### Lecture 3

## Dr. Rusul H. Hamza



# Molarity (M)

M =

It expresses the no. of moles of solute dissolved per liter of the solution.

### <u>mole of solute</u> L of solution

molarity= weight / molecular weight x 1/ volume of solution in liters

If 0.435 g of KMnO<sub>4</sub> is dissolved in enough water to give 250. mL of solution, what is the molarity of KMnO<sub>4</sub>?





Mole = weight / molecular weight

 $0.435 \text{ g/158 (g/mol}) = 0.00275 \text{ mol KMnO}_4$ 

Molar Mass of KMnO<sub>4</sub>

K = 1(39.1) = 39.1Mn = 1(54.9) = 54.9 O = 4(16.0) = 64.0MM = 158 g

250. mL/1000 = 0.25 L.

Molarity  $KMnO_4 = 0.00275 mol KMnO_4 = 0.0110 M$ 

0.25 L solution

## Molality(*m*)

m =

It expresses the no. of moles of solute dissolved per kg of the solvent.

moles of solute kg of solvent

Normality (N)

It expresses the no. of gram equivalent of solute dissolved per liter of the solution.

 $N = \frac{\text{No. gram equivalent of solute}}{\text{L of solution}}$ 

Normality= weight / equivalent weight x 1/ volume of solution in liters

## EQUIVALENT WEIGHT

The no. of parts by weight of that substance that will combine with one part by weight of replaceable H+ or OH- or number of positive charge on elements

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Equivalent Mass of Acid
Equivalent mass of acid =
                Molecular mass of acid
         Number of replacable H<sup>+</sup> (Basicity)
Example:
     Equivalent mass of HCl and H<sub>2</sub>SO<sub>4</sub>
            HCI \longrightarrow H^+ + CI^-
           H_2SO_4 \longrightarrow 2H^+ + SO_4^{--}
Equivalent mass of HCl = \frac{1+35.5}{1} = 36.5
Equivalent mass of H_2SO_4 = \frac{2 \times 1 + 32 + 4 \times 16}{2} = 49
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## Equivalent Mass of Base

Equivalent mass of base =

#### Molecular mass

#### Number of replacable OHT (Acidity)

Example:

Equivalent mass of NaOH and Ca(OH)<sub>2</sub>

Ca(OH)<sub>2</sub> → Ca<sup>++</sup> + 2OH<sup>-</sup>

Equivalent mass of NaOH =  $\frac{23+16+1}{1} = 40$ Equivalent mass of Ca(OH)<sub>2</sub> =  $\frac{40+2\times16+2\times1}{2} = 37$ 



#### Equivalent mass of salt Equivalent mass of salt = Molecular mass Total number of positive or negative charge Example: Equivalent mass of NaCl and MgCl<sub>2</sub> $NaCl \longrightarrow Na^+ + Cl^-$ Equivalent mass of NaCl = $\frac{23 + 35.5}{1} = 58.5$ $MgCl_2 \longrightarrow Mg^{++} + 2Cl^-$ Equivalent mass of MgCl<sub>2</sub> = $\frac{240 + 2 \times 35.5}{2} = 47.5$

Find the normality of 0.321 g sodium carbonate (Na2CO3) in a 250 mL solution.

Normality= weight / equivalent weight x 1/ volume of solution in liters

Na : 2 x 23.0 = 46

C : 1 x 12.0 = 12

O:3 x 16 = 48

46 + 12 + 48 = molar mass of Na2CO3 is 106 g/mole.

Equivalent weight of  $Na_2CO_3 = 106 / 2 = 53 g/eq$ 

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N = 0.321 g /53 (g/eq) * 1 / 0.250 L
N = 0.0755 eq/L = 0.0755 N
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