Mole, molecule, atom, molarity, mass and volume problems
CLASS NOTES

1. **Finding quantity of moles (mol)**

a- Use mole formula: n=m/mm	b- Set up as ratio
How many moles are in 20.0 g of HCl?	How many moles of HCl are in 750 mL of a 4.3 M solution?

$n = \dfrac{m}{mm}$ $\dfrac{20.0g}{36.46g/mol}$

$\boxed{0.549 \, mol}$

$\dfrac{4.3 \, mol}{2} \quad \dfrac{x}{.5L} \quad \boxed{3.2 \, mol}$

OR

$n = CV \quad 4.3 \, mol/L \times .75L = \boxed{3.2 \, mol}$

2. **Finding the molecule (molecule)**

1- Use mole formula: n=m/mm
2- Use molecule ratio (6.02x10²³)
How many molecules are in 5.00 g of H_2SO_4?

$n = \dfrac{m}{mm}$ $\dfrac{5.00g}{98.09g/mol} = \dfrac{0.05097...mol}{x} = \dfrac{1 \, mol}{6.02\times10^{23} \, molec} = \boxed{3.07\times10^{22} \, molec}$

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$\dfrac{5.00}{98.05} = .05097... \times 6.02\times10^{23} = \boxed{3.07\times10^{23} \, molec}$

3. **Finding the number of atoms in a molecule (atoms)**

1- Use mole formula: n=m/mm
2- Use molecule ratio (6.02x10²³)
3- Multiply answer by number of atoms molecule has
How many oxygen atoms are in 250 g of $CaCO_3$?

$n = \dfrac{m}{mm} = \dfrac{250g}{100.09g/mol} = \dfrac{2.4977...mol}{x} = \dfrac{1 \, mol}{6.02\times10^{23} \, mol} =$

$1.503646...\times10^{24} \times 3 = \boxed{4.5\times10^{24} \, O_2 \, atoms}$

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$\dfrac{250}{100.08} = 2.4977...mol \times 6.02\times10^{23} \times 3 = \uparrow$

4. Finding the volume (L)

1- Use mole formula: n=m/mm

2- Use answer in mol/L ratio

What volume of a 1.5 M solution of NaCl contains 6.0 g of solute?

$$n = \frac{m}{mm} \quad \frac{6.0g}{58.44g/mol} = \frac{.10266...mol}{x} = \frac{1.5mol}{L} = \boxed{0.068L}$$

OR

$$n = \frac{m}{mm} \quad \frac{6.0g}{58.44g/mol} = .102...mol \qquad V = \frac{n}{c} \quad \frac{.102...mol}{1.5mol/L} =$$

5. Finding the molarity (mol/L)

1- Use mole formula: n=m/mm	1- Set up ratio to find grams
2- Divide answer by the volume	2- Use mole formula: n=m/mm
Calculate the molarity of a solution by dissolving 24 g of NaOH in enough water to make 1.75 L of solution.	There are 600 g/ 400 mL of fructose $C_6H_{12}O_6$ in a Coke can. What is the molar concentration of the drink?

$$n = \frac{m}{mm} = \frac{24g}{40.00g/mol} = .6$$

$$= \frac{.6mol}{1.75L} = \boxed{.34\frac{mol}{L}}$$

$$\frac{600g}{.4L} = \frac{x}{1L} = 1500g$$

$$n = \frac{m}{mm} = \frac{1500g}{180.00g/mol} = \boxed{8\frac{mol}{L}}$$

6. Finding mass (g) and process

1- Use mass formula m = n x mm

2- Find mole with ratio mol/L ratio or formula

How many grams of $CaCO_3$ are in 250 ml of a 0.75 M solution? ①

②

$$m = n \times mm$$

$$.1875 mol \times 100.09g/mol$$

$$= \boxed{19g}$$

$$\frac{.75mol}{L} = \frac{x}{.25L} \quad \text{or} \quad \frac{.75mol}{L} \times .25L =$$

$$n = C \times V$$

$$= .1875 mol$$