

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

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

Example 1) Molar Mass of  $\text{AlCl}_3$  = molar mass of one Al + molar mass of three Cl

$$= (26.98) + (3 \times 35.45)$$

$$\text{Molar Mass of } \text{AlCl}_3 = 133.33 \text{ g/mol}$$

Example 2) Molar Mass of  $\text{Ba}(\text{NO}_3)_2$  = MM of one Ba + MM of two N + MM of six oxygens

$$= (137.33) + (2 \times 14.01) + (6 \times 16)$$

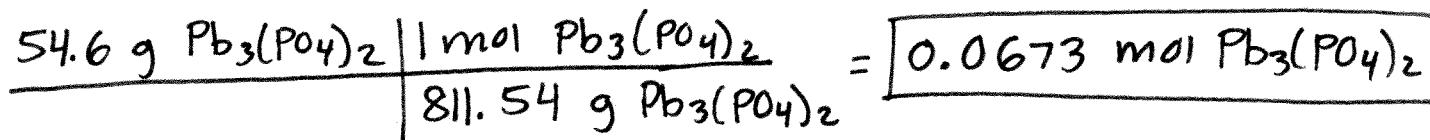
$$\text{Molar Mass of } \text{Ba}(\text{NO}_3)_2 = 261.35 \text{ g/mol}$$

	Formula	I/M	Name	Molar Mass (g/mol)
Example	$\text{AlCl}_3$	I	Aluminum chloride	$(26.98) + (3 \times 35.45)$ = 133.33 g/mol
1.	$\text{CCl}_4$	M	Carbon tetrachloride	$(12.01) + (4 \times 35.45)$ = 153.81 g/mol
2.	$\text{ZnS}$	I	Zinc sulfide	$(65.39) + (32.07)$ = 97.46 g/mol
3.	$(\text{NH}_4)_2\text{CO}_3$	I	Ammonium carbonate	$(2 \times 14.01) + (8 \times 1.01)$ + (12.01) + (3 \times 16) = 96.11 g/mol
4.	$\text{Cl}_2$	M	Chlorine	$35.45 \times 2 = 70.9 \text{ g/mol}$
5.	$\text{Cu}_2\text{SO}_4$	I	copper (I) sulfate	$(2 \times 63.55) + (32.07)$ + (4 \times 16) = 223.17 g/mol
6.	$\text{Pb}_3(\text{PO}_4)_2$	I	Lead (II) phosphate	$(3 \times 207.2) + (2 \times 30.97)$ + (8 \times 16) = 811.54 g/mol

Instead of 1 mole =  $6.02 \times 10^{23}$  atoms we will now use 1 mole =  $6.02 \times 10^{23}$  particles

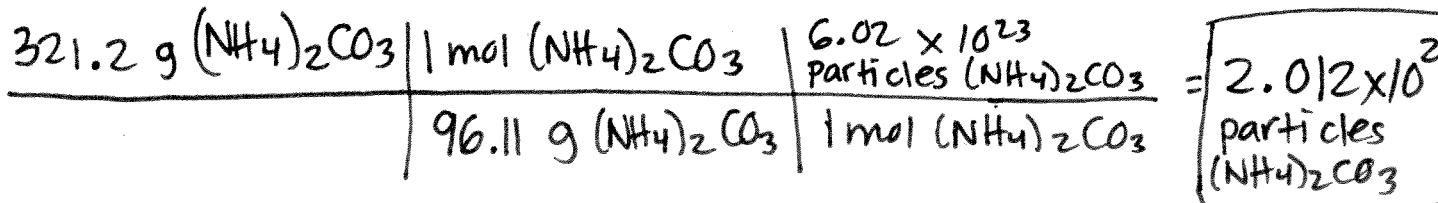
Class example 1: How many moles are in 54.6 grams of lead (II) phosphate?

grams  $\xrightarrow{\text{MM}}$  moles



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

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



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=  $\text{Cu(OH)}_2$   
grams  $\xrightarrow{\text{MM}}$  moles

$$\frac{34 \text{ g Cu(OH)}_2}{97.57 \text{ g Cu(OH)}_2} \left| \begin{array}{c} 1 \text{ mol Cu(OH)}_2 \\ 6.02 \times 10^{23} \text{ particles Cu(OH)}_2 \end{array} \right. = \boxed{0.35 \text{ mol Cu(OH)}_2}$$

2) How many moles are present in  $2.45 \times 10^{23}$  particles of carbon tetrahydride? Formula=  $\text{CH}_4$   
particles  $\xrightarrow{6.02 \times 10^{23}}$  moles

$$\frac{2.45 \times 10^{23} \text{ particles CH}_4}{6.02 \times 10^{23} \text{ particles CH}_4} \left| \begin{array}{c} 1 \text{ mol CH}_4 \\ 6.02 \times 10^{23} \text{ particles CH}_4 \end{array} \right. = \boxed{0.407 \text{ mol CH}_4}$$

3) How many grams are there in  $4.5 \times 10^{22}$  particles of Barium Nitrite? Formula=  $\text{Ba(NO}_2)_2$   
particles  $\xrightarrow{6.02 \times 10^{23}}$  moles  $\xrightarrow{\text{MM}}$  grams

$$\frac{4.5 \times 10^{22} \text{ particles Ba(NO}_2)_2}{6.02 \times 10^{23} \text{ particles Ba(NO}_2)_2} \left| \begin{array}{c} 1 \text{ mol Ba(NO}_2)_2 \\ 229.35 \text{ g Ba(NO}_2)_2 \end{array} \right. = \boxed{17 \text{ g Ba(NO}_2)_2}$$

4) How many particles are there in 9.34 grams of Lithium chloride? Formula=  $\text{LiCl}$   
grams  $\xrightarrow{\text{MM}}$  moles  $\xrightarrow{6.02 \times 10^{23}}$  particles

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