JEE Main Chemistry Previous Year Questions With Solutions on Surface Chemistry

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

Solution:
There is always a decrease in surface energy which appears as heat when adsorption happens. So adsorption always takes place with the evolution of heat. Since the adsorption process is exothermic, the physical adsorption occurs readily at low temperatures and decreases with increasing temperature.

Hence option (b) is the answer.

2. The aerosol is kind of colloid in which
(a) gas is dispersed in liquid
(b) liquid is dispersed in water
(c) solid is dispersed in gas
(d) gas is dispersed in solid.

Solution:
The dispersion medium is gas in aerosol.

Hence option (b) is the answer.

3. The Tyndall effect is observed only when the following conditions are satisfied
(A) the diameter of the dispersed particle is much smaller than the wavelength of the light used (B) the diameter of the dispersed particles is not much smaller than the wavelength of the light used
(C) the refractive indices of the dispersed phase and dispersion medium are almost similar in magnitude
(D) the refractive indices of the dispersed phase and the dispersion medium differ greatly in magnitude.
(a) (A) and (C)
(b) (B) and (C)
(c) (A) and (D)
(d) (B) and (D)

Solution:
The process in which the particles in a colloid scatter the beams of light that are directed at them is called Tyndall effect.

Hence option (d) is the answer.

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

Solution:
The relation between the mass of the gas adsorbed per gram of the adsorbent and equilibrium pressure is given by $x/m = aP/(1+bP)$
where x is the mass of the gas adsorbed on m gram of the adsorbent, P is the pressure and a, b are constants.

Hence option (c) is the answer.

5. Which one of the following is not a property of physical adsorption?
(a) Unilayer adsorption occurs.
(b) Greater the surface area, the more the adsorption.
(c) Lower the temperature, more the adsorption.
(d) Higher the pressure, the more the adsorption.

Solution:
Physical adsorption forms a multimolecular layer.

Hence option (a) is the answer.

6. Which of the following statements is incorrect regarding physisorption?
(a) It occurs because of van der Waals forces.
(b) More easily liquefiable gases are adsorbed readily.
(c) Under high pressure, it results in a multimolecular layer on the adsorbent surface.
(d) Enthalpy of adsorption ($\Delta H_{adsorption}$) is low and positive.

Solution:
Physical adsorption is an exothermic process. Enthalpy of adsorption ($\Delta H_{adsorption}$) is low and negative.

Hence option (d) is the answer.

7. Haemoglobin and gold sol are examples of
(a) positively and negatively charged sols, respectively
(b) negatively charged sols
(c) positively charged sols
(d) negatively and positively charged sols, respectively.

Solution:
Haemoglobin and gold sol are examples of positively and negatively charged sols, respectively.
Hence option (a) is the answer.

8. Peptization is a
(a) process of converting a colloidal solution into precipitate
(b) process of converting soluble particles to form colloidal solution
(c) process of bringing colloidal molecule into solution
(d) process of converting precipitate into colloidal solution.

Solution:
Peptization is the process of converting precipitate into a colloidal solution.

Hence option (d) is the answer.

9. Which of the following statements about colloids is false?
(a) When excess electrolyte is added to a colloidal solution, colloidal particle will be precipitated.
(b) Freezing point of colloidal solution is lower than true solution at same concentration of a solute.
(c) When silver nitrate solution is added to potassium iodide solution, a negatively charged colloidal solution is formed.
(d) Colloidal particles can pass through ordinary filter paper.

Solution:
The freezing point of the colloidal solution is higher than the true solution at the same concentration of a solute.

Hence option (b) is the answer.

10. An example of solid sol is
(a) butter
(b) paint
(c) hair cream
(d) gemstones.

Solution:
Solid sol is a type of colloid, of the form of one solid dispersed in another continuous solid.
Gemstone is an example of a solid sol.

Hence option (d) is the answer.

11. According to Freundlich adsorption isotherm, which of the following is correct?
(a) $(x/m) \propto p^1$
(b) $(x/m) \propto p^{1/n}$
(c) $(x/m) \propto p^0$
(d) All the above are correct for different ranges of pressure.

Solution:
According to Freundlich adsorption isotherm, $(x/m) \propto k\, p^{1/n}$.
The value of 1/n can be between 0 to 1 over different ranges of pressure.

Hence option (d) is the answer.

12. A particular adsorption process has the following characteristics:
(i) It arises due to van der Waals forces and
(ii) it is reversible.
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 greater than 100 kJ mol–1.
(d) Energy of activation is low.

Solution:
Very low activation energy is required in physical adsorption.

Hence option (d) is the answer.

13. The correct option among the following is
(a) colloidal particles in lyophobic sols can be precipitated by electrophoresis
(b) colloidal medicines are more effective because they have small surface area
(c) addition of alum to water makes it unfit for drinking
(d) Brownian motion in colloidal solution is faster if the viscosity of the solution is very high.

Solution:
Electrophoresis is a process that separates charged particles in a fluid using a field of electrical charge.
The colloidal particles in lyophobic sols can be precipitated by electrophoresis.

Hence option (a) is the answer.

14. 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

Solution:

Gold number ∝ 1/ Protective power.
Gelatin has the lowest gold number. So it is a better protective colloid.
Hence option (a) is the answer.

15. Which of the following is not an example of heterogeneous catalytic reaction?

(a) Haber's process
(b) Hydrogenation of vegetable oils
(c) Combustion of coal
(d) Ostwald's process

Solution:

The combustion of coal is not an example of a heterogeneous catalytic reaction.

Hence option (c) is the answer.