
 **Mustansiriyah University – Collage of Science**

**Department of Chemistry – First Grade – First Term (2018 – 2019)**

**Subject: - Analytical Chemistry Examiner: - Dr: KHITAM JABER NABHAN**

**Q1 – Define Five of the following terms: -**

1. **Saturated Solution, 2- (**$\frac{wt}{wt})$**%, 3- Density, 4- Quantitative Analysis,**

 **5-Molality, 6- Mole Fraction (X).**

**Q2 – Answer the questions:-**

1. **Calculate the volume of a 0.232 N solution contains (a.) 3.17 milliequvalent of solute (b.) 6.5 equivalent of solute?**
2. **A solution contains (10 gm) Iodic Acid and (125 gm) Water, Calculate the concentration of solution expressed as: -**

**(a-) Mole fraction (X) of Iodic Acid. (b-) Molality.**

**Q3 – Answer the questions:-**

 **a. How many (cm3) of concentrated sulfuric acid, of density 1.84 gm/ cm3 and containing 98 % by weight , should be taken to make 1 L of 2 N solution?**

 **b. Calculate the formal concentration of: (a) an aqueous solution that contains (1.80 gm) of ethanol in 750 mL. (b) An aqueous solution that contains (0.365 gm) of Hydrochloric Acid in (50.0 mL) (the acid is 75.0 % ionized in this solution).**

**Q4 – Answer the questions:-**

**a. Calculate the hydrogen ion concentration of the solutions, pH values (3.47)?**

 **b. Calculate the millimoles of (0.5 L) Sodium Sulfate in (1000 ppm)?**

 **c. Calculate the weight in gram for (25 mL) dilute Nitric Acid (200 gm\mL)?**

**A.wt: - O =16, Na = 23, P = 31, Ca = 40, N = 14, Cl = 35.5, I = 127, H = 1, C = 12, and S = 32.**

**(WITH MY BEST WISHES)**

**حل أسئلة الأمتحان**

1. **Calculate the volume of a 0.232 N solution contains (a.) 3.17 milliequvalent of solute (b.) 6.5 equivalent of solute?**

**(a)** $N=\frac{No.of milliequivalent}{Solution Volumn (mL)}$

$$Solution Volumn (mL)=\frac{No.of milliequivalent}{N}$$

$$Solution Volumn \left(mL\right)=\frac{3.17}{0.232}=13.7 mL$$

$$ \left(b\right) Solution Volumn (L)=\frac{No.of equivalent}{N}$$

$$Solution Volumn \left(L\right)=\frac{6.5}{0.232}=28.0 L$$

1. **A solution contains (10 gm) Iodic Acid and (125 gm) Water, Calculate the concentration of solution expressed as: -**

**(a-) Mole fraction (X) of Iodic Acid. (b-) Molality.**

***Solution:***

**(a) Mol. HIO3 =wt / M.wt 10.0 /176 = 0.057 mol.**

**Mol. water =wt / M.wt 125 / 18.0 = 6.95 mol.**

**Sum of mole = 0.167+ 6.94 = 7.007 mole**

$$Mole fraction for HIO\_{3}(X) =\frac{0.057 mole}{7.007 mole} =0.008 $$

$$Mole fraction for water\left(X\right) =\frac{6.95 mole}{7.007 mole} =0.992$$

**(b) molality**

**molality =** $=\frac{No. of moles (solute)}{wt. of solvent (Kg)} $

$$b. m=\frac{wt (gm)}{M.wt (\frac{gm}{mol})} × \frac{1000}{wt(gm)}$$

$$ m= \frac{10 (g)}{176 (\frac{g}{mol})} × \frac{1000}{125 gm}=0.456 m Iodic Acid$$

1. **How many (cm3) of concentrated sulfuric acid, of density 1.84 gm/ cm3 and containing 98 % by weight , should be taken to make 1 L of 2 N solution?**

$$N= \frac{\% ×sp.gr. or (Density)×1000}{Eq.wt}$$

$$N= \frac{0.98 ×1.84×1000}{(\frac{98}{2})}$$

**= 36.8 N**$(\frac{Eq.}{L.})$**.**

$$(N\_{1} × V\_{1})\_{conc.}= (N\_{2} × V\_{2})\_{dilu.}$$

$$(36.8 × V\_{1})\_{conc.}= (2 × 1000)\_{dilu.}$$

$$V\_{1}=54.34 mL$$

1. **Calculate the formal concentration of: (a) an aqueous solution that contains (1.80 gm) of ethanol in 750 mL. (b) An aqueous solution that contains (0.365 gm) of Hydrochloric Acid in (50.0 mL) (the acid is 75.0 % ionized in this solution).**

$$F\_{C\_{2}H\_{5}OH}=\frac{wt}{Fwt}×\frac{1000}{V mL}=\frac{1.80}{46}×\frac{1000}{750}=0.052 F C\_{2}H\_{5}OH$$

The only solute species present in significant amount in an aqueous solution of ethanol is C2H5OH, therefore;$ M=F=0.0521$

  **(b)**

$$F=\frac{wt}{F.wt}×\frac{1000}{V mL}=\frac{0.365}{60}×\frac{1000}{50}=0.122 F (CH3COOH)$$

**(100% ⎻ 75.0%) = 25%**

$$\frac{25.0}{100}×0.122F=0.030M (CH3COOH)$$

1. **Calculate the hydrogen ion concentration of the solutions, pH values (3.47)?**

**pH= -log [H+] = 6.372,**

**log [H+] = -3.47,**

**[H +] = 0.00034 = 3.4 × 10-4 M**

1. **Calculate the millimoles of (0.5 L) Sodium Sulfate in (1000 ppm)? Na2SO4**

$$\left(ppm\right)= \frac{wt solute (g)}{V solution (sample)(mL)}×10^{6} $$

$$1000= \frac{wt solute (g)}{500 mL}×10^{6} $$

**= 0.5 gm**

**No. of Moles =** $\frac{wt (gm)}{M.wt}$ **=** $\frac{0.5 (gm)}{142 gm\mol.}$ **= 0.0035 moles = 3.5 mmoles.**

**c. Calculate the weight in gram for (25 mL) dilute Nitric Acid (1.121 gm\mL)? HNO3**

 **1.121 ppm**

$$\left(ppm\right)= \frac{wt solute (gm)}{V solution (sample)(mL)}×10^{6} $$

$$1.121= \frac{wt solute (gm)}{25 mL}×10^{6} $$

**wt = 0.00003 gm**

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