

Surface Chemistry

5.1 Adsorption

- The correct option representing a Freundlich adsorption isotherm is
 - $\frac{x}{m} = kp^{0.3}$
 - $\frac{x}{m} = kp^{2.5}$
 - $\frac{x}{m} = kp^{-0.5}$
 - $\frac{x}{m} = kp^{-1}$
 (Odisha NEET 2019)
- Which one of the following characteristics is associated with adsorption?
 - ΔG and ΔH are negative but ΔS is positive.
 - ΔG and ΔS are negative but ΔH is positive.
 - ΔG is negative but ΔH and ΔS are positive.
 - ΔG , ΔH and ΔS all are negative.
 (NEET-I 2016)
- In Freundlich adsorption isotherm, the value of $1/n$ is
 - between 0 and 1 in all cases
 - between 2 and 4 in all cases
 - 1 in case of physical absorption
 - 1 in case of chemisorption.
 (2012)
- If x is amount of adsorbate and m is amount of adsorbent, which of the following relations is not related to adsorption process?
 - $x/m = f(p)$ at constant T
 - $x/m = f(T)$ at constant p
 - $p = f(T)$ at constant (x/m)
 - $\frac{x}{m} = p \times T$
 (2011)
- The Langmuir adsorption isotherm is deduced using the assumption
 - the adsorption sites are equivalent in their ability to adsorb the particles
 - the heat of adsorption varies with coverage
 - the adsorbed molecules interact with each other
 - the adsorption takes place in multilayers.
 (2007)

- A plot of $\log(x/m)$ versus $\log P$ for the adsorption of a gas on a solid gives a straight line with slope equal to
 - $\log k$
 - $-\log k$
 - n
 - $1/n$
 (2006, 1994)
- Which is not correct regarding the adsorption of a gas on surface of a solid?
 - On increasing temperature adsorption increases continuously.
 - Enthalpy and entropy change is negative.
 - Adsorption is more for some specific substance.
 - It is a reversible reaction.
 (2001)

5.2 Catalysis

- Which one of the following statements is not correct?
 - The value of equilibrium constant is changed in the presence of a catalyst in the reaction at equilibrium.
 - Enzymes catalyse mainly biochemical reactions.
 - Coenzymes increase the catalytic activity of enzyme.
 - Catalyst does not initiate any reaction.
 (NEET 2017)
- Which one of the following statements is incorrect about enzyme catalysis?
 - Enzymes are mostly proteinous in nature.
 - Enzyme action is specific.
 - Enzymes are denatured by ultraviolet rays and at high temperature.
 - Enzymes are least reactive at optimum temperature.
 (2012)
- The enzyme which hydrolyses triglycerides to fatty acids and glycerol is called
 - maltase
 - lipase
 - zymase
 - pepsin.
 (2004)

11. According to the adsorption theory of catalysis, the speed of the reaction increases because
- the concentration of reactant molecules at the active centres of the catalyst becomes high due to adsorption
 - in the process of adsorption, the activation energy of the molecules becomes large
 - adsorption produces heat which increases the speed of the reaction
 - adsorption lowers the activation energy of the reaction. (2003)

5.3 Colloids

12. A colloidal system has particles of which of the following size?
- 10^{-9} m to 10^{-12} m
 - 10^{-6} m to 10^{-9} m
 - 10^{-4} m to 10^{-10} m
 - 10^{-5} m to 10^{-7} m (1996)

5.4 Classification of Colloids

13. Measuring zeta potential is useful in determining which property of colloidal solution?
- Viscosity
 - Solubility
 - Stability of the colloidal particles
 - Size of the colloidal particles (NEET 2020)
14. Which mixture of the solutions will lead to the formation of negatively charged colloidal $[\text{AgI}]\text{I}^-$ sol?
- 50 mL of 0.1 M AgNO_3 + 50 mL of 0.1 M KI
 - 50 mL of 1 M AgNO_3 + 50 mL of 1.5 M KI
 - 50 mL of 1 M AgNO_3 + 50 mL of 2 M KI
 - 50 mL of 2 M AgNO_3 + 50 mL of 1.5 M KI (NEET 2019)
15. On which of the following properties does the coagulating power of an ion depend?
- The magnitude of the charge on the ion alone
 - Size of the ion alone
 - Both magnitude and sign of the charge on the ion
 - The sign of charge on the ion alone (NEET 2018)
16. The coagulation values in millimoles per litre of the electrolytes used for the coagulation of As_2S_3 are given below :

- I. (NaCl) = 52, II. (BaCl_2) = 0.69,
III. (MgSO_4) = 0.22

The correct order of their coagulating power is

- $\text{I} > \text{II} > \text{III}$
 - $\text{II} > \text{I} > \text{III}$
 - $\text{III} > \text{II} > \text{I}$
 - $\text{III} > \text{I} > \text{II}$ (NEET-II 2016)
17. Fog is a colloidal solution of
- solid in gas
 - gas in gas
 - liquid in gas
 - gas in liquid. (NEET-I 2016)
18. Which property of colloidal solution is independent of charge on the colloidal particles?
- Electroosmosis
 - Tyndall effect
 - Coagulation
 - Electrophoresis (2015, Cancelled 2014)
19. The protecting power of lyophilic colloidal sol is expressed in terms of
- coagulation value
 - gold number
 - critical micelle concentration
 - oxidation number. (2012)
20. Which one of the following forms micelles in aqueous solution above certain concentration?
- Dodecyl trimethyl ammonium chloride
 - Glucose
 - Urea
 - Pyridinium chloride (2005)
21. Position of non-polar and polar part in micelle
- polar at outer surface but non-polar at inner surface
 - polar at inner surface non-polar at outer surface
 - distributed over all the surface
 - are present in the surface only. (2002)
22. Which one of the following method is commonly used method for destruction of colloid?
- Dialysis
 - Condensation
 - Filtration by animal membrane
 - By adding electrolyte (2000)
23. At the critical micelle concentration (CMC) the surfactant molecules
- associate
 - dissociate
 - decompose
 - become completely soluble. (1998)

24. The ability of anion, to bring about coagulation of a given colloid, depends upon
 (a) magnitude of the charge
 (b) both magnitude and charge
 (c) its charge only
 (d) sign of the charge alone. (1997)
25. When a few typical solutes are separated by a particular selective membrane such as protein particles, blood corpuscles, this process is called
 (a) transpiration
 (b) endosmosis
 (c) dialysis
 (d) diffusion. (1996)

ANSWER KEY

1. (a) 2. (d) 3. (a) 4. (d) 5. (a) 6. (d) 7. (a) 8. (a) 9. (d) 10. (b)
 11. (d) 12. (b) 13. (c) 14. (b) 15. (c) 16. (c) 17. (c) 18. (b) 19. (b) 20. (a)
 21. (a) 22. (d) 23. (a) 24. (b) 25. (c)

Hints & Explanations

1. (a): Freundlich adsorption isotherm equation is

$$\frac{x}{m} = kp^n \quad \left(1 \geq \frac{1}{n} \geq 0\right)$$

2. (d): As the molecules of the adsorbate are held on the surface of the solid adsorbent, entropy decreases *i.e.*, $\Delta S = -ve$.

$$\text{As } \Delta G = \Delta H - T\Delta S$$

For the adsorption to occur, $\Delta G = -ve$ and it is possible only if $\Delta H = -ve$.

3. (a): Freundlich adsorption isotherm :

$$\frac{x}{m} = k \cdot p^{1/n}; \quad 0 \leq \frac{1}{n} \leq 1$$

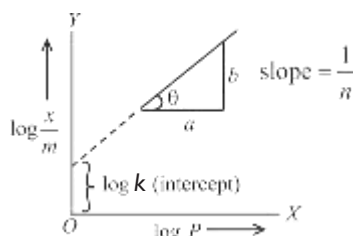
4. (d): $\frac{x}{m} = p \times T$ is the incorrect relation.

The correct relation is

$$\text{amount of absorption } \frac{x}{m} \propto \frac{P}{T}$$

5. (a): Langmuir adsorption isotherm is based on the assumption that every adsorption site is equivalent and that the ability of a particle to bind there is independent of whether nearby sites are occupied or not occupied.

6. (d):

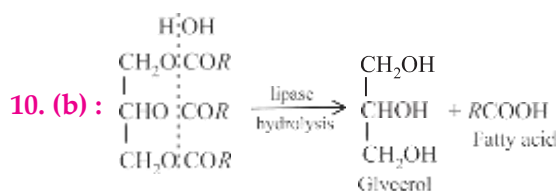


This is according to Freundlich adsorption isotherm.

7. (a): Adsorption is the ability of a substance to concentrate or hold gases, liquids or dissolved substances upon its surface. Solids adsorb greater amounts of substances at lower temperature. In general, adsorption decreases with increase in temperature.

8. (a): Catalyst does not change the value of equilibrium constant as they affect forward as well as backward reactions equally.

9. (d): The enzyme activity rises rapidly with temperature and becomes maximum at definite temperature, called optimum temperature.

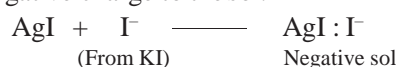


11. (d): Adsorption causes decrease in surface energy which appears as heat. Thus, adsorption is an exothermic process and hence lowers the activation energy of the reaction.

12. (b): Particle size of colloids lies in the range of 10^{-6} m to 10^{-9} m. Particles themselves are invisible even under the most powerful microscope.

13. (c): Measuring zeta potential is useful in determining stability of the colloidal particles.

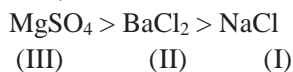
14. (b): If colloidal sol of AgI is prepared by adding KI solution to AgNO_3 till KI is in slight excess, iodide ion (I^-) will be adsorbed on the surface of AgI thereby, giving a negative charge to the sol.



15. (c) : According to Hardy-Schulze rule, the coagulating power of an electrolyte depends on both magnitude and sign of the charge of the effective ion or electrolyte.

16. (c) : Coagulating power $\propto \frac{1}{\text{Coagulation value}}$

Lower the coagulation value, higher is the coagulating power so, the correct order is :

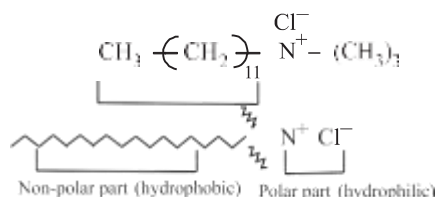


17. (c) : Fog is an example of aerosol in which dispersed phase is liquid and dispersion medium is gas.

18. (b) : Tyndall effect is scattering of light by colloidal particles which is independent of charge on them.

19. (b)

20. (a) :



21. (a) : Micelles are the clusters or aggregates formed in solution by association of colloids. Usually such

molecules have a lyophobic group and a lyophilic group. The long hydrocarbon is the lyophobic portion which tries to recede away from the solvent water and the ionisable lyophilic group which tends to go into water resulting into ions. As the concentration is increased the lyophobic parts receding away from the solvent approach each other and form a cluster. Thus, the lyophobic ends are in the interior and lyophilic groups projecting outward in contact with the solvent.

22. (d) : By adding electrolytes the colloidal particles are precipitated. The electrolytes neutralise the charge of colloids leading to their coagulation and thus, destroy the colloid.

23. (a) : The soap concentration at which micelles (spherical colloid molecules) first appear is called as critical micelle concentration (CMC). At this condition, the surfactant molecules associate with each other.

24. (b) : Both magnitude of charge and nature of charge effect coagulation of a given colloid. Greater the magnitude of the charge, quicker will be the coagulation.

25. (c) : Dialysis is the process of separating the particles of colloids from the particles of crystalloids by means of diffusion through a selective membrane placed in water.