Warm Up

Determine the number of atoms found in 0.924 moles of glucose ($C_6H_{12}O_6$).

$$0.924 \; \cancel{mol} \; \cancel{C_6H_{12}O_6} \times \frac{6.02 \times 10^{23} \; molecules \; \cancel{C_6H_{12}O_6}}{1 \; \cancel{mol \; C_6H_{12}O_6}} \times$$

$$\frac{24 \; atoms}{1 \; \cancel{molecules \; C_6H_{12}O_6}} = \boxed{1.33 \times 10^{25} \; atoms}$$

Molar Mass

- the molar mass of a substance represents the mass of one mole of the substance
  - it is expressed in grams per mol (g/mol)

To determine the molar mass of a substance:
- make sure the formula is written properly
- determine the number of atoms of each element
- use the atomic molar masses of each atom from the periodic table and multiply this by the number of atoms
- add the mass of the atoms together so as to represent the total mass of the substance in grams per mole
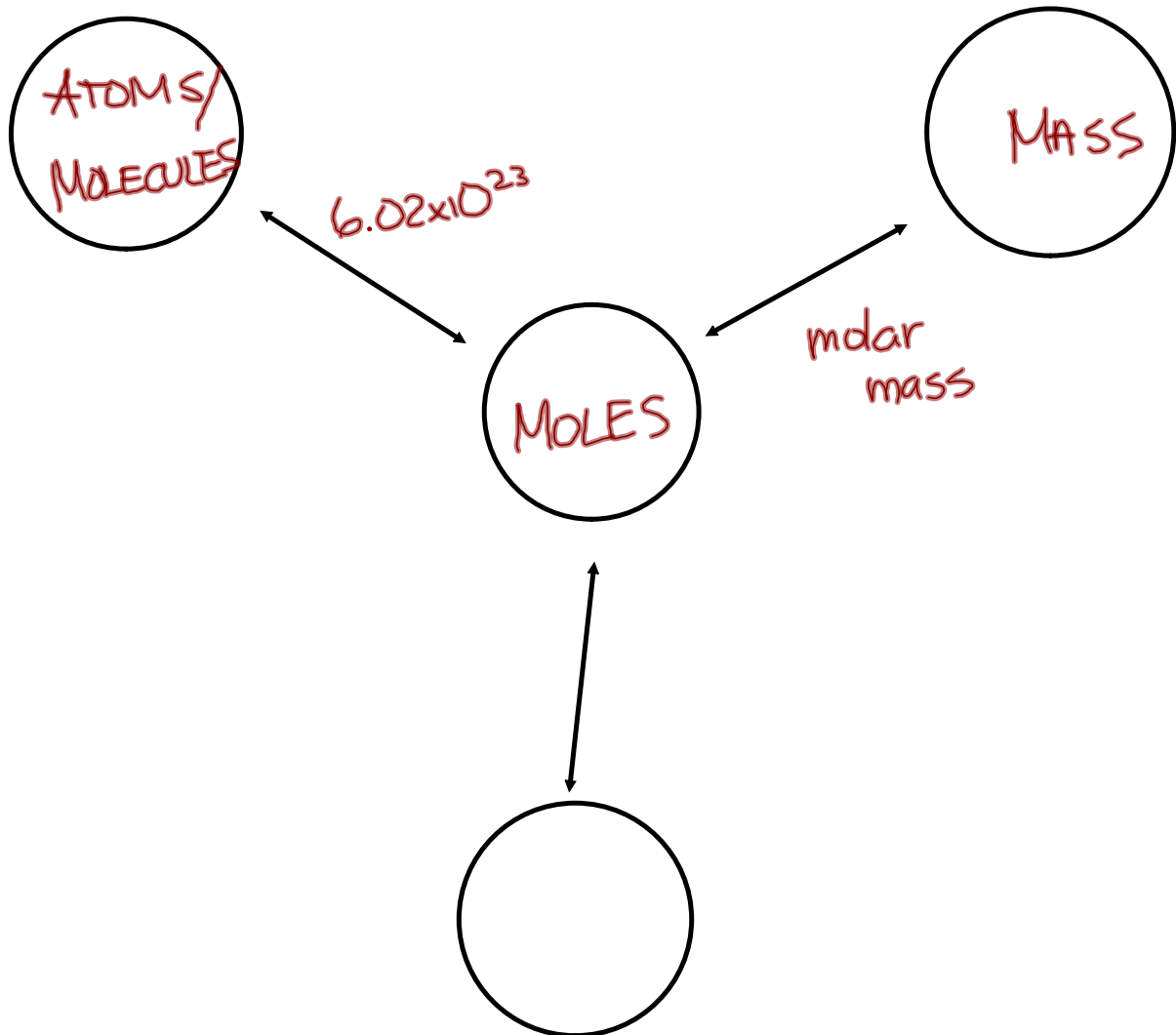
Ex. What is the molar mass of $(NH_4)_3PO_4$?

$$N \longrightarrow 3 \times 14.01 = 42.03$$
$$H \longrightarrow 12 \times 1.01 = 12.12$$
$$P \longrightarrow 1 \times 30.97 = 30.97$$
$$O \longrightarrow 4 \times 16.00 = \underline{64.00}$$
$$149.12 \text{ g/mol}$$

ATOMS/
MOLECULES

6.02x10^{23}

MASS

MOLES

molar
mass

Find the molar mass of:

a) H_2O

$$(2 \times 1.01) + (1 \times 16.00) = \boxed{18.02 \, g/mol}$$

b) $Ca(NO_3)_2$

$$(1 \times 40.08) + (2 \times 14.01) + (6 \times 16.00) = \boxed{164.10 \, g/mol}$$

c) $C_6H_{12}O_6$

$$(6 \times 12.01) + (12 \times 1.01) + (6 \times 16.00) = \boxed{180.18 \, g/mol}$$

Molar Mass Conversions

Once molar mass is established, a conversion can be made from grams to moles or moles to grams (depending on the measurement of the sample)

$$Mm = \frac{m}{n}$$

mass (g)

# of moles

Ex. 100. g of NaCl, converted to moles

$$100.\text{g NaCl} \times \frac{1 \text{ mol NaCl}}{58.44 \text{ g NaCl}} = \boxed{1.71 \text{ mol NaCl}}$$

$$NaCl \rightarrow (1 \times 22.99) + (1 \times 35.45) = 58.44 \text{ g/mol}$$

Ex. 5.05 mol of NaNO$_3$, converted to grams

$$5.05 \text{ mol NaNO}_3 \times \frac{85.00 \text{ g NaNO}_3}{1 \text{ mol NaNO}_3} = \boxed{429 \text{ g NaNO}_3}$$

NaNO$_3$
$$\hookrightarrow (1 \times 22.99) + (1 \times 14.01) + (3 \times 16.00) = 85.00 \text{ g/mol}$$

Homework

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