One Two academy | Surface Chemistry

Maximum Mark: 25 **Chemistry** **Time: 50 minutes**

Choose the correct answer: **3 x 1 = 3**

1. Which one of the following is an example for homogeneous catalysis?
   a) manufacture of ammonia by Haber's process
   b) manufacture of sulphuric acid by contact process
   c) hydrogenation of oil
   d) Hydrolysis of sucrose in presence of dil HCl
2. When $\Delta S < 0$ and $T\Delta S$ is negative.
   a) adsorption is exothermic b) absorption is exothermic
   c) adsorption is endothermic d) absorption is endothermic
3. The change of W/O emulsion into O/W emulsion is called ____.
   a) Coagulation b) Emulsification
   c) Decomposition d) Inversion of phase

Answer Any four of the following: **4 x 2 = 8**

4. What is the difference between a sol and a gel?
5. Why does bleeding stop by rubbing moist alum?
6. What is the difference between homogeneous and heterogeneous catalysis?
7. Give three uses of emulsions.
8. What is flocculation value?

Answer any three of the following: **3 x 3 = 9**

9. Write a note on electro osmosis.
10. Differentiate physisorption and chemisorption
11. Write the general characteristics of catalysts.
12. How are colloids used in tanning of leather and in rubber industry?

Answer the following: **1 x 5 = 5**

13. a) Describe adsorption theory of catalysis.

(Or)

b) i) Explain electro dialysis with a neat, labelled diagram.
ii) Heat of adsorption is greater for chemisorptions than physisorption. Why?

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All the Best

Answer Key attached in the next page !!!

This page is to prevent seeing answer key

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Answer Key

Choose the Correct answer:

1. – d) 2. – a) 3. - d)

Answer any four of the following:

4. **Sol:** A sol is a type of colloid in which solid is the dispersed phase and liquid is the dispersion medium Ex. Ink, Paints.
   Gel: A gel is a type of colloid in which liquid is the dispersed phase and solid is the dispersion medium. Ex. Cheese, butter.
5. Blood is a colloidal solution of an albuminoid substance. The styptic action of alum is done due to coagulation of blood forming a clot which stops further bleeding.
6.

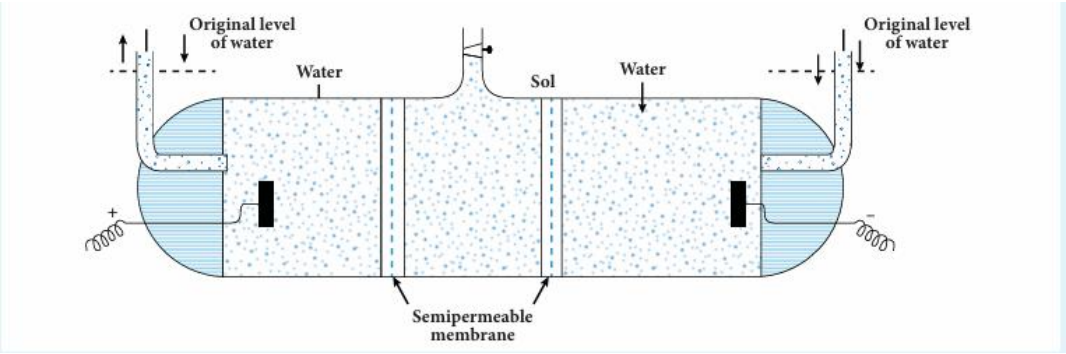
Homogeneous catalysis	Heterogeneous catalysis
In a homogeneous catalysed reaction, the reactants, products and catalyst are present in the same phase.	In a heterogenous catalysis, the catalyst is present in a different phase i.e. it is not present in the same phase as that of reactants or products. This is generally referred as contact catalysis
$2SO_{2(g)}+O_{2(g)}+[NO]_{(g)} \rightarrow 2SO_{3(g)}+[NO]_{(g)}$ In this reaction the catalyst NO, reactants, SO_2 and O_2 and product, SO_3 are present in the gaseous form.	$2SO_{2(g)}+O_{2(g)} \xrightarrow{Pt_{(s)} \text{ or } V_2O_{5(s)}} 2SO_{3(g)}$ In this reaction the catalyst (Pt) is in solid phase, whereas the reactants and the product are in gaseous phase

7. **Uses of emulsions:**
   a. It is used in the making of medicines
   b. Cleansing action of soap is based on emulsion formation.
   c. Antiseptic and disinfectant added to water form emulsion for cleaning
8. **Flocculation value:** The precipitation power of electrolyte is determined by finding the minimum concentration (millimoles/lit) required to cause precipitation of a sol in 2hours. This value is called flocculation value. The smaller the flocculation value greater will be precipitation.

Answer any three of the following:

9. **Electro osmosis:**

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A sol is electrically neutral. Hence the medium carries an equal but opposite charge to that of dispersed particles. When sol particles are prevented from moving, under the influence of electric field the medium moves in a direction opposite to that of the sol particles. This movement of dispersion medium under the influence of electric potential is called electro osmosis

10.

Chemical adsorption or Chemisorption or Activated adsorption	**Physical adsorption or van der waals adsorption or Physisorption**
1. It is very slow	1. It is instantaneous
2. It is very specific depends on nature of adsorbent and adsorbate.	2. It is non-specific
3. Chemical adsorption is fast with increased pressure, it cannot alter the amount.	3. In Physisorption, when pressure increases the extent of adsorption increases.
4. When temperature is raised chemisorption first increases and then decreases.	4. Physisorption decreases with increase in temperature.
5. Chemisorption involves transfer of electrons between the adsorbent and adsorbate.	5. No transfer of electrons
6. Heat of adsorption is high i.e., from 40 400kJ/mole.	6. Heat of adsorption is low in the order of 40kJ/mole.
7. Monolayer of the adsorbate is formed.	7. Multilayer of the adsorbate is formed on the adsorbent.
8. Adsorption occurs at fixed sites called active centres. It depends on surface area	8. It occurs on all sides.
9. Chemisorption involves the formation of activated complex with appreciable activation energy.	9. Activation energy is insignificant.

11. **Characteristics of catalysts:**

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- For a chemical reaction, catalyst is needed in very small quantity. Generally, a pinch of catalyst is enough for a reaction in bulk.
- There may be some physical changes, but the catalyst remains unchanged in mass and chemical composition in a chemical reaction.
- A catalyst itself cannot initiate a reaction. It means it cannot start a reaction which is not taking place. But, if the reaction is taking place in a slow rate it can increase its rate.
- A solid catalyst will be more effective if it is taken in a finely divided form.
- A catalyst can catalyse a particular type of reaction, hence they are said to be specific in nature.
- In an equilibrium reaction, presence of catalyst reduces the time for attainment of equilibrium and hence it does not affect the position of equilibrium and the value of equilibrium constant.
- A catalyst is highly effective at a particular temperature called as optimum temperature.
- Presence of a catalyst generally does not change the nature of products
  For example. $2SO_2+O_2 \rightarrow 2SO_3$
  This reaction is slow in the absence of a catalyst, but fast in the presence of Pt catalyst

12. **Tanning of leather and rubber:**
    Skin and hides are protein containing positively charged particles which are coagulated by adding tannin to give hardened leather for further application. Chromium salts are used for the purpose. Chrome tanning can produce soft and polishable leather.
    Latex is the emulsion of natural rubber with negative particles. By heating rubber with sulphur, vulcanized rubbers are produced for tyres, tubes, etc.

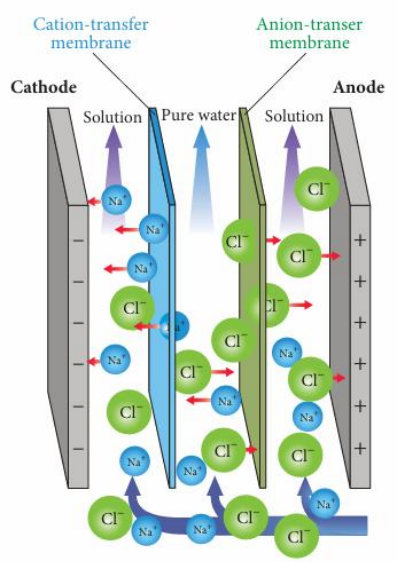
Answer the following:

4. a) **Adsorption theory**:
    Langmuir explained the action of catalyst in heterogeneous catalysed reactions based on adsorption. The reactant molecules are adsorbed on the catalyst surfaces, so this can also be called as contact catalysis.
    According to this theory, the reactants are adsorbed on the catalyst surface to form an activated complex which subsequently decomposes and gives the product.
    The various steps involved in a heterogeneous catalysed reaction are given as follows:
    1. Reactant molecules diffuse from bulk to the catalyst surface.
    2. The reactant molecules are adsorbed on the surface of the catalyst.
    3. The adsorbed reactant molecules are activated and form activated complex which is decomposed to form the products.
    4. The product molecules are desorbed.
    5. The product diffuse away from the surface of the catalyst.

(OR)

b) i) **Electro dialysis:**

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The presence of electric field increases the speed of removal of electrolytes from colloidal solution. The colloidal solution containing an electrolyte as impurity is placed between two dialysing membranes enclosed into two compartments filled with water. When current is passed, the impurities pass into water compartment and get removed periodically. This process is faster than dialysis, as the rate of diffusion of electrolytes is increased by the application of electricity.

ii) In chemical adsorption, gas molecules are held to the surface by formation of chemical bonds and hence heat of adsorption is high.
In physical adsorption, physical forces such as van der waals force of attraction, dipole - dipole interaction, dispersion forces etc., exist between adsorbent and adsorbate and hence heat of adsorption is low.

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