×10^{23} atoms

1 Mol = 6.02×10^{23} **objects** (atoms, molecules, formula units, horses, cars etc.....)

For example: 1 dozen eggs = 12 eggs

1 ream paper = 500 sheets of paper

A Bakers Dozen = 13 "whatever"

A Gross = 144 "whatever"

1 Mol Eggs = 6.02×10^{23} eggs

1 Mol euro's = 6.02×10^{23} euro's

FYI: If the entire state of Texas, with an area of 262,000 sq miles, were covered with a thin layer of fine sand 50 ft deep, each grain of sand being $1/100^{\text{th}}$ of an inch in diameter would equal Avogadro's number of sand particles!

$$\frac{1 \text{ mole}}{6.02 \times 10^{23} \text{ objects}} \qquad \frac{6.02 \times 10^{23} \text{ objects}}{1 \text{ mole}} \qquad \frac{1 \text{ mole}}{\text{"X" grams}} \qquad \frac{\text{"X" grams}}{1 \text{ mole}}$$

Molar Mass: the mass in grams (taken from the atomic mass off the periodic table of the element) of 1 mole of any substance (units: g/mol)

I. A.) What is the molar mass of lead?

B.) What is the molar mass of sucrose, $\text{C}_{12}\text{H}_{22}\text{O}_{11}$?

II. GRAMS \rightarrow MOLES

A.) How many moles of carbon are in 26 g of carbon?

B.) How many moles of iron (II) sulfate are in 50g of iron (II) sulfate?

III. MOLES \rightarrow GRAMS

A.) How many grams of copper are in 2.50 mol of Cu?

B.) How many grams of potassium phosphate are in 0.76 mol of potassium phosphate?

IV. MOLES \rightarrow REPRESENTATIVE PARTICLES

A.) How many formula units are in 2.5 mol of nickel (III) carbonate?

B.) How many molecules (mole's) are in 0.75 mol of carbon tetrachloride?

V. REPRESENTATIVE PARTICLES → MOLES

- A.) How many moles are in 1.25×10^{21} atoms of Zn?
- B.) How many moles are in 0.45×10^8 formula units of copper (II) nitrate?

VI. GRAMS → REPRESENTATIVE PARTICLES

- A.) How many atoms of lithium are in 29.8 g Li?
- B.) How many formula units are in 75 g of sodium chloride?
- C.) How many molecules are in 50 g of carbon dioxide?

VII. REPRESENTATIVE PARTICLES → GRAMS

- A.) How many grams are in 2.41×10^{24} formula units of Magnesium Cyanide?
- B.) How many grams of water are in 2.17×10^{23} molecules of water?

VIII. MASS OF 1 REPRESENTATIVE UNIT

- A.) What is the mass of 1 carbon atom?
- B.) What is the mass of mole molecule of diphosphorus pentoxide?
- C.) What is the mass of one formula unit of iron (III) chloride?

IX. ASSORTED

- A.) How many atoms are in 2.12 mol of propane (C_3H_8)?
- B.) What is the mass of 2.76×10^{18} g of copper (II) sulfate pentahydrate?
- C.) What is the mass of 10 molecules of glucose? ($C_6H_{12}O_6$)