Almustaqbal University College

Medical Laboratories Techniques Department

First year students

Subject : Lecture 4A

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Part per million (ppm) :

It is a convenient way to express the concentration of the very dilute solution .

(1 **ppm** = 1 **mg / liter**) or (1 **ppm** = 1 **µg /mL**)

ppm: is a mass ratio of grams of solute to one million grams of sample or solution.

$$C_{ppm} = \frac{mass\ of\ solute(g)}{mass\ of\ solution\ (g)} \times 10^6$$

also

$$\mathbf{Cppm} = \frac{\boldsymbol{mass\ of\ solute(mg)}}{\boldsymbol{volume\ of\ solution(liter)}}$$

$$\mathbf{Cppm} = \frac{\boldsymbol{wt(mg)}}{\boldsymbol{V\ (liter)}} = \frac{\frac{\boldsymbol{wt(\mu g)}}{\boldsymbol{1000}}}{\frac{\boldsymbol{VmL}}{\boldsymbol{1000}}}$$

$$\mathbf{Cppm} = \frac{\boldsymbol{wt(\mu g)}}{\boldsymbol{VmL}} \quad \mathbf{(\mu g / mL)}$$

1 g =1000 mg , 1mg = 1000 µg , 1 g = 10^6µg

$$\mathbf{Cppm} = \frac{\boldsymbol{wt(g)}}{\boldsymbol{VmL}} \boldsymbol{x}\ \mathbf{10^6}$$

Example: Prepare (500mL) of (1000 ppm) KCl aqueous solution .

solution :

Cppm = $\frac{wt(g)}{VmL}$ **x 10^6** $\quad$ wt $_g = \frac{C_{ppm} \times V_{mL}}{10^6}$ (By rearrangement)

wt (g) $= \frac{1000\ x\ 500}{10^6} = 0.5$ g

Then 0.5 g of KCl is to be dissolved in water and the volume is completed to 500 mL in a volumetric flask to get(1000 ppm) solution.

Example :

A 25 μL serum sample was analyzed for glucose content and found to contain 26.7 μg. Calculate the concentration of glucose in ppm and in mg/dL.

Solution:

1 mL = 1000 μL

V (mL) = $\frac{V(\mu L)}{1000} = \frac{25(\mu L)}{1000} =$ **25x10^{-3} mL**

Cppm = $\frac{wt(\mu g)}{VmL} = \frac{26.7}{25x10^{-3}}$ = **1068 ppm**

1 dL = 100 mL

V(dL) = $\frac{V_{mL}}{100}$

V(dL) = $\frac{V(mL)}{100} = \frac{25x10^{-3}\ mL}{100}$ = **25x10^{-5} dL**

mg = 1000 μg

wt (mg) = $\frac{weight\ (\mu g)}{1000}$ = $weight\ (\mu g)$ **x 10^{-3}**

wt (mg) = 26.7 x 10^{-3}

Concentration (mg/dL) = $\frac{wt(mg)}{V(dL)} = \frac{26.7\ x\ 10^{-3}}{25x10^{-5}}$ = **106.8 mg/dL**

يمكن ان نطبق القانون التالي بشكل مباشر :

** $C_{(mg/dL)} = \frac{C_{ppm}}{10}$

Then $C_{(mg/dL)} = \frac{1068}{10}$ = 106.8 mg/dL

Relationship of ppm with Molarity(M) and Normality (N)

ppm = M x M.wt x 1000

ppm = N x Eq.wt x 1000

$$\text{Molarity(M)} = \frac{PPm}{Mwt\ x1000}$$

يستخدم هذا القانون لتحويل التركيز من PPm الى المولاريه(M)

Or $Normality(N) = \frac{PPm}{Eq.wt\ x1000}$

يستخدم هذا القانون لتحويل التركيز من PPm الى التركيز النورمالي (N)

Example:

The maximum allowed concentration of chloride (35.5 g/mol) in drinking water supply is (2500 ppm) . express this concentration in terms of mole/liter (M) ?

Solution:

ppm = mg/L

$$Molarity(M) = \frac{PPm}{Mwt\ x1000}$$

$$Molarity(M) = \frac{PPm}{Mwt\ x1000} = \frac{2500}{35.5\ x\ 1000} = 7.05 \text{ x } 10^{-3} \text{ M}$$

Second method: $2500 \text{ ppm} = \frac{2500 \text{ mg}}{\text{liter}}$

$$\text{Molarity (M)} = \frac{\text{wt g}}{\text{M.wt } x \text{ V}_L} = \frac{(2500 \ x \ 10^{-3}) \text{ g}}{35.5 \ x \ 1} = 7.05 \text{ x } 10^{-3} \text{ M}$$

Conversions:

As $C_{(mg/dL)} = \frac{C_{ppm}}{10}$

Then $C_{(mg/dL)} = \frac{Molarity(M) x M.wt \ x1000}{10}$

**** $C_{(mg/dL)}$ = Molarity(M) x M.wt x100**

Example:

For the solution of 100 ppm of Fructose (180 g/mol) Calculate the concentration in:

a. **Molarity** b. **mmol / L** c. **mg/dL**

Solution:

a. **Molarity(M)** $= \frac{PPm}{Mwt \ x1000} = \frac{100}{180 \ x1000} = 5.55 \text{ x} 10^{-4}$ **M**

b. **mmol/L = Molarity(M) x 1000 = 5.55 x 10^{-4} x 1000 = 0.555**

c. **mg/dL = Molarity(M) x M.wt x 100**

mg/dL = 5.55x10^{-4} x 180 x100 = 10

Or C (mg/dL) = $\frac{C_{ppm}}{10} = \frac{100}{10}$ **= 10** mg/dL

Exercise:

A solution was prepared by dissolving 1210 mg of $K_3Fe(CN)_6$ (329.2 g/mol) in sufficient water to give 775 mL. Calculate

a) the molar concentration of $K_3Fe(CN)_6$. (b) pK^+ for the solution.

c) the (w/v)% of $K_3Fe(CN)_6$ (d) the ppm concentration of $K_3Fe(CN)_6$.