DPP - Daily Practice Problems

Chapter-wise Sheets

Date : | Start Time : | End Time :

CHEMISTRY CC19

SYLLABUS : Surface Chemistry

Max. Marks : 180 **Marking Scheme :** + 4 for correct & (–1) for incorrect **Time : 60 min.**

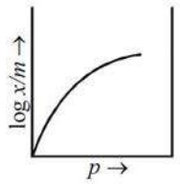
INSTRUCTIONS : This Daily Practice Problem Sheet contains 45 MCQ's. For each question only one option is correct. Darken the correct circle/ bubble in the Response Grid provided on each page.

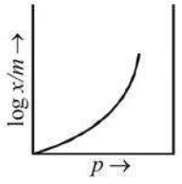
1. Which of the following statements is *not* true about the oil-in-water type emulsion?
   (a) On addition of small amount of water, no separate layer of water appears
   (b) On addition of oil, separate layer of oil is formed
   (c) Addition of an electrolyte causes the conductivity of the emulsion to increase
   (d) Addition of small amount of oil soluble dye renders the entire emulsion coloured.
2. Which of the following is **not** a favourable condition for physical adsorption ?
   (a) High pressure
   (b) Negative ΔH
   (c) Higher critical temperature of adsorbate
   (d) High temperature
3. The disperse phase in colloidal iron (III) hydroxide and colloidal gold is positively and negatively charged, respectively. Which of the following statements is NOT correct ?
   (a) Coagulation in both sols can be brought about by electrophoresis
   (b) Mixing the sols has no effect
   (c) Sodium sulphate solution causes coagulation in both sols
   (d) Magnesium chloride solution coagulates, the gold sol more readily than the iron (III) hydroxide sol
4. Among the following, correct statement is :
   (a) Brownian movement is more pronounced for smaller particles than for bigger–particles.
   (b) Sols of metal sulphides are lyophilic.
   (c) Hardy Schulze law states that bigger the size of the ons, the greater is its coagulating power.
   (d) One would expect charcoal to adsorb chlorine more than hydrogen sulphide.

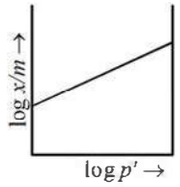
RESPONSE GRID	1. ⓐⓑⓒⓓ	2. ⓐⓑⓒⓓ	3. ⓐⓑⓒⓓ	4. ⓐⓑⓒⓓ

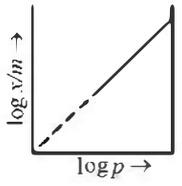
Space for Rough Work

5. One desires to prepare a positively charged sol of silver iodide. This can be achieved by
   (a) adding small amount of $AgNO_3$ solution to KI solution in slight excess
   (b) adding small amount of KI solution to $AgNO_3$ solution in slight excess
   (c) mixing equal volumes of equimolar solutions of $AgNO_3$ and KI
   (d) None of these
6. How many layers are adsorbed in chemical adsorption ?
   (a) One (b) Two
   (c) Many (d) Zero
7. Adsorption of gases on solid surface is exothermic reaction because
   (a) free energy increases (b) enthalpy is positive
   (c) entropy increases (d) enthalpy is negative
8. Cod Liver oil is
   (a) fat dispersed in water (b) water dispersed in fat
   (c) water dispersed in oil (d) fat dispersed in fat.
9. Physical adsorption of a gaseous species may change to chemical adsorption with _____.
   (a) decrease in temperature
   (b) increase in temperature
   (c) increase in surface area of adsorbent
   (d) decrease in surface area of adsorbent
10. Hydrolysis of urea is an example of
   (a) homogenous catalysis (b) heterogenous catalysis
   (c) biochemical catalysis (d) zeolite catalysis
11. Alum helps in purifying water by
   (a) forming Si complex with clay particles
   (b) sulphate part which combines with the dirt and removes it
   (c) aluminium which coagulates the mud particiles
   (d) making mud water soluble
12. The efficiency of an enzyme in catalysing a reaction is due to its capacity
   (a) to form a strong enzyme-substrate complex
   (b) to decrease the bond energies of substrate molecule
   (c) to change the shape of the substrate molecule
   (d) to lower the activation energy of the reaction
13. Tyndall effect is shown by
   (a) sol (b) solution
   (c) plasma (d) precipitate
14. The cause of Brownian movement is
   (a) Heat changes in liquid state
   (b) Convectional currents
   (c) The impact of molecules of the dispersion medium on the colloidal particles.
   (d) Attractive forces between the colloidal particles and molecules of dispersion medium.
15. Which of the following curves is in accordance with Freundlich adsorption isotherm ?

   (a) 

   (b) 

   (c) 

   (d) 

16. Which of the following kind of catalysis can be explained by the adsorption theory ?
   (a) Homogeneous catalysis
   (b) Acid - base catalysis
   (c) Heterogeneous catalysis
   (d) Enzyme catalysis
17. The electrolytic impurities of a sol can most easily be separated by
   (a) dialysis (b) electrosmosis
   (c) electrophoresis (d) electrodialysis
18. Which of the following constitutes irreversible colloidal system in water as dispersion medium?
   (a) Clay (b) Platinum
   (c) $Fe(OH)_3$ (d) All of these

RESPONSE GRID					
	5. ⓐⓑⓒⓓ	6. ⓐⓑⓒⓓ	7. ⓐⓑⓒⓓ	8. ⓐⓑⓒⓓ	9. ⓐⓑⓒⓓ
	10. ⓐⓑⓒⓓ	11. ⓐⓑⓒⓓ	12. ⓐⓑⓒⓓ	13. ⓐⓑⓒⓓ	14. ⓐⓑⓒⓓ
	15. ⓐⓑⓒⓓ	16. ⓐⓑⓒⓓ	17. ⓐⓑⓒⓓ	18. ⓐⓑⓒⓓ	

Space for Rough Work

19. If x is amount of adsorbate and m is amount of adsorbent, which of the following relations is not related to adsorption process ?
(a) $x/m = f(p)$ at constant T.
(b) $x/m = f(T)$ at constant p.
(c) $p = f(T)$ at constant (x/m).
(d) $\frac{x}{m} = p^{r}\ T$

20. Gold numbers of some colloids are : Gelatin : 0.005 – 0.01, Gum arabic : 0.15 – 0.25; Oleate : 0.04 – 1.0; Starch : 15 – 25. Which among these is a better protective colloid ?
(a) Gelatin (b) Starch
(c) Oleate (d) Gum arabic

21. Colloidal gold is prepared by
(a) Mechanical dispersion (b) Peptisation
(c) Bredig's Arc method (d) Hydrolysis

22. Freundlich equation for adsorption of gases (in amount of x g) on a solid (in amount of m g) at constant temperature can be expressed as
(a) $\log\frac{x}{m} = \log p + \frac{1}{n}\log K$ (b) $\log\frac{x}{m} = \log K + \frac{1}{n}\log p$
(c) $\frac{x}{m} \propto p^{n}$ (d) $\frac{x}{m} = \log p + \frac{1}{n}\log K$

23. Given below, catalyst and corresponding process/reaction are matched. The one with mismatch is
(a) $[RhCl(PPh_3)_2]$: Hydrogenation
(b) $TiCl_4 + Al(C_2H_5)_3$: Polymerization
(c) V_2O_5 : Haber-Bosch process
(d) Nickel : Hydrogenation

24. Which of the following does not contain a hydrophobic structure ?
(a) Linseed oil (b) Lanolin
(c) Glycogen (d) Rubber

25. The heats of adsorption in physisorption lie in the range (in kJ/mol)
(a) 40-400 (b) 40- 100
(c) 10 - 40 (d) 1 - 10

26. Which one of the following characteristics is **not** correct for physical adsorption ?
(a) Adsorption increases with increase in temperature
(b) Adsorption is spontaneous
(c) Both enthalpy and entropy of adsorption are negative
(d) Adsorption on solids is reversible

27. Under ambient conditions, which among the following surfactants will form micelles in aqueous solution at lowest molar concentration?
(a) $CH_3\text{-}(CH_2)_8\text{-}COO^{-}Na^{+}$
(b) $CH_3(CH_2)_{11}\overset{\oplus}{N}(CH_3)_3Br^{-}$
(c) $CH_3\text{-}(CH_2)_{13}\text{-}OSO_3^{-}Na^{+}$
(d) $CH_3(CH_2)_{15}\overset{\oplus}{N}(CH_3)_3Br^{-}$

28. Flocculation value of $BaCl_2$ is much less than that of KCl for sol A and flocculation value of Na_2SO_4 is much less than that of NaBr for sol B. The correct statement among the following is :
(a) Both the sols A and B are negatively charged.
(b) Sol A is positively charged and Sol B is negatively charged.
(c) Both the sols A and B are positively charged.
(d) Sol A is negatively charged and sol B is positively charged.

29. The density of gold is 19 g/cm^3. If 1.9×10^{-4} g of gold is dispersed in one litre of water to give a sol having spherical gold particles of radius 10 nm, then the number of gold particles per mm^3 of the sol will be
(a) 1.9×10^{12} (b) 6.3×10^{14}
(c) 6.3×10^{10} (d) 2.4×10^{6}

30. The stablity of lyophillic colloids is due to which of the following?
(a) Charge on their particles
(b) Large size of their particles
(c) Small size of their particles
(d) A layer of dispersion medium

31. Colloid of which one of the following can be prepared by electrical dispersion method as well as reduction method ?
(a) Sulphur (b) Ferric hydroxide
(c) Arsenious sulphide (d) Gold

32. Example of intrinsic colloid is
(a) glue (b) sulphur
(c) Fe (d) As_2S_3

RESPONSE GRID					
	19. (a)(b)(c)(d)	20. (a)(b)(c)(d)	21. (a)(b)(c)(d)	22. (a)(b)(c)(d)	23. (a)(b)(c)(d)
	24. (a)(b)(c)(d)	25. (a)(b)(c)(d)	26. (a)(b)(c)(d)	27. (a)(b)(c)(d)	28. (a)(b)(c)(d)
	29. (a)(b)(c)(d)	30. (a)(b)(c)(d)	31. (a)(b)(c)(d)	32. (a)(b)(c)(d)	

Space for Rough Work

33. A particular adsorption process has the following characteristics : (i) It arises due to van der Waal's forces and (ii) it is reversile. Identify the correct statement that describes the above adsorption process :
(a) Adsorption is monolayer.
(b) Adsorption increases with increase in temperature.
(c) Enthalpy of adsorption is greaterthan 100 kJ mol^{-1}
(d) Energy of activation is low.

34. In petrochemical industry alcohols are directly converted to gasoline by passing over heated
(a) Platinum (b) ZSM-5
(c) Iron (d) Nickel

35. Match the columns

	Column-I		Column-II
A.	As_2S_3 sol	I.	Bredig's Arc method
B.	$Fe(OH)_3$ sol	II.	Double decomposition
C.	Colloidal sols of metals like Au, Ag, Pt, etc.	III.	Peptization
D.	Conversion of freshly prepared precipitate into a colloidal sol	IV.	Hydrolysis

(a) A– II; B – IV; C – III; D – I
(b) A – II; B – I; C – IV; D – III
(c) A – IV; B – II; C – I; D – III
(d) A – II; B – IV; C – I; D – III

36. In Langmuir's model of adsorption of a gas on a solid surface
(a) the mass of gas striking a given area of surface is proportional to the pressure of the gas
(b) the mass of gas striking a given area of surface is independent of the pressure of the gas
(c) the rate of dissociation of adsorbed molecules from the surface does not depend on the surface covered
(d) the adsorption at a single site on the surface may involve multiple molecules at the same time

37. Which of the following electrolytes is least effective in coagulating ferric hydroxide solution?
(a) KBr (b) K_2SO_4
(c) K_2CrO_4 (d) $K_4[Fe(CN)_6]$

38. ..... is a silver sol used as an eye lotion.
(a) Amytol (b) Argyrol
(c) Ciprofloxacin (d) Cylol

39. Which of the following is not emulsifying agent for W/O emulsion?
(a) Lampblack
(b) Long chain alcohol
(c) Proteins
(d) Heavy metal salts of fatty acids

40. Among the following, the surfactant that will form micelles in aqueous solution at the lowest molar concentration at ambient condition is : -
(a) $CH_3(CH_2)_{15}N^+(CH_3)_3Br^-$
(b) $CH_3(CH_2)_{11}OSO^-_3Na^+$
(c) $CH_3(CH_2)_6COO^-Na^+$
(d) $CH_3(CH_2)_{11}N^+(CH_3)_3Br^-$

41. At low pressure, the fraction of the surface covered follows
(a) zero-order reaction (b) second-order reaction
(c) first-order reaction (d) fractional order

42. The following statements relate to the adsorption of gases on a solid surface. Identify the incorrect statement among them:
(a) Enthalpy of adsorption is negative
(b) Energy appears as heat
(c) On adsorption, the residual forces on the surface are increased
(d) Entropy of adsorption is negative

43. Peptization involves
(a) precipitation of colloidal particles
(b) disintegration of colloidal aggregates
(c) evaporation of dispersion medium
(d) impact of molecules of the dispersion medium on the colloidal particles

44. The isoelectric-point of a colloidally dispersed material is the pH value at which
(a) the dispersed phase migrate in an electric field
(b) the dispersed phase does not migrate in an electric field
(c) the dispersed phase has pH equal to 7
(d) the dispersed phase has pH equal to zero

45. When solution of 5g of iodine in CS_2 was shaken with the same volume of water. The amount of iodine in water is (Distribution coefficient $C_{CS_2}/C_{H_2O} = 420.0$)
(a) 1.19 (b) 0.0019 (c) 0.0119 (d) 0.119

RESPONSE GRID					
	33.ⓐⓑⓒⓓ	34.ⓐⓑⓒⓓ	35.ⓐⓑⓒⓓ	36.ⓐⓑⓒⓓ	37. ⓐⓑⓒⓓ
	38.ⓐⓑⓒⓓ	39.ⓐⓑⓒⓓ	40.ⓐⓑⓒⓓ	41.ⓐⓑⓒⓓ	42. ⓐⓑⓒⓓ
	43.ⓐⓑⓒⓓ	44.ⓐⓑⓒⓓ	45.ⓐⓑⓒⓓ		

Space for Rough Work

DAILY PRACTICE PROBLEMS

1. (d)
2. (d)
3. (b) When oppositely charged sols are mixed their charges are neutralised. Both sols may be partially or completely precipitated.
4. (a) Brownian movement is the random motion of particles suspended in a fluid (a liquid or gas) resulting from their collision with the fast moving atom or molecules in the liquid or gaseous state of the matter. That means smaller particles are responsible for the Brownian movement than for bigger particles.
5. (b)
6. (a) Chemical adsorption involves formation of monolayer.
7. (d) Adsorption is accompanied by evolution of heat as the residual forces acting along the surface of adsorbent decrease i.e., adsorption is accompanied by decrease in enthalpy.
8. (c)
9. (b)
10. (c) Hydrolysis of urea can be represented as follows

$$H_2N-\underset{\underset{O}{\|}}{C}-NH_2 + H_2O \xrightarrow[(enzyme)]{Urease} 2NH_3 + CO_2$$

Since it involves biological catalyst (enzyme) so it is an example of biochemical catalysis.

11. (c) Alum coagulates mud particles and helps in purifying water.
12. (d) Efficiency of catalysing property of a catalyst is inversely proportional to activation energy.
13. (a) Tyndall effect is shown by sols.
14. (c) It is due to impact of molecules of dispersion medium on the colloidal particles.
15. (c)
16. (c) Adsorption theory is applied to heterogeneous catalysis.
17. (d) Electrolytic (Ionic) impurities can be most easily removed on application of electric field.
18. (d) All are irreversible colloidal systems.
19. (d)
20. (a) Gold number $\propto \frac{1}{\text{Protective power}}$

i.e., The smaller the value of gold number of lyophilic sol, the greater is the protective action. Hence, gelatin will be better protective colloid.

21. (c) Colloidal gold is prepared by Bredig's arc method.
22. (b) According to Freundlich equation,

$$\text{or } \log\frac{x}{m} = \log Kp^{1/n} \text{ or } \log\frac{x}{m} = \log K + \frac{1}{n}\log p$$

23. (c) V_2O_5 is used as catalyst in contact process of manufacturing H_2SO_4.
24. (d) Linseed oil, lanolin and glycogen attract water hence contain a hydrophilic structure but rubber does not attract water and thus does not contain a hydrophobic structure.
25. (c) For physiosorption the ΔH value is 10 - 40 kJ/mol.
26. (a) As adsorption is an exothermic process.

$\therefore$ Rise in temperature will decrease adsorption.

27. (d) Greater the surface area, greater the van der waal forces of attraction and therefore at lesser concentration micelle formation will take place. In case of $CH_3(CH_2)_{15}\overset{\oplus}{N}(CH_3)_3BrO$ due to greater chain length, greater will be van der waal forces.
28. (d) In first case the given compounds have same anion but different cations having different charge hence they will precipitate negatively charged sol i.e. 'A'.

In second case the given compounds have similar cation but different anion with different charge. Hence they will precipitate positively charged sol. i.e. 'B'.

29. (d) Volume of gold present in solution

$$= \frac{\text{Mass of gold}}{\text{Density of gold}} = \frac{1.9\times10^{-4}\,g}{19\,g/cm^3}$$

$$= 0.1 \times 10^{-4}\,cm^3.$$

For spherical particles of gold with radius equal to 10 nm

The volume of each particle

$$= \frac{4}{3}\pi r^3 = \frac{4}{3}\times\frac{22}{7}\times(10\times10^{-7}\,cm)^3$$

$$= \frac{88}{21}\times10^{-18}\,cm^3$$

Number of gold particles present

$$\frac{\text{Volume of gold in solution}}{\text{Volume of each particle}}$$

$$\frac{0.1\times10^{-4}\,cm^3}{\frac{88}{21}\times10^{-18}\,cm^3}$$

$$= \frac{21}{88}\times10^{13} \text{ particles}$$

$$= 2.4 \times 10^{12} \text{ particles}$$

2.4×10^{12} particles of gold are present in 1000 cm^3 (1 litre).

$\therefore$ Number of particles present per mm^3

$$= \frac{2.4 \times 10^{12}}{10^6} [1\,L = 10^6 mm^3]$$

$$= 2.4 \times 10^6$$

30. (d) The stability of lyophilic colloids is due to layer of dispersion medium around sol particles.

31. (d)

32. (a) On shaking with the dispersion medium, colloids directly form the colloidal sol. Hence they are called intrinsic colloids. i.e., glue.

33. (d) The characteristics given suggests that this should be physical adsorption.

Physical adsorption usually takes place at low temperature and decreases with increase in temperature. The force of attraction holding the adsorbate are van der Waal's forces. Heat of adsorption is low. It is reversible and forms multimolecular layer. It does not acquire any activation energy.

34. (b) ZSM-5 is a shape selective catalyst. Zeolites are good shape selective catalysts because of the honey comb like structure.

35. (d)

36. (a) According to Langmuir's model of adsorption of a gas on a soild surface the mass of gas adsorbed(x) per gram of the adsorbent (m) is directly proportional to the pressure of the gas (p) at constant temperature i.e.

$$\frac{x}{m} \propto p$$

37. (a) Smaller the charge on anion, lesser will be its coagulating power.

$\therefore$ KBr have Br^- with least charge of -1 on Br thus KBr is least effective in coagulating $Fe(OH)_3$.

38. (a)

39. (c) Protein is an emulsifying agent for O/W emulsion.

40. (b)

41. (c) At low pressure the extent of adsorption is directly proportional to pressure which follows first order kinetics.

42. (c) Adsorption is a phenomena of attracting and retaining the molecules of a substance on the surface of a liquid or a solid resulting into a higher concentration of the molecules on the surface.

After adsorption there is a decrease in the residual forces due to bond formation ΔG, ΔH & ΔS all are negative in the case of adsorption.

43. (b) Peptisation is disintegration of colloidal aggregate.

44. (b) At isoelectric point there is no migration of dispersed phase in an electric field.

45. (c) Let the amount of iodine in water be a gm., $C_1 = 5g$ in x ml of CS_2, $C_2 = 5 - a$ gin x ml of H_2O. Then

$$\frac{5-a}{a} = 420, \quad \therefore = 0.0118$$