SCH 3U
MOLAR MASS

STOICHIOMETRY & CONVERSION FACTORS:

- The ratio (by atoms or by moles) in which they occur in the formula.

Consider the molecule of dinitrogen pentoxide, N_2O_5.

The immediate information we receive from the molecular formula includes the following:

1 molecule of N_2O_5 ↔ 2 nitrogen atoms to 5 oxygen atoms
1 mole of N_2O_5 ↔ 2 mol nitrogen and 5 mol oxygen

The relationships in N_2O_5 can be expressed in each of the following ways:

1 mol N_2O_5 ↔ 2 mol N
1 mol N_2O_5 ↔ 5 mol O
2 mol N ↔ 5 mol O

We can use the above relationships to create conversion factors for solving stoichiometric problems.

$$\frac{1\ mol\ N_2O_5}{2\ mol\ N}\ \ or\ \ \frac{2\ mol\ N}{1\ mol\ N_2O_5}$$

$$\frac{1\ mol\ N_2O_5}{5\ mol\ O}\ \ or\ \ \frac{5\ mol\ O}{1\ mol\ N_2O_5}$$

$$\frac{2\ mol\ N}{5\ mol\ O}\ \ or\ \ \frac{5\ mol\ O}{2\ mol\ N}$$

EXERCISE:

① How many moles of O atoms are combined with 8.70 moles of Cl atoms in Cl_2O_7?

② How many moles of C atoms are combined with 4.15 moles of Fe atoms in $Fe_2(CO_3)_3$?

One mole of any element has a mass ***in grams*** that is numerically equal to the element's atomic mass.
This mass is commonly referred to as **MOLAR MASS**.

Consider the phosphorus atom:

1 atom of P has a mass of 30.97376 **amu**
1 mol of P has a mass of 30.97376 **g**

Similarly, one mole of any compound has a mass in grams that is numerically equal to the compound's formula (or molecular) mass.

Consider the water molecule:

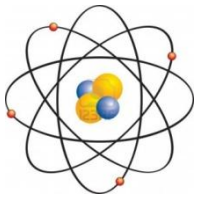
1 molecule of H_2O has a mass of $2(1.00794) + 15.9994$ = 18.01528 **amu**
1 mol of H_2O has a mass of $2(1.00794) + 15.9994$ = 18.01528 **g**

EXERCISE:

① What is the mass of...

A) 1 atom of Au?

B) 1 mole of Au?



② What is the molar mass of Na_2CO_3?

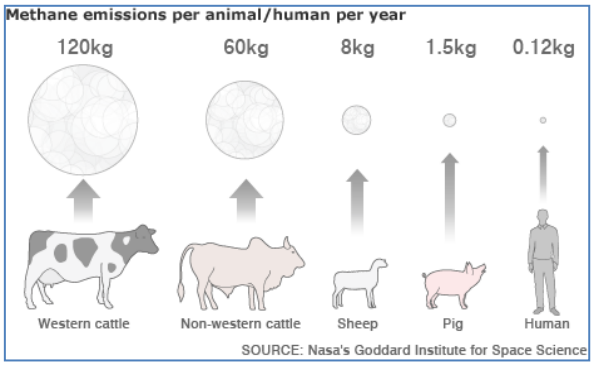
③ What is the mass of...

A) 1 molecule of CH_4?

B) 1 mole of CH_4

C) 2.25 moles of CH_4?

D) 2.25×10^{24} molecules of CH_4?



④ How many moles of stannous bromide are there in...

A) 1.02×10^{25} formula units?

B) 9.95×10^{25} atoms of bromine?

C) 400. 0 grams of the compound?

⑤ How many moles of sulfur are present in 35.6 g of sulfur?

⑥ What mass of silver is in 0.263 mol of Ag?

⑦ How many atoms are in 3.500×10^{-5} g of lead?

⑧ How many moles are equivalent to...

A) 9.1×10^{24} molecules of $C_6H_{12}O_6$?

B) 9.1×10^{24} atoms of hydrogen in $C_6H_{12}O_6$?

C) What is the mass of the sample in part A?

⑨ A student has determined that 0.125 mol of sodium hydrogen phosphite is needed as a starting material for an experiment. How many grams of the compound should be measured?

⑩ How many grams of iron are needed to combine with 25.6 g of oxygen to make ferric oxide?

⑪ How many hydrogen atoms are there in a 100 mL sample of pure water?

⑫ A sample of air consists of 5.83×10^{24} molecules of CO_2.
What is the mass of the compound?