

PHYSICAL CHEMISTRY

SURFACE CHEMISTRY

1. Consider the following statements related to colloids.
- (I) Lyophobic colloids are **not** formed by simple mixing of dispersed phase and dispersion medium.
- (II) For emulsions, both the dispersed phase and the dispersion medium are liquid.
- (III) Micelles are produced by dissolving a surfactant in any solvent at any temperature.
- (IV) Tyndall effect can be observed from a colloidal solution with dispersed phase having the same refractive index as that of the dispersion medium.

The option with the correct set of statements is [JEE(Advanced) 2023]

- (A) (I) and (II) (B) (II) and (III) (C) (III) and (IV) (D) (II) and (IV)

2. The correct option(s) related to adsorption processes is(are) [JEE(Advanced) 2022]

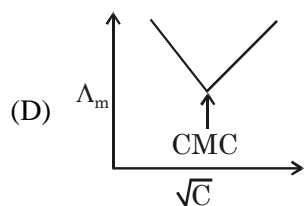
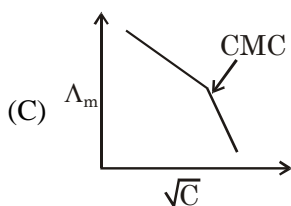
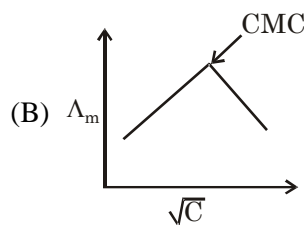
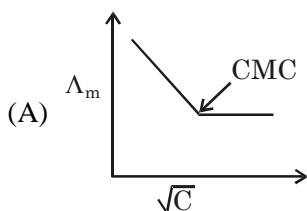
- (A) Chemisorption results in a unimolecular layer.
- (B) The enthalpy change during physisorption is in the range of 100 to 140 kJ mol⁻¹.
- (C) Chemisorption is an endothermic process.
- (D) Lowering the temperature favors physisorption processes.

3. The correct statement(s) related to colloids is(are) [JEE(Advanced) 2021]

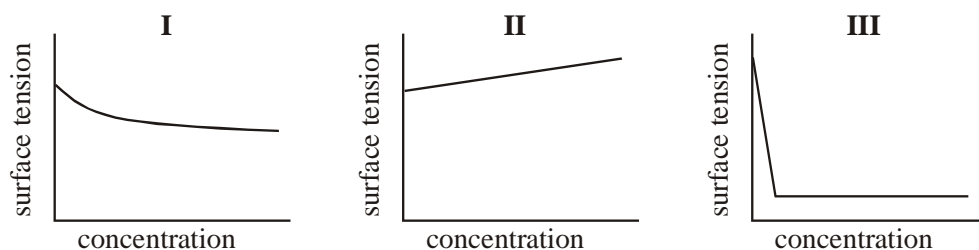
- (A) The process of precipitating colloidal sol by an electrolyte is called peptization.
- (B) Colloidal solution freezes at higher temperature than the true solution at the same concentration.
- (C) Surfactants form micelle above critical micelle concentration (CMC). CMC depends on temperature
- (D) Micelles are macromolecular colloids.

4. Molar conductivity (Λ_m) of aqueous solution of sodium stearate, which behaves as a strong electrolyte, is recorded at varying concentration(c) of sodium stearate. Which one of the following plots provides the correct representation of micelle formation in the solution?

(Critical micelle concentration (CMC) is marked with an arrow in the figures.) [JEE(Advanced) 2019]



5. The correct statement(s) about surface properties is (are) [JEE(Advanced) 2017]
- (A) Cloud is an emulsion type of colloid in which liquid is dispersed phase and gas is dispersion medium
 (B) Adsorption is accompanied by decrease in enthalpy and decrease in entropy of the system.
 (C) Brownian motion of colloidal particles does not depend on the size of the particles but depends on viscosity of the solution.
 (D) The critical temperatures of ethane and nitrogen are 563 K and 126 K, respectively. The adsorption of ethane will be more than that of nitrogen on same amount of activated charcoal at a given temperature.
6. The qualitative sketches I , II and III given below show the variation of surface tension with molar concentration of three different aqueous solutions of KCl, CH₃OH and CH₃(CH₂)₁₁OSO₃⁻ Na⁺ at room temperature. The correct assignment of the sketches is - [JEE(Advanced) 2016]



- (A) I : KCl II : CH₃OH III : CH₃(CH₂)₁₁OSO₃⁻ Na⁺
 (B) I : CH₃(CH₂)₁₁OSO₃⁻ Na⁺ II : CH₃OH III : KCl
 (C) I : KCl II : CH₃(CH₂)₁₁OSO₃⁻ Na⁺ III : CH₃OH
 (D) I : CH₃OH II : KCl III : CH₃(CH₂)₁₁OSO₃⁻ Na⁺
7. When O₂ is adsorbed on a metallic surface, electron transfer occurs from the metal to O₂. The TRUE, statement (s) regarding this adsorption is (are) [JEE(Advanced) 2015]
- (A) O₂ is physisorbed
 (B) heat is released
 (C) occupancy of π_{2p}^{*} of O₂ is increased
 (D) bond length of O₂ is increased

SOLUTIONS

1. **Ans. (A)**

Sol. (I) As in Lyophobic colloids there is no interaction between dispersed phase and dispersion medium, special methods are used for preparation, simple mixing will not form colloid.

(II) Emulsions are liquid in liquid type colloids.

(III) Dissolving surfactant in a proper solvent will only form micelles at temperature above Kraft's temperature.

(IV) For Tyndall effect there must be a large difference in refractive index between dispersed phase and dispersion medium in order to have diffraction of light.

Hence ans (I) & (II) are correct.

2. **Ans. (A, D)**

Sol. (A) Chemisorption is unimolecular layered.

(B) Enthalpy of physisorption is much less in magnitude.

(C) Chemisorption of gases on solids is exothermic.

(D) As physisorption is exothermic so lowering temperature favours it.

3. **Ans. (B, C)**

Sol. (A) Process of precipitating colloidal solution is called coagulation. Hence false.

(B) For colloidal solutions concentration is very small due to very large molar mass and hence their colligative properties are very small as compared to true solutions

$\therefore \Delta T_f$ is lesser for colloidal solution. Hence true.

(C) At CMC surfactant form micelles. Hence true

(D) Micelles and macromolecular colloids are two different types of colloids. Hence false.

4. **Ans. (C)**

5. **Ans. (B, D)**

Sol. (A) Emulsion is liquid in liquid type colloid.

(B) For adsorption, $\Delta H < 0$ & $\Delta S < 0$

(C) Smaller the size and less viscous the dispersion medium, more will be the brownian motion.

(D) Higher the T_C , greater will be the extent of adsorption.

6. **Ans. (D)**

Sol. Water has large surface tension due to very strong interaction. Generally adding organic derivatives to water decreases its surface tension due to hydrophobic interaction.

In case III, hydrophobic interaction is stronger than case I causing surface tension to decrease more rapidly.

Due to K^+Cl^- (inorganic electrolyte) intermolecular forces increases, surface tension increases.

7. **Ans. (B, C, D)**

Sol. (A) : Incorrect : Because electronic transfer takes place and it is chemisorption

(B) : Correct : Adsorption is always exothermic

(C) : Correct : O_2 will accept the electron from metal into its π^*_{2p} orbital

(D) : Correct : Since the electron enters into π^* orbital bond order decreases and bond length increases