DAILY PRACTICE PROBLEMS

CHEMISTRY SOLUTIONS

DPP/CC16

1. **(d)** A negative ion causes the precipitation of positively charged sol and *vice-versa*. Since As_2S_3 is a negative sol so more will be the positive charge on cation more effective it will be in causing coagulation of As_2S_3 sol. Among the given ions, Al^{3+} has the greatest valency and thus is the most effective coagulating agent.

2. **(d)** $FeCl_3 + 3NaOH \longrightarrow Fe(OH)_3(s) + 3NaCl$

   $Fe(OH)_3 + OH^-$ (from excess of NaOH) $\longrightarrow [Fe(OH)_3]OH^-$

   The sol is negatively charged and would be coagulated most effectively by Al^{3+}.

3. **(d)** Gold number $= \dfrac{6.0\times10^{-5}\times10^3(\text{mg})\times10}{20} = 0.03$

4. **(c)** Sols of Al_2O_3 and even inorganic lyophilic sols e.g. silica, stannic oxide show no difference in surface tension as compared to water.

   If protein is dissolved in water it will lower the surface tension to some extent.

5. **(a)** Particle size of colloidal particle = 1mμ to 100 mμ (suppose 10 mμ)

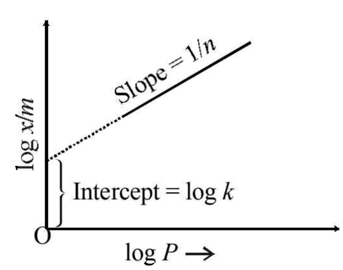
   $V_C = \frac{4}{3}\pi r^3 = V_C = \frac{4}{3}\pi(10)^3$

   Particle size of true solution particle = 1mμ

   $V_S = \frac{4}{3}\pi(1)^3$

   Hence $\frac{V_C}{V_S} = 10^3$

6. **(c)** Freundlich adsorption isotherm gives straight line on plotting log x/m vs log p as show below.



7. **(a, b, d)** At pH < isoelectric pH, $-NH_2$ group is protonated to $-\overset{+}{N}H_3$ and the sol is positively charged. At pH > isoelectric pH, –COOH is deprotonated to $-COO^-$ and the sol is negatively charged. At isoelectric pH both groups are equally ionised, the sol particles carry no net charge.

8. **(a,d)** If a univalent ion is used for coagulating a hydrophilic sol, the coagulating power increases with increasing dilution of the sol. But if a polyvalent ion is used, the coagulating power decreases with increasing dilution of the sol.

9. **(a,b)** The solutions of colloidal electrolytes have lower osmotic pressure than expected because the number of particles decreases due to association or aggregation of several ions to form micelles.

   Colloidal electrolytes can not be regarded as macro-molecules, as they are individual molecules of very big size in solution.

10. **(a, c)**
    (a) $\Delta G = \Delta H - T\Delta S < 0$ as $\Delta S < 0$, so ΔH has to be negative
    (b) micelles formation will take place above T_k and above CMC
    (c) this solution will be negatively charged.
    (d) Fe^{3+} ions will have greater flocculatibility power so smaller flocculating value.

11. **(4)** 2 mL of 1 M NaCl contains NaCl $= \frac{2}{1000} = 2$ m mole

    Thus 500 mL of As_2S_3 sol require NaCl for complete coagulation = 2 m mole

    Hence 1 L, i.e., 1000 mL of the sol require NaCl for complete coagulation = 4 m mole

    Therefore, flocculation value of NaCl = 4.

12. **(1)** Gold number of gelatin = 0.01

    or 0.01 mg gelatin required to be added to 10 mL of gold sol to completely prevent coagulation of 1 mL of 10% NaCl solution.

    Therefore, gelatin added to 1000 mL of gold sol to prevent coagulation $= \frac{0.01\times1000}{10} = 1$ mg

13. **(4)** Mass of HCl acid adsorbed by 10 g charcoal

    $= 526.3 \times 10^{-3}(0.5 - 0.4) \times 38 \approx 2$

    (Mw of HCl = 38 g mol^{-1})

    The amount of adsorption

    $\frac{x}{m} = \frac{2}{0.5} = 4$

14. **(6)** $\log\frac{x}{m} = \log K + \frac{1}{n}\log P$

    $\therefore$ Plot of $\log\frac{x}{m}$ versus $\log P$ is linear with slope $= \frac{1}{n}$ and intercept = $\log K$

Thus $\frac{1}{n} = \tan\theta = \tan 45° = 1$ or $n = 1$

$\log K = 0.301$ or $K = \text{antilog } 0.301 = 2$

At $P = 3$ atm

$\frac{x}{m} = KP^{1/n} = 2 \times (3)^1 = 6$

15. (c) As_2S_3 sol is negatively charged due to preferential adsorption of S^{2-} ions by As_2S_3 particles. Hence, cation of largest valence would be most effective in causing coagulation of the sol.

Coagulating value of Ba^{2+} ion $= \frac{1.0 \times 10^{-4} \times 10^3}{9+1}$

$= 1.0 \times 10^{-2}$ mol $L^{-1} = 10.0$ m mol L^{-1}

16. (c) Both KCl and RCOOK (Potassium oleate) are 1 : 1 electrolytes (salts) and are expected to have a van't Hoff factor $i = 2$. But in potassium oleate solution, the oleate ions, being ampiphilic in nature, associate to give much bigger particles (micelles). As a result the concentration of particles in this solution is very much decreased and so also the colligative properties.

17. (d) $SnO_2 + 2NaOH \rightarrow Na_2SnO_3$

SnO_2 particles adsorb SnO_3^{2-} ions preferrentially, and acquire negative charge. Hence cation of maximum valence would be most effective in bringing about coagulation.

18. (c) Sodium oleate (soap) is a hydrophilic sol. Sol particles are heavily hydrated. For coagulation, both removal of charge and solvation have to be effected.

19. **A → q ; B → r; C → s; D → p**

$FeCl_3 + NaOH$ forms $Fe(OH)_3 : OH^-$ colloidal particles in the sol.

20. **A → s ; B → r; C → p; D → q**

Dialysis is used for purification, peptisation is used for colloidal sol formation, emulsification helps in cleansing action of soap and electrophoresis leads to coagulation of sol.