

## Final Theory Assignment

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Section: U

### Problem: 1

a) 36% (w/w) HCl, specific gravity 1.18

$$1000 \text{ mL HCl contains} = 0.36 \times 1.18 \times 1000 = 424.8 \text{ gm HCl}$$

$$424.8 \text{ gm HCl in } 1000 \text{ mL} = \frac{1 \times 424.8}{36.5} = 11.64 \text{ N HCl}$$

b) 96% (w/w)  $\text{H}_2\text{SO}_4$ , specific gravity 1.84

$$1000 \text{ mL } \text{H}_2\text{SO}_4 \text{ contains} = 0.96 \times 1.84 \times 1000 = 1766.4 \text{ gm } \text{H}_2\text{SO}_4$$

$$1766.4 \text{ gm } \text{H}_2\text{SO}_4 \text{ in } 1000 \text{ mL} = \frac{1 \times 1766.4}{98}$$

$$= 18.03 \text{ N } \text{H}_2\text{SO}_4$$

(Answer)

Example: 1

Molecular weight of  $\text{PbSO}_4 = 303.37$

Solubility of  $\text{PbSO}_4 = 0.0037 \text{ g/100 g H}_2\text{O}$

$$= 0.037 \text{ gm/liter H}_2\text{O}$$

$$= \frac{0.037}{303.37} = 1.2 \times 10^{-4} \text{ mole/liter H}_2\text{O}$$

Here,  $K_{sp} = [\text{Pb}^{2+}] [\text{SO}_4^{2-}]$

$$= 1.2 \times 10^{-4} \times 1.2 \times 10^{-4} = 1.44 \times 10^{-8}$$

(Answer)

Problem: 2

Solubility product of  $\text{CuCl}_2 = 3.2 \times 10^{-7}$



$$\text{Now, } K_{sp} = [\text{Cu}^{2+}] [\text{Cl}^-]^2$$

$$\Rightarrow 3.2 \times 10^{-7} = x \cdot x \cdot x^2$$

$$\Rightarrow 4x^3 = 3.2 \times 10^{-7}$$

$$\Rightarrow x = 4.3 \times 10^{-3} \text{ mole/litre}$$

(Answer)

### Problem: 3

$$K_{sp} = 1.7 \times 10^{-10}$$

$$\text{Mol. wt.} = 78 \text{ g mole}^{-1}$$

$$\text{Here, } K_{sp} = [\text{Cu}^{2+}] [\text{F}^{-}]^2$$

$$\Rightarrow 4x^3 = 1.7 \times 10^{-10}$$

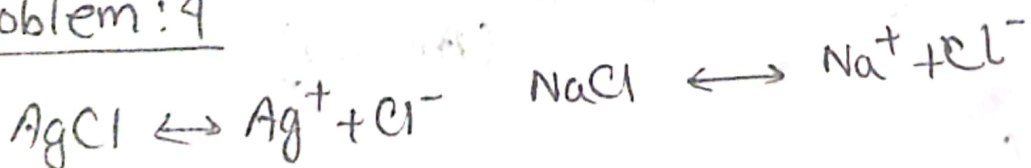
$$\Rightarrow x = 3.5 \times 10^{-4} \text{ mole litre}^{-1}$$

$$\text{No. of moles} = 0.078 \text{ g} / (78 \text{ g/mole}) = 1 \times 10^{-3} \text{ moles}$$

$$\text{Volume of solution} = \frac{1 \text{ litre} \times 1 \times 10^{-3} \text{ mole}}{3.5 \times 10^{-4} \text{ mole}} = 2.857$$

$$= 2.857 \text{ litre (Answer)}$$

### Problem: 4

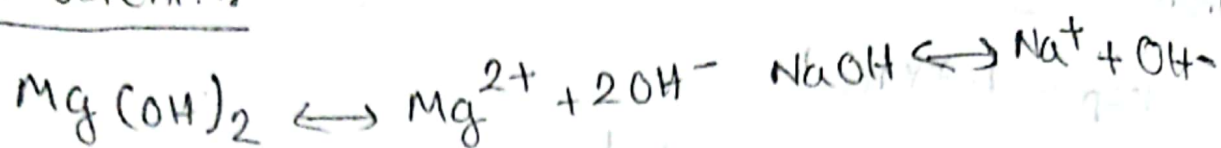


$$\text{Here, } K_{sp} = [\text{Ag}^{+}] [\text{Cl}^{-}]$$

$$\Rightarrow 1.7 \times 10^{-10} = x \times 0.01$$

$$\Rightarrow x = 1.7 \times 10^{-8} \text{ M (Answer)}$$

### Problem: 5



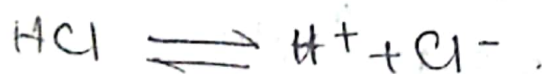
Here,  $K_{sp} = [\text{Mg}^{2+}] [\text{OH}^-]^2$

$$\Rightarrow 1.8 \times 10^{-11} = x \times (0.1)^2$$

$$\Rightarrow x = 1.8 \times 10^{-9} \text{ M}$$

(Answer)

### Example: 2

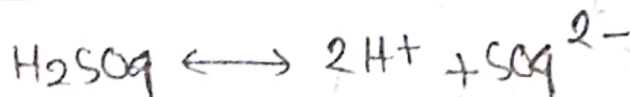


$$\text{pH} = -\log [\text{H}^+]$$

$$= -\log [0.001] = 3$$

(Answer)

### Problem: 6



$$[\text{OH}^-] = \frac{1 \times 10^{-14}}{0.04} = 2.5 \times 10^{-13} \text{ M}$$

$$\text{pH} = -\log [\text{H}_3\text{O}^+] = -\log (0.04) = 1.40$$

$$\text{pOH} = -\log [\text{OH}^-] = -\log (2.5 \times 10^{-13}) = 12.60$$

(Answer)

### Problem: 7

$$pH = 2.699$$

$$\text{Here, } pH = -\log [H^+]$$

$$\Rightarrow [H_3O^+] = \text{antilog}(-2.699) \\ = 0.002 \text{ M (Answer)}$$

### Example: 1

$$\lambda_{\infty} (NH_4Cl) = 130$$

$$\lambda_{\infty} (OH^-) = 174$$

$$\lambda_{\infty} \text{ ~~the~~ } (Cl^-) = 66$$

Applying the Kohlrausch's law,

$$\lambda_{\infty} (NH_4OH) = \lambda_{\infty} (NH_4Cl) + \lambda_{\infty} (OH^-) - \lambda_{\infty} (Cl^-)$$

$$= 130 + 174 - 66$$

$$= 238 \text{ ohm}^{-1} \times \text{cm}^2 \times \text{eqvt.}^{-1}$$

(Answer)