

Surface-Chemistry Assignment

- Which one of the following characteristics is not correct for physical adsorption
 - Adsorption on solids is reversible
 - Adsorption increases with increase in temperature
 - Adsorption is spontaneous
 - Both enthalpy and entropy of adsorption are negative
- Which among the following statement is false
 - The adsorption may be monolayered or multilayered
 - Particle size of adsorbent will not affect the amount of adsorption
 - Increase of pressure increases amount of adsorption
 - Increase of temperature may decrease the amount of adsorption
- Sorption is the term used when
 - Adsorption takes place
 - Absorption takes place
 - Both (a) and (b)
 - Desorption takes place
- Which one of the following statement is not correct
 - The extent of adsorption depends on the nature of the adsorbent and adsorbate
 - The extent of adsorption depends on the pressure of the gas
 - The extent of adsorption depends on the temperature
 - The extent of adsorption has no upper limit
- Which one is Freundlich's equation
 - $\frac{x}{m} = \log k + \frac{1}{n} \log P$
 - $\frac{x}{m} = \exp(-kP)$
 - $\frac{x}{m} = kP^2$
 - $\log \frac{x}{m} = \log k + \frac{1}{n} \log C$
- Which of the following statement is not correct
 - Physical adsorption is due to Vander Waal's forces
 - Chemical adsorption decreases at high temperature and low pressure
 - Physical adsorption is reversible
 - Adsorption energy for a chemical adsorption is generally greater than that of physical adsorption
- According to Langmuir adsorption isotherm, the amount of gas adsorbed at very high pressures
 - Reaches a constant limiting value
 - Goes on increasing with pressure
 - Goes on decreasing with pressure
 - Increases first and decreases later with pressure
- Point out the wrong statement
Physical adsorption is characterised by
 - Attraction due to weak Vander Waal's forces
 - Irreversible nature of adsorption
 - Multimolecular adsorption layers
 - Decrease in adsorption with increase in temperature
- The adsorption of a gas on a solid surface varies with pressure of the gas in which of the following manner
 - Fast \rightarrow slow \rightarrow independent of the pressure
 - Slow \rightarrow fast \rightarrow independent of the pressure
 - Independent of the pressure \rightarrow fast \rightarrow slow
 - Independent of the pressure \rightarrow slow \rightarrow fast
- For the adsorption of a gas on a solid, the plot of $\log(x/m)$ versus $\log P$ is linear with slope equal to
 - k
 - $\log k$
 - n
 - $1/n$
- In Freundlich adsorption isotherm, adsorption is proportional to pressure P as
 - P^0
 - P
 - P^n
 - $P^{1/n}$
- Assertion (A)** : Physical adsorption of molecules takes place on surface only
Reason (R) : In this process, the bonds of the absorbed molecules are broken
 - Both the A and the R are true and R is a correct explanation of A
 - Both the A and the R are true but R is not a correct explanation of A
 - A is true but R is false
 - Both A and R are false
 - A is false but R is true
- 50 mL of 1 M oxalic acid (molar mass = 126) is shaken with 0.5 g of wood charcoal. The final concentration of the solution after adsorption is 0.5 M. What is the amount of oxalic acid adsorbed per g of carbon
 - 3.15
 - 1.575
 - 6.30
 - 12.60

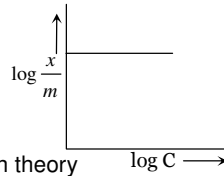
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14. For the adsorption of solution on a solid surface $\frac{x}{m} = kC^{1/n}$.

Adsorption isotherm of $\log\left(\frac{x}{m}\right)$ and $\log C$ was found of the type (Fig. 13.15)

This is when

- (a) $C = 0$
- (b) $C = 1 M$
- (c) $C = \text{constant}$
- (d) $C = 2 M$



15. Following are the events taking place to explain adsorption theory

I : Desorption

III : Adsorption of the reactants

These events are taking place in the following order

- (a) I, II, III, IV
- (b) III, II, IV, I

II : Diffusion of the reactants along the surface

IV : Formation of the activated surface complex

- (c) III, IV, I, II

- (d) IV, III, II, I

16. Modern theory of heterogeneous catalysis is

- (a) Intermediate compound formation theory
- (b) Adsorption theory
- (c) A combination of two theories, i.e., intermediate compound formation and adsorption theory
- (a) None of these

17. There are certain properties related to physical adsorption

I : Reversible

II : Formation of unimolecular layer

III : Low heat of adsorption

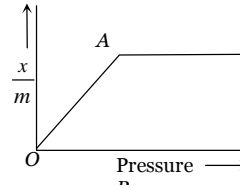
IV : Occurs at low temperature and decreases with increasing temperature

Which of the above properties are for physical adsorption

- (a) I, II, III
- (b) I, III, IV
- (c) II, III, IV
- (d) I, III

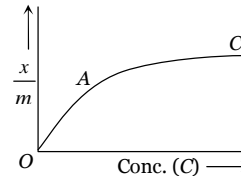
18. In the following isotherm

- (a) $\frac{x}{m} \propto p^0$ when point A is reached
- (b) Desorption may start along AB
- (c) $\frac{x}{m} \propto p^{1/n}$ along OA
- (d) All of these



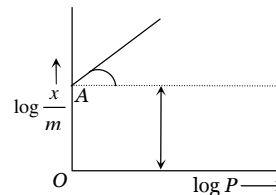
19. When saturation is attained in terms of adsorption, variation of $\left(\frac{x}{m}\right)$ and C (concentration) is given by the portion of the isotherm

- (a) OA
- (b) OB
- (c) AB
- (d) BC

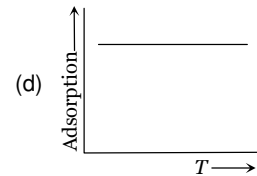
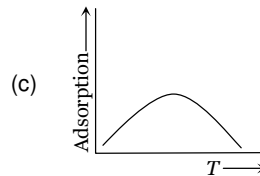
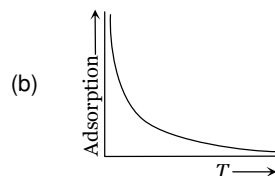
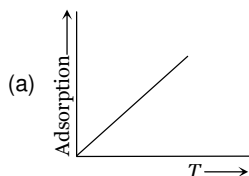


20. Graph between $\log\left(\frac{x}{m}\right)$ and $\log p$ is a straight line at angle 45° with intercept OA as shown (Figure). Hence, $\left(\frac{x}{m}\right)$ at a pressure of 0.2 atm is

- (a) 0.2
- (b) 0.4
- (c) 0.6
- (d) 0.8



21. Following is the variation of physical adsorption with temperature

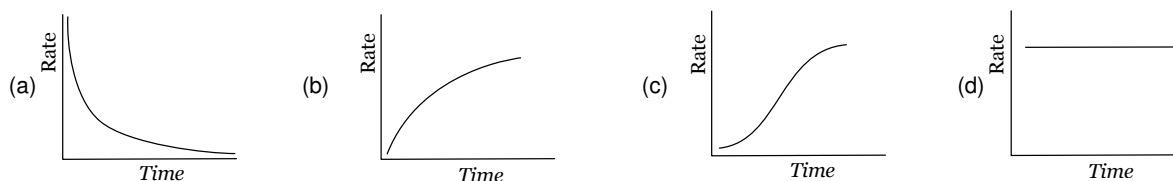


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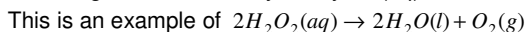
22. Which of the following kinds of catalysis can be explained by the adsorption theory
(a) Homogeneous catalysis (b) Acid base catalysis (c) Heterogeneous catalysis (d) Enzyme catalysis
23. A catalyst increases the rate of a chemical reaction by
(a) Increasing the activation energy (b) Decreasing the activation energy
(c) Reacting the reactant (d) Reacting the product
24. A catalyst can affect reversible reaction by
(a) Changing equilibrium (b) Slowing forward reaction
(c) Attaining equilibrium in both direction (d) None of these
25. Wilhem Ostwald redefined the action of
(a) Anamers (b) Isomers (c) Catalyst (d) Geometry of monomers
26. In a reversible reaction, a catalyst will affect the rate of
(a) Forward reaction (b) Reverse reaction
(c) Forward and reverse reaction (d) Neither (a) nor (b)
27. The role of a catalyst in a reversible reaction is to
(a) Increase the rate of forward reaction (b) Decrease the rate of backward reaction
(c) Alter the equilibrium constant of the reaction (d) Allow the equilibrium to be achieved quickly
28. Which of the following is less than zero during adsorption
(a) ΔG (b) ΔS (c) ΔH (d) All the above
29. Which of the following statements is true for a catalyst
(a) It increases the energy of the reactants (b) It decreases the energy of the products
(c) It decreases the energy of the reactants (d) It does not change the enthalpy of the reactants
30. Which one of the following changes when catalyst is used in a reaction
(a) Heat of reaction (b) Product of reaction (c) Equilibrium constant (d) Activation energy
31. Which one of the following statements is correct in reversible reaction. A catalyst
(a) Increases the rate of forward reaction (b) Decreases the rate of forward reaction
(c) Increases the rate of backward and forward reactions (d) Alters the equilibrium constant of the reaction
32. Which one of the following statements is incorrect in the case of heterogeneous catalysis
(a) The catalyst lowers the energy of activation (b) The catalyst actually forms a compound with the reactant
(c) The surface of the catalyst plays a very important role (d) There is no change in the energy of activation
33. Which one is *false* in the following statement
(a) A catalyst is specific in its action
(b) A very small amount of the catalyst alters the rate of a reaction
(c) The number of free valencies on the surface of the catalyst increases on subdivision
(d) *Ni* is used as catalyst in the manufacture of ammonia
34. Which of the following statements is wrong
(a) Catalysts can aid a rapid reaching of the equilibrium position, but do not change the position of the equilibrium
(b) Homogeneous catalysis generally involves an equilibrium reaction between at least one of the reactants and the catalyst
(c) Heterogeneous catalysis involves chemisorption on the surface of the catalyst
(d) Positive catalysts raise the energy of activation of the reaction they catalyse
35. Which of the following statements about a catalyst is true
(a) It lowers the energy of activation (b) The catalyst altered during the reaction is regenerated
(c) It does not alter the equilibrium (d) All of these
36. Amongst the following chemical reactions, the one representing homogeneous catalysis is
(a) $N_2(g) + 3H_2(g) \xrightarrow{Fe} 2NH_3(g)$ (b) $2SO_2(g) + O_2(g) \xrightarrow{2NO} 2SO_3(g) + 2NO(g)$
(c) $CO(g) + 3H_2(g) \xrightarrow{Ni} CH_4(g) + H_2O$ (d) $2SO_2(g) + O_2(g) \xrightarrow{V_2O_5} 2SO_3(g)$
37. According to the adsorption theory of catalysis, the speed of the reaction increases because
(a) Adsorption lowers the activation energy of the reaction
(b) The concentration of reactant molecules at the active centres of the catalyst becomes high due to adsorption
(c) In the process of adsorption, the activation energy of the molecules becomes large
(d) Adsorption produces heat which increases the speed of the reaction

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38. When MnO_4^- is added to oxalic acid rate of the reaction with time (oxidation of MnO_4^- by oxalic acid) may follow graph



39. Following reaction is catalysed by $Br^-(aq)$



- (a) Homogeneous catalysis (b) Heterogeneous catalysis (c) Both (a) and (b) (d) None of these

40. Graph between $\log \frac{x}{m}$ and $\log P$ is a straight line inclined at an angle $\theta = 45^\circ$. When pressure is 0.5 atm and $\log k = 0.699$,

the amount of solute adsorbed per g of adsorbent will be

- (a) 1 g/g adsorbent (b) 1.5 g/g adsorbent (c) 2.5 g/g adsorbent (d) 0.25 g/g adsorbent

41. A vessel has already been exhausted as far as possible by a vacuum pump, then bulb of charcoal cooled in liquid air is connected to this vessel. This results in

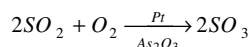
- (a) Increase in the pressure in vessel (b) A very high vacuum
(c) An increase in the temperature in vessel (d) No change

42. In the redox reaction, $2MnO_4^- + 5C_2O_4^{2-} + 16H^+ \rightleftharpoons 2Mn^{2+} + 10CO_2 + 8H_2O$

The ion acting as autocatalyst is

- (a) MnO_4^- (b) $C_2O_4^{2-}$ (c) H^+ (d) Mn^{2+}

43. Platinised asbestos helps in the formation of SO_3 from SO_2 and O_2 . But, if even a small amount of As_2O_3 is present the platinised asbestos does not help in the formation of SO_3 . As_2O_3 acts here as

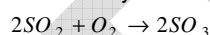


- (a) A positive catalyst (b) A negative catalyst (c) An autocatalyst (d) A poison

44. Hydrolysis of ester ($RCOOR'$) is slow initially but becomes fast as reaction proceeds. It is due to formation of which catalyses the reaction

- (a) H_2O (b) $RCOOH$ (c) $R'OH$ (d) $RCOO^-$

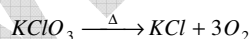
45. In lead-chamber process, NO is the catalyst



Formation of the intermediate is indicated by

- (a) Brown coloured vapour (b) Green coloured vapour
(c) Light yellow coloured vapour (d) Violet coloured vapour

46. Following reaction is catalysed by MnO_2



If reaction mixture is plunged into water at the intermediate stage, sometime solution appears green. This indicates the formation of the intermediate

- (a) KCl (b) $KMnO_4$ (c) K_2MnO_4 (d) $K_2Mn_2O_7$

47. Organic catalysts differ from inorganic catalysts

- (a) By acting at very high temperature (b) By acting at low temperature
(c) Being used up (d) Being proteinous in nature

48. Enzymes are

- (a) Substances made by chemists to activate washing powder (b) Very active vegetable catalysts
(c) Catalysts found in organism (d) Synthetic catalysts

49. Enzymes with two sites are called

- (a) Apoenzyme (b) Holoenzyme (c) Allosteric enzyme (d) Conjugate enzyme

50. Following are the terms about activity and selectivity

I : Activity is the ability of catalysts to accelerate chemical reactions and selectivity is the ability of catalysts to direct reaction to yield particular products

II : Activity is the ability of catalysts to direct reaction to yield particular products and selectivity is the ability of catalysts to accelerate chemical reactions.

Select correct term :

- (a) I (b) II (c) I and II both (d) None of these