Dimensional Analysis: Molar Mass, Particles, Ionic, & Covalent Compounds

Molar Mass (MM) = mass of one mole of a substance

Example 1) Molar Mass of $AlCl_3$ = molar mass of one Al + molar mass of three Cl
= (26.98) + (3 x 35.45)
Molar Mass of $AlCl_3$ = **133.33 g/mol**

Example 2) Molar Mass of $Ba(NO_3)_2$ = MM of one Ba + MM of two N + MM of six oxygens
= (137.33) + (2 x 14.01) + (6 x 16)
Molar Mass of $Ba(NO_3)_2$ = **261.35 g/mol**

	Formula	I/M	Name	Molar Mass (g/mol)
Example	$AlCl_3$	I	Aluminum chloride	(26.98) + (3 x 35.45) = **133.33 g/mol**
1.	CCl_4	M	Carbon tetrachloride	(12.01) + (4x 35.45) = 153.81 g/mol
2.	ZnS	I	Zinc sulfide	(65.39) + (32.07) = 97.46 g/mol
3.	$(NH_4)_2CO_3$	I	Ammonium carbonate	(2x 14.01) + (8x1.01) +(12.01) +(3x16) = 96.11 g/mol
4.	Cl_2	M	Chlorine	35.45 x2 = 70.9 g/mol
5.	Cu_2SO_4	I	copper (I) sulfate	(2x63.55) + (32.07) + (4x16) = 223.17 g/mol
6.	$Pb_3(PO_4)_2$	I	Lead (II) phosphate	(3x207.2) + (2x30.97) + (8x16) = 811.54 g/mol

Instead of 1 mole = 6.02 x 10^{23} atoms we will now use ***1 mole = 6.02x10^{23} particles***

Class example 1: How many moles are in 54.6 grams of lead (II) phosphate?

grams $\xrightarrow{MM}$ moles

$$54.6\ g\ Pb_3(PO_4)_2 \left| \frac{1\ mol\ Pb_3(PO_4)_2}{811.54\ g\ Pb_3(PO_4)_2} \right. = \boxed{0.0673\ mol\ Pb_3(PO_4)_2}$$

Class example 2: How many particles are in 321.2 grams of ammonium carbonate?

grams $\xrightarrow{MM}$ moles $\xrightarrow{6.02 \times 10^{23}}$ particles

$$321.2\ g\ (NH_4)_2CO_3 \left| \frac{1\ mol\ (NH_4)_2CO_3}{96.11\ g\ (NH_4)_2CO_3} \right| \frac{6.02 \times 10^{23}\ particles\ (NH_4)_2CO_3}{1\ mol\ (NH_4)_2CO_3} = \boxed{2.012 \times 10^{2}\ particles\ (NH_4)_2CO_3}$$

Part II: Solve each of the problems. Remember to use the grid.

1) How many moles are present in 34 grams of copper (II) hydroxide? **Formula=** $Cu(OH)_2$

grams $\xrightarrow{MM}$ moles

$$34\text{ g } Cu(OH)_2 \left| \frac{1\text{ mol } Cu(OH)_2}{97.57\text{ g } Cu(OH)_2} \right. = \boxed{0.35\text{ mol } Cu(OH)_2}$$

2) How many moles are present in 2.45×10^{23} particles of carbon tetrahydride? **Formula=** CH_4

particles $\xrightarrow{6.02 \times 10^{23}}$ moles

$$2.45 \times 10^{23}\text{ particles } CH_4 \left| \frac{1\text{ mol } CH_4}{6.02 \times 10^{23}\text{ particles } CH_4} \right. = \boxed{0.407\text{ mol } CH_4}$$

3) How many grams are there in 4.5×10^{22} particles of Barium Nitrite? **Formula=** $Ba(NO_2)_2$

particles $\xrightarrow{6.02 \times 10^{23}}$ moles $\xrightarrow{MM}$ grams

$$4.5 \times 10^{22}\text{ particles } Ba(NO_2)_2 \left| \frac{1\text{ mol } Ba(NO_2)_2}{6.02 \times 10^{23}\text{ particles } Ba(NO_2)_2} \right. \left| \frac{229.35\text{ g } Ba(NO_2)_2}{1\text{ mol } Ba(NO_2)_2} \right.$$

$$= \boxed{17\text{ g } Ba(NO_2)_2}$$

4) How many particles are there in 9.34 grams of Lithium chloride? **Formula=** $LiCl$

grams $\xrightarrow{MM}$ moles $\xrightarrow{6.02 \times 10^{23}}$ particles

$$9.34\text{ g } LiCl \left| \frac{1\text{ mol } LiCl}{42.39\text{ g } LiCl} \right. \left| \frac{6.02 \times 10^{23}\text{ particles } LiCl}{1\text{ mol } LiCl} \right. = \boxed{1.33 \times 10^{23}\text{ particles } LiCl}$$