



IDX G10 Chemistry Study Guide Issue #

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Chapter 10.1

- A mole (mol) of a substance is 6.02×10^{23} representative particles of that substance and is the SI unit for measuring the amount of a substance.
 - The number of representative particles in a mole, 6.02×10^{23} , is called Avogadro's number.(NA)
- The mole allows chemists to count the number of representative particles in a substance.
 - Representative particles refer to the species present in a substance.
 - ◆ For elements consist of atoms, their representative particles are atoms.
 - E.g. Fe, Hg, Cu
 - ◆ For elements consist of molecules, their representative particles are molecules.
 - E.g. H₂O
 - ◆ For ions, their representative particles are ions.
 - E.g. Calcium ion, or Ca²⁺
 - ◆ For ionic compounds, their representative particles are formula units.
 - E.g. Calcium Fluoride, or CaF₂
- A mole of any substance contains Avogadro's number of representative particles, or 6.02×10^{23} representative particles.

Examples: (representative particles correspond to the correct subject)

- 1 mole iron contains 1 mole iron atoms.
- 1 mole H₂O contains 2 moles H atoms and 1 mole O atoms.
- 1 mole CaF₂ contains 1mole Ca²⁺ ions and 2 moles F⁻ ions

E.g. Magnesium is a light metal used in the manufacture of aircraft, automobile

wheels, and tools. How many moles of magnesium is 1.25×10^{23} atoms of magnesium?

Multiply the number of atoms of Mg by the conversion factor.

$$1.25 \times 10^{23} \text{ atoms Mg} \times$$
$$= 0.208 \text{ mol Mg}$$

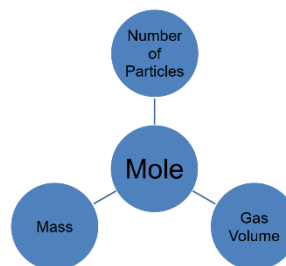
$$\frac{1 \text{ mol Mg}}{6.02 \times 10^{23} \text{ atoms Mg}}$$

In the conversion factor, we put the unit we want to get as a numerator, and the unit we want to neutralize as the denominator.

- Atomic mass is the mass of an atom expressed relative to 1/12 of the mass of a carbon-12 atom.
- The mass of a mole of an element is its molar mass. And it is numerically equal to its atomic mass.
 - E.g. mass of 1 mol $\text{H}_2\text{O}_2 = 2.0 \text{ g H} + 32.0 \text{ g O} = 34.0 \text{ g}$
molar mass of $\text{H}_2\text{O}_2 = 34.0 \text{ g/mol}$

Chapter 10.2

- Mole is the central unit in converting the amount of a substance from one type of measurement to another.
 - Mole to mass relationship
 - ◆ Unit equality: $1 \text{ mol} = \text{molar mass (g)}$
 - Mole to volume relationship
 - ◆ At STP, 1 mol representative particles of any gas occupies a volume of 22.4 L
 - ◆ The quantity, 22.4 L, is called the molar volume of a gas.
 - ◆ Unit equality: $1 \text{ mol} = 22.4 \text{ L}$
- Avogadro's hypothesis states that equal volumes of gases at the same temperature and pressure contain equal numbers of particles.
- Standard temperature and pressure (STP) means a temperature of 0°C and a



pressure of 101.3 kPa, or 1 atmosphere (atm).

Hint: this chapter is mainly related to calculations, so be aware of the correct way of using conversion factors, and representative units while calculating.

Chapter 10.3

- The relative amounts of the elements in a compound are expressed as the percent composition or the percent by mass of each element in the compound.

$$\% \text{ by mass of element} = \frac{\text{mass of element}}{\text{mass of compound}} \times 100\%$$

- Empirical formula: a formula that gives the simplest whole-number ratio of the atoms of the elements in a substance.
 - Ionic compounds only have Empirical formula
- Molecular formula: A formula that gives the actual number of atoms of each element in a molecular compound.
 - Molecular compounds could have both Empirical and Molecular formula

