CBSE Test Paper-05

Class - 12 Chemistry (Surface Chemistry)

1. Which among the following is an example of homogenous catalyst?
   a. CH_2=CH_2 + H_2 $\xrightarrow{Ni}$ CH_3CH_3
   b. 2NO $\xrightarrow{Au}$ $2N_2$ + O_2
   c. $2SO_2$(g) + O_2(g) $\xrightarrow{NO(g)}$ $2SO_3$(g)
   d. $N_{2(g)}$ + $3H_2$(g) $\xrightarrow{Fe(s)}$ $2NH_3$(g)
2. Catalyst used in hydrogenation of vegetable oil is
   a. Nickel
   b. Platinum
   c. Molybdenum
   d. Vanadium
3. Powdered substances are more effective adsorbents than their crystalline forms because
   a. Pressure increases
   b. Surface area increases
   c. Temperature increases
   d. All of these
4. Gelatine is often used as an ingredient in the manufacture of ice cream for
   a. Improving the flavour
   b. Causing mixture to solidify
   c. Stabilizing the colloidal system and preventing the growth of crystal
   d. Preventing formation of colloid
5. An example of autocatalysis is
   a. Decomposition of KClO3 to KCl and O_2
   b. Oxidation of NO to NO_2
   c. Oxidation of SO_2 to SO_3
   d. Oxidation of oxalic acid by acidified $KMnO_4$

6. What name is given to sol in which dispersion medium is benzene?
7. What is adsorption isotherm?
8. What is the coagulation process?
9. Distinguish between micelles and colloidal particles.
10. Indicate a chemical reaction involving a homogeneous catalyst.
11. What is sorption?
12. What are the factors which influence the adsorption of a gas on a solid?
13. Define adsorption isotherm. Describe Freundlich adsorption isotherm.
14. Write any four differences between physisorption and chemisorption.
15. Write short notes on:
    i. Brownian movement
    ii. Hardy and Schultz rule.

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Solutions

1. c. $2SO_2(g) + O_2(g) \xrightarrow{NO(g)} 2SO_3(g)$

   Explanation: Homogeneous catalysis is one in which catalyst and reactants are both in same phase.

2. a. Nickel

   Explanation: Vegetable oil is unsaturated fats which are hydrogenated by using Nickel(Ni) as catalyst.

3. b. Surface area increases

   Explanation: Both physisorption and chemisorption increases with increase in surface area of the adsorbent. Surface area can be increased by powdering the adsorbent.

4. a. Stabilizing the colloidal system and preventing the growth of crystal

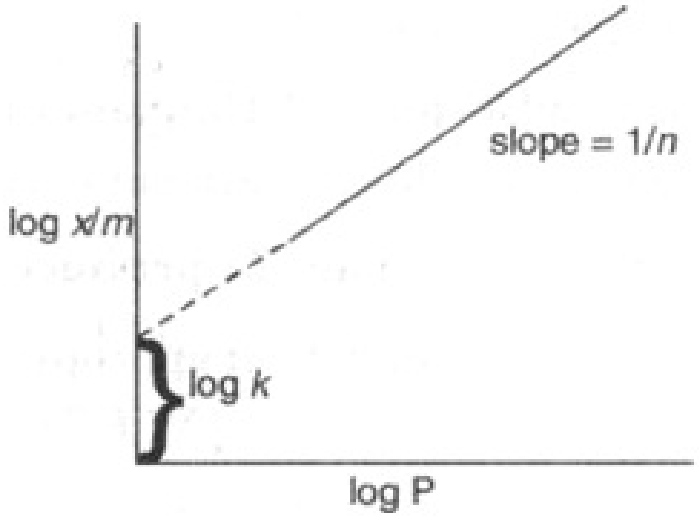
   Explanation: Gelatin is used as ingredient in manufacture of ice cream. It also gives soft texture and fresh appearance to the ice cream.

5. d. Oxidation of oxalic acid by acidified $KMnO_4$

   Explanation: Autocatalysis occurs when the product of a reaction serves as a catalyst for the reaction.

6. Benzosol
7. The variation in the amount of gas adsorbed by the adsorbent with pressure at constant temperature can be expressed by means of a curve known as adsorption isotherm.
8. The process of settling of colloidal particles is called coagulation or precipitation of the sol.
9. Micelles: When small (particles or ions) of an electrolyte or soap or detergent molecules form the aggregate particles which behave like colloidal particles, these aggregate particles are known as micelles. Examples: Soaps and detergents.
   Colloidal particles: Colloidal particles have an enormous surface area per unit mass as a result of their small size. Its size range between 1 nm to 100 nm.

10. $2SO_2(g) + O_2(g) \overset{NO(g)}{\rightleftharpoons} 2SO_3(g)$
11. Sorption is process in which adsorption and absorption takes place simultaneously, e.g. dyeing of cotton fibres by azodyes.
12. Factors which influence adsorption of gas on solid surface:
    i. **Nature of adsorbate:** Easily liquefiable gases like NH_3, HCl, CO_2 etc. are adsorbed to greater extent whereas H_2,O_2, N_2 etc. are adsorbed to lesser extent. Higher the critical temperature more will be the extent of adsorption.
    ii. **Nature of adsorbent:** Activated carbon, metal oxides, silica gel are commonly used adsorbents. They have their specific properties depending upon pores.
    iii. **Surface areas of the adsorbent:** The greater the specific area, more will be the extent of adsorption that is why porous or finely divided forms of adsorbents adsorbs larger quantities of adsorbate.
    iv. **Pressure of gas:** Physical adsorption increases with increase in pressure.
13. Adsorption isotherm corresponds to a curve which reflects the variation in the amount of gas adsorbed by the adsorbent with pressure at constant temperature.
    Freundlich adsorption isotherm: It is an empirical relationship between the quantity of gas adsorbed by unit mass of solid adsorbent and pressure at a particular temperature.
    $\frac{x}{m} = kP^{\frac{1}{n}} (n > 1) \, or \, \log \frac{x}{m} = \log k + \frac{1}{n} \log P$
    where x is the mass of the gas adsorbed on mass m of the adsorbent at pressure P, k and n are constants which depend on the nature of the adsorbent and the gas at a particular temperature.



14.

Physical Adsorption	Chemical Adsorption
1. It is caused by Vander Waal's forces formation.	1. It is caused by chemical bond formation.
2. It is not very specific in nature.	2. It is highly specific in nature.
3. It is reversible in nature.	3. It is irreversible in nature.
4. Enthalpy of adsorption quite low (20-40 kJ/mol)	4. Enthalpy of adsorption is high (> 40 kJ/mol).

15. i. Brownian movement: When colloidal solution are viewed under the powerful microscope, the colloidal particles are seen to be in constant motion in zig-zag path. This zig-zag motion of dispersed phase particles is known as Brownian movement. This zig-zag movement is supposed to be due to the unequal bombardment of the colloidal particles by the molecules of dispersion medium.
    Importance:
    a. With the help of Brownian movement Avogadro's number can be calculated.
    b. It gives the direct demonstration of ceaseless motion of molecules as shown by kinetic theory.
    c. Due to Brownian movement, colloidal particle do not settle down under the influence of gravity, hence it is responsible for the stability of colloidal solution.

    ii. Hardy and Schultz rule: For the coagulation of sol, different electrolytes may be added to the colloidal solution. Different electrolytes have different coagulation values. Hardy and Schultz rule tells us about the effectiveness of an electrolyte which is used for coagulation. According to it, greater the valency of the active ion, greater will be the power to cause coagulation.
    Active ion is responsible for coagulation, it has the charge opposite to the charge present on sol. Thus, in case of the coagulation of positively charged sol, the coagulation power of anion in the order of as:
    $[Fe(CN)_6]^{4-} > PO_4^{3-} > SO_4^{2-} > Cl^-$