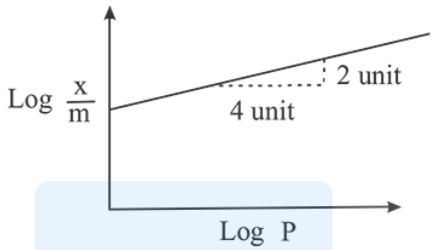
JEE Mains 2019 Chapter wise Question Bank

Surface Chemistry - Questions

Q1

Adsorption of a gas follows Freundlich adsorption isotherm. In the given plot, x is the mass of the gas adsorbed on mass m of the adsorbent at pressure p. $\frac{x}{m}$ is proportional to:



(1) p^2 (2) $p^{1/4}$
(3) $p^{1/2}$ (4) p

9 Jan Morning

Q2

For coagulation of arsenious sulphide sol, which one of the following salt solution will be most effective?

(1) $BaCl_2$ (2) $AlCl_3$
(3) NaCl (4) Na_3PO_4

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Q3

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

(1) Ostwald's process
(2) Combustion of coal
(3) Hydrogenatoin of vegetable oils
(4) Haber's process

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Q4

Haemoglobin and gold sol are examples of:

(1) positively and negatively charged sols, respectively
(2) positively charged sols
(3) negatively charged sols
(4) negatively and positively charged sols, respectively

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Q5

An example of solid sol is :

(1) Paint (2) Gem stones
(3) Butter (4) Hair cream

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Q6

Among the colloids cheese (C), milk (M) and smoke (S), the correct combination of the dispersed phase and dispersion medium, respectively is :

(1) C : liquid in solid; M : liquid in solid; S : solid in gas
(2) C : liquid in solid; M : liquid in liquid; S : solid in gas
(3) C : solid in liquid; M : liquid in liquid; S : gas in solid
(4) C : solid in liquid; M : solid in liquid; S : solid in gas

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Q7

Given gas critical temperature/K for

H_2	CH_4	CO_2	SO_2 is
33	190	304	630

On the basis of data given above, predict which of the following gases shows least adsorption on a definite amount of charcoal?

(1) SO_2 (2) CH_4
(3) CO_2 (4) H_2

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Q8

Among the following, the false statement is :

(1) It is possible to cause artificial rain by throwing electrified sand carrying charge opposite to the one on clouds from an aeroplane.

(2) Tyndall effect can be used to distinguish between a colloidal solution and a true solution.

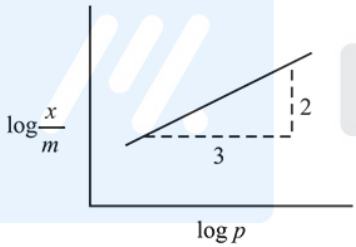
(3) Lyophilic sol can be coagulated by adding an electrolyte.

(4) Latex is a colloidal solution of rubber particles which are positively charged.

12 Jan Evening

Q9

Adsorption of a gas follows Freundlich adsorption isotherm. x is the mass of the gas adsorbed on mass m of the adsorbent. The plot of $\frac{x}{m}$ versus log p is shown in the given graph. $\frac{x}{m}$ is proportional to :



(1) $p^{2/3}$ (2) $p^{3/2}$ (3) p^3 (4) p^2

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Q10

0.27 g of a long chain fatty acid was dissolved in 100 cm^3 of hexane. 10 mL of this solution was added dropwise to the surface of water in a round watch glass. Hexane evaporates and a monolayer is formed. The distance from edge to centre of the watch glass is 10 cm. What is the height of the monolayer?

[Density of fatty acid = 0.9 g cm^{-3} ; $\pi = 3$]

(1) 10^{-6} m (2) 10^{-8} m (3) 10^{-2} m (4) 10^{-4} m

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Q11

Match the catalysts **(Column I)** with products **(Column II)**.

Column I	**Column II**
Catalyst	**Product**
(1) V_2O_5	(i) Polyethylene
(2) $TiCl_4$/ $Al(Me)_3$	(ii) ethanol
(3) $PdCl_2$	(iii) H_2SO_4
(4) Iron Oxide	(iv) NH_3

(1) (1)-(iii); (B)-(iv); (C)-(i); (D)-(ii)

(2) (1)-(ii); (B)-(iii); (C)-(i); (D)-(iv)

(3) (1)-(iii); (B)-(i); (C)-(ii); (D)-(iv)

(4) (1)-(iv); (B)-(iii); (C)-(ii); (D)-(i)

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Q12

The aerosol is a kind of colloid in which:

(1) solid is dispersed in gas

(2) gas is dispersed in solid

(3) gas is dispersed in liquid

(4) liquid is dispersed in water

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Q13

10 mL of 1 mM surfactant solution forms a monolayer covering 0.24 cm^2 on a polar substrate. If the polar head is approximated as a cube, what is its edge length?

(1) 1.0 pm (2) 2.0 pm (3) 0.1 nm (4) 2.0 nm

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Q14

A gas undergoes physical adsorption on a surface and follows the given Freundlich adsorption isotherm equation $\frac{x}{m} = kp^{0.5}$ Adsorption of the gas increases with :

(1) Decrease in p and increase in T

(2) Decrease in p and decrease in T

(3) Increase in p and decrease in T

(4) Increase in p and increase in T

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Q15

The correct option among the following is :
(1) Colloidal medicines are more effective because they have small surface area.
(2) Addition of alum to water makes it unfit for drinking
(3) Colloidal particles in lyophobic sols can be precipitated by electrophoresis.
(4) Brownian motion in colloidal solution is faster if the viscosity of the solution is very high.

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Q16

Peptization is a :
(1) process of bringing colloidal molecule into solution
(2) process of converting precipitate into colloidal solution
(3) process of converting a colloidal solution into precipitate
(4) process of converting soluble particles to form colloidal solution

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Q17

Among the following, the INCORRECT statement about colloids is:
(1) They can scatter light.
(2) They are larger than small molecules and have high molar mass.
(3) The osmotic pressure of a colloidal solution is of higher order than the true solution at the same concentration.
(4) The range of diameters of colloidal particles is between 1 and 1000 nm.

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JEE Mains 2019 Chapter wise Question Bank

Surface Chemistry - Answers

Q1

(3) In Freundlich adsorption isotherm the extent of adsorption (x/m) of a gas on the surface of a solid is related to the pressure of the gas (P) which can be formulated as:

$$\frac{x}{m} = K(P)^{1/n}$$

$$\Rightarrow \log\frac{x}{m} = \log K + \frac{1}{n}\log P$$

In the given plot, the slope between $\log\frac{x}{m}$ versus $\log P = \frac{2}{4} = \frac{1}{2}$

$$\therefore \quad \frac{x}{m} \propto P$$

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Q2

(2) For coagulation of a negatively charged arsenious sulphide sol, the cation which is in higher oxidation state will be most effective.

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Q3

(2) $C + O_2 \rightarrow CO_2$ No catalyst is requiredIn Ostwald process, Haber's process and hydrogenation of vegetable oils, catalyst (solid) such as Pt/Rh, Fe and Ni are used.

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Q4

(1) Haemoglobin and gold sol (metal) are examples of positive and negative sols, respectively.

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Q5

(2) Gem stones are solid sol.

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Q6

(2)

Colloids	Dispersed phase	Dispersion medium
Cheese (C)	liquid	solid
Milk (M)	liquid	liquid
Smoke (S)	solid	gas

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Q7

(4) Smaller the value of critical temperature of gas, lesser is the extent of adsorption.
$\therefore$ Least adsorption is shown by H_2 (least critical temperature).

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Q8

(4) Latex is a colloidal solution of negatively charged rubber particles.

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Q9

(1) According to Freundlich adsorption isotherm

$$\frac{x}{m} \propto p^{\frac{1}{n}} \quad ; \quad \frac{x}{m} = kp^{\frac{1}{n}}$$

$$\text{Slope} = \frac{2}{3}$$

$$\log\frac{x}{m} = \log k + \frac{1}{n}\log p$$

$$\text{Slope} = \frac{1}{n} = \frac{2}{3}$$

$$\frac{x}{m} \propto p^{\frac{2}{3}}$$

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Q10

(1) Given: 0.27 g is present in 100 cm^3 of hexane

$\therefore$ 10 mL of aqueous solution contains only 0.027 g acid.

$$\text{Volume of 0.027 g acid} = \frac{0.027}{0.9} \text{ mL}$$

$\therefore$ $\pi r^2 h = \frac{0.027}{0.9}$ (given $r = 10$ cm, $\pi = 3$)

$\therefore$ $h = 10^{-4}$ cm $= 10^{-6}$ m

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Q11

(3) (A) V_2O_5 Preparation of H_2SO_4 in contact process

(B) $TiCl_4 + Al(Me)_3$ Polyethylene (Ziegler-Natta catalyst)

(C) $PdCl_2$ Ethanal (Wacker's process)

(D) Iron oxide NH_3 in (Haber's process)

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Q12

(1) In aerosol, the dispersion medium is gas while the dispersed phase can be both solid or liquid.

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Q13

(2) No. of surfactant molecule $= 6 \times 10^{23} \times \frac{10}{1000} \times 10^{-3}$

$= 6 \times 10^{18}$ molecule

Let edge length = a cm

Total surface area of surfactant $= 6 \times 10^{18} a^2$

$= 0.24$ cm^2

$$a^2 = \frac{0.24}{6 \times 10^{18}} = 0.04 \times 10^{-18} = 4 \times 10^{-20}$$

$a = 2 \times 10^{-10}$ cm $= 2$ pm

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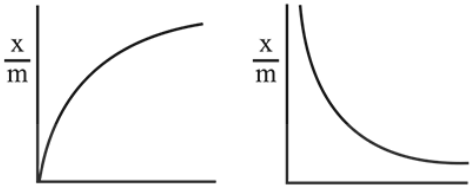
Q14

(3) Freundlich adsorption is applicable for physical adsorption. The variation of extent of adsorption with (i) Pressure and (ii) Temperature is given by the following curves.



Hence, extent of adsorption increases with increase in pressure and decrease in temperature.

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Q15

(3) The process of electrophoresis is used to precipitate colloidal particles in lyophobic sols.

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Q16

(2) Peptisation is the process of converting a precipitate into a colloidal sol by shaking it with dispersion medium in the presence of small amount of electrolyte. It is also known as deflocculation.

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Q17

(3) Due to the association of solute molecule till they acquire colloidal dimensions, the osmotic pressure of a colloidal solution is of lower order than that of true solution at the same concentation.

$\pi = iCRT$

i (vant hoff factor) is less in colloidal solution than true solution. So, π (osmotic pressures) will also be less in colloidal solution.

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