GENERAL CHEMISTRY STANDARD 7.1

7.1: Use Avogadro's number to differentiate between number of molecules and a mole of a substance

DEFINITIONS

- **Mole:** The fundamental unit for measuring the amount of a substance
  - Defined as the amount of substance that contains as many elementary entities (atoms, molecules, or other particles) as there are atoms in exactly 12.000 grams of the carbon-12 isotope.
  - That number is called **Avogadro's Number**: 6.02×10^{23}
  - Avogadro's Number can be used as a conversion factor in dimensional analysis

EXAMPLES

- Calculate the number of atoms of helium in 8.5 moles of helium.

$$\frac{8.5 \text{ moles He}}{1} \left| \frac{6.02 \times 10^{23} \text{ atoms He}}{1 \text{ mol He}} \right. = 5.1 \times 10^{24} \text{ atoms He}$$

- Calculate the number of molecules of methane in 0.520 moles of methane.

$$\frac{0.520 \text{ moles } CH_4}{1} \left| \frac{6.02 \times 10^{23} \text{ molecules } CH_4}{1 \text{ mol } CH_4} \right. = 3.13 \times 10^{23} \text{ molecules CH3}$$

EXAMPLES

- Calculate the number of moles of oxygen if you have 5.5×10^{24} molecules of oxygen.

$$\frac{5.5 \times 10^{24} \text{ molecules } O_2}{} \times \frac{1 \text{ mol } O_2}{6.02 \times 10^{23} \text{ molecules } O_2} = 9.1 \text{ moles } O_2$$

- Calculate the number of atoms of oxygen if you have 3.2 moles of oxygen

$$\frac{3.2 \text{ moles } O_2}{} \times \frac{6.02 \times 10^{23} \text{ molecules } O_2}{1 \text{ mol } O_2} \times \frac{2 \text{ atoms oxygen}}{1 \text{ molecule } O_2}$$

$$= 3.9 \times 10^{24} \text{ atoms oxygen}$$