

Surface Chemistry

CHAPTER 19

- The formation of gas at the surface of tungsten due to adsorption is the reaction of order [2002]
 - 0
 - 1
 - 2
 - insufficient data.
- Which one of the following characteristics is **not** correct for physical adsorption? [2003]
 - Adsorption increases with increase in temperature
 - Adsorption is spontaneous
 - Both enthalpy and entropy of adsorption are negative
 - Adsorption on solids is reversible
- Identify the correct statement regarding enzymes [2004]
 - Enzymes are specific biological catalysts that cannot be poisoned
 - Enzymes are normally heterogeneous catalysts that are very specific in their action
 - Enzymes are specific biological catalysts that can normally function at very high temperatures ($T \sim 1000\text{K}$)
 - Enzymes are specific biological catalysts that possess well-defined active sites
- The volume of a colloidal particle, V_C as compared to the volume of a solute particle in a true solution V_S , could be [2005]
 - $\frac{V_C}{V_S} \approx 10^3$
 - $\frac{V_C}{V_S} \approx 10^{-3}$
 - $\frac{V_C}{V_S} \approx 10^{23}$
 - $\frac{V_C}{V_S} \approx 1$
- 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? [2005]
 - Coagulation in both sols can be brought about by electrophoresis
 - Mixing the sols has no effect
 - Sodium sulphate solution causes coagulation in both sols
 - Magnesium chloride solution coagulates, the gold sol more readily than the iron (III) hydroxide sol
- In Langmuir's model of adsorption of a gas on a solid surface [2006]
 - the mass of gas striking a given area of surface is proportional to the pressure of the gas
 - the mass of gas striking a given area of surface is independent of the pressure of the gas
 - the rate of dissociation of adsorbed molecules from the surface does not depend on the surface covered
 - the adsorption at a single site on the surface may involve multiple molecules at the same time
- Gold numbers of protective colloids A, B, C and D are 0.50, 0.01, 0.10 and 0.005, respectively. the correct order of their protective powers is [2008]
 - $D < A < C < B$
 - $C < B < D < A$
 - $A < C < B < D$
 - $B < D < A < C$
- Which of the following statements is incorrect regarding physisorptions? [2009]
 - More easily liquefiable gases are adsorbed readily.
 - Under high pressure it results into multi molecular layer on adsorbent surface.
 - Enthalpy of adsorption ($\Delta H_{\text{adsorption}}$) is low and positive.
 - It occurs because of van der Waal's forces.
- According to Freundlich adsorption isotherm which of the following is correct? [2012]
 - $\frac{x}{m} \propto p^0$
 - $\frac{x}{m} \propto p^1$

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- (c) $\frac{x}{m} \propto p^{1/n}$
- (d) All the above are correct for different ranges of pressure
10. The coagulating power of electrolytes having ions Na^+ , Al^{3+} and Ba^{2+} for arsenic sulphide sol increases in the order : [2013]
- (a) $\text{Al}^{3+} < \text{Ba}^{2+} < \text{Na}^+$ (b) $\text{Na}^+ < \text{Ba}^{2+} < \text{Al}^{3+}$
- (c) $\text{Ba}^{2+} < \text{Na}^+ < \text{Al}^{3+}$ (d) $\text{Al}^{3+} < \text{Na}^+ < \text{Ba}^{2+}$
11. For a linear plot of $\log(x/m)$ versus $\log p$ in a Freundlich adsorption isotherm, which of the following statements is correct? (k and n are constants) [JEE M 2016]
- (a) Only $1/n$ appears as the slope.
- (b) $\log(1/n)$ appears as the intercept.
- (c) Both k and $1/n$ appear in the slope term.
- (d) $1/n$ appears as the intercept.
12. The Tyndall effect is observed only when following conditions are satisfied: [JEE M 2017]
- (i) The diameter of the dispersed particles is much smaller than the wavelength of the light used.
- (ii) The diameter of the dispersed particle is not much smaller than the wavelength of the light used.
- (iii) The refractive indices of the dispersed phase and dispersion medium are almost similar in magnitude.
- (iv) The refractive indices of the dispersed phase and dispersion medium differ greatly in magnitude.
- (a) (i) and (iv) (b) (ii) and (iv)
- (c) (i) and (iii) (d) (ii) and (iii)

Answer Key

1	2	3	4	5	6	7	8	9	10	11	12			
(b)	(a)	(d)	(a)	(b)	(a)	(c)	(c)	(d)	(c)	(a)	(b)			

SOLUTIONS

1. (b) It is zero order reaction
- [NOTE Adsorption of gas on metal surface is of zero order]
2. (a) As adsorption is an exothermic process.
 \therefore Rise in temperature will decrease adsorption (according to Le-chatelier principle).
3. (d) Enzymes are very specific biological catalysts possessing well - defined active sites
4. (a) Particle size of colloidal particle = $1\text{m}\mu$ to $100\text{m}\mu$
 (suppose $10\text{m}\mu$)
- $$V_c = \frac{4}{3}\pi r^3 = V_c = \frac{4}{3}\pi(10)^3$$
- Particle size of true solution particle = $1\text{m}\mu$
- $$V_s = \frac{4}{3}\pi(1)^3 \text{ hence now } \frac{V_c}{V_s} = 10^3$$
5. (b) When oppositely charged sols are mixed their charges are neutralised. Both sols may be partially or completely precipitated.
6. (a) According to Langmuir's Model of adsorption of a gas on a solid 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.
- $$\frac{x}{m} \propto p$$
7. (c) For a protective colloid μ lesser the value of gold number better is the protective power.
 Thus the correct order of protective power of A, B, C and D is
 $\Rightarrow (A) < (C) < (B) < (D)$
 Gold number 0.50 0.10 0.01 0.005
 Hence (c) is the correct answer

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8. (c) Adsorption is an exothermic process, hence ΔH will always be negative

9. (d) The Freundlich adsorption isotherm is mathematically represented as

$$\frac{x}{m} = kP^{1/n}$$

at high pressure $1/n = 0$. Hence, $x/m \propto P^0$

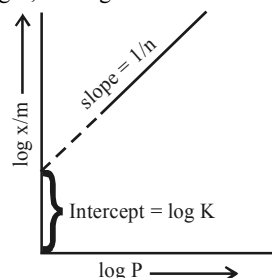
at low pressure $1/n = 1$ Hence, $x/m \propto P^1$

10. (c) According to Hardy Schulze rule, greater the charge on cation, greater is its coagulating power for negatively charged sol (As_2S_3), hence the correct order of coagulating power : $\text{Na}^+ < \text{Ba}^{2+} < \text{Al}^{3+}$

11. (a) According to Freundlich adsorption isotherm

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

Thus if a graph is plotted between $\log(x/m)$ and $\log P$, a straight line will be obtained



The slope of the line is equal to $1/n$ and the intercept on $\log x/m$ axis will correspond to $\log K$.

12. (b)