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CLASS 12 - CHEMISTRY

Q: 1 The experimental data for the reaction $2A + B_2 \rightarrow 2AB$ is as follows:

Expt. No.	[A] (mol L^{-1})	[B_2] (mol L^{-1})	Rate (mol L^{-1} s^{-1})
1	0.50	0.50	1.6×10^{-4}
2	0.50	1.00	3.2×10^{-4}
3	1.00	1.00	3.2×10^{-4}

Write the most probable equation for the rate of reaction giving reason for your answer. Write down the rate law for the reaction.

Q: 2 For the reaction: 2NO + Cl2 → 2NOCl at 300 K following data are obtained.

Expt. No.	Initial concentration		Initial rates
	[NO]	[Cl_2]	
1	0.010	0.010	1.2×10^{-4}
2	0.010	0.020	2.4×10^{-4}
3	0.020	0.020	9.6×10^{-4}

Write rate of law for the reaction. What is the order of the reaction? Also calculate the specific rate constant. .

Q:3 For the hypothetical reaction $2A + B \rightarrow$ products the following data are obtained.

Expt. No.	Initial concentration (mol $L^{-1)}$		Initial reaction rates (mol $L^{-1}min^{-1}$)
	[A]	[B]	
1	0.10	0.20	3×102
2	0.30	0.40	3.6×103
3	0.30	0.80	1.44×104
4	0.10	0.40	
5	0.20	0.60	
6	0.30	1.20	

Find out how the rate of the ration depends upon the concentration of A and B and fill in the blanks.

Q: 4 The rate law for the reaction, $2Cl_2O \rightarrow 2Cl_2 + O_2$ at 200oC is found to be : rate = $k[Cl_2O]^2$
(a) How would the rate change if $[Cl_2O]$ is reduced to one-third of its original value?
(b) How should the $[Cl_2O]$ be changed in order to double the rate?
(c) How would the rate change if $[Cl_2O]$ is raised to threefold of its original value?

Q: 5 For a reaction in which A and B from C, the following data were obtained from three experiments:

Expt. No.	Initial concentration (mol L^{-1})		Initial reaction rates (mol $L^{-1}s^{-1}$)
	[A]	[B]	
1	0.03	0.03	0.3×10^{-4}
2	0.06	0.06	1.2×10^{-4}
3	0.06	0.09	2.7×10^{-4}

What is the rate equation of the reaction and what is the value of rate constant?

Q: 6 For a first order reaction when log k was plotted against, a straight 1/T line with a slope of -6000 was obtained. Calculate the activation energy of the reaction

Q: 7 For a reaction, the energy of activation is zero. What is the value of rate constant at 300 K if k = 1.6 × 106 s^{-1} at 280 K? (R = 8.31 J K^{-1} mol^{-1})

Q: 8 The time required for 10% completion of first order reaction at 298 K is equal to that required for its 25% completion at 308K. If the pre-exponential factor for the reaction is 3.56 x 10^9 s^{-1}, calculate the energy of activation

Q: 9 At 380°C, the half-life period for the first order decomposition of H_2O_2 is 360 min. the energy of activation of the reaction is 200 kJ mol^{-1}, Calculate the time required for 75% decomposition at 450°C.

Q: 10 For Adsorption of a gas on a solid, the plot of log x/m vs. log p is linear with slope equal to (n being whole number)

a. K b. log K c. n d. 1/n

Q: 11 Which of the following statements regarding the physical adsorption of a gas on surface of a solid is not correct?

a. On increasing temperature, adsorption increases continuously.

b. Enthalpy changes are negative.

c. Adsorption is more for some specific substances.

d. It is reversible in nature.

Q: 12 Which of the following is not characteristic of chemisorptions?

a. It is irreversible.

b. It is specific

c. It is multilayer phenomenon

d. Heat of adsorption is about 400 kj

Q:13 Rate of physisorption increases with

a. decrease in temperature

b. increase in temperature

c. decrease in pressure

d. decrease in surface area

Q:14 For the coagulation of 100 mL of arsenious sulphide sol, 5 ml of 1 M NaCl is required. What is the flocculation value of NaCl?

Q:15 Which of the following electrolytes is most effective coagulating agent for Sb_2S_3?

a. Na_2SO_4 b. $CaCl_2$ c. $Al_2(SO_4)_3$ d. NH_4Cl

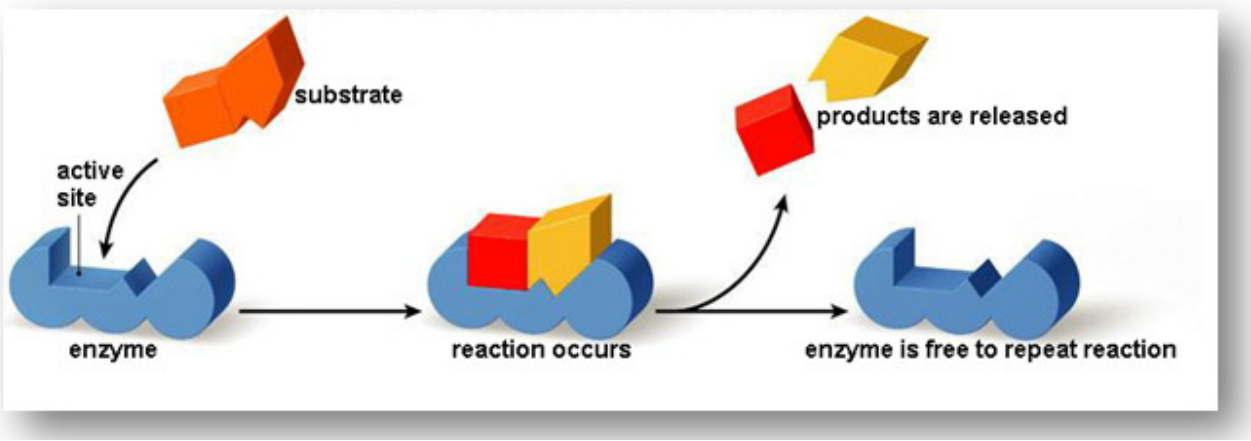
Q:16 Explain the mechanism of enzyme catalysis.

Solution: Two models of enzyme action have been proposed.

- Lock and key hypothesis
- Induced fit hypothesis

According to the lock-and-key model, when the 'key (substrate) fits the 'lock' (active site), the chemical change begins. Lock and key model for enzymatic catalysis was first postulated in 1894 by Emil Fischer.

The lock and key theory can be explained easily by the fact that a particular lock can be opened by a particular key specially designed to open it. Similarly enzymes have specific sites where a particular substrate can only be attached. The lock and key model accounts for enzyme specificity



However, modern X-ray crystallographic and spectroscopic methods show that in many cases, the enzyme changes shape when the substrate lands at the active site. This induced-fit model of enzyme action pictures the substrate inducing the active site to adopt a perfect fit, rather than a

rigidly shaped lock and key. Therefore, we might picture a hand in a glove, in which the 'glove' (active site) does not attain its functional shape until the 'hand' (substrate) moves into place.

The kinetic of enzyme catalysis has many features in common with ordinary catalysis. In the enzyme catalyzed reaction, substrate (S) and enzyme (E) form an intermediate enzyme-substrate complex (ES) whose concentration determines the rate of product (P) formation. The steps common to virtually all enzyme catalyzed reactions are:

$(1)\ E + S \rightleftharpoons ES\ (Fast\ \ Reversible)$

$(2)\ ES \rightarrow E + P\ (Slow\ \ Rate\ determining)$

The rate of enzyme catalyzed reaction changes from first-order to zero-order as the concentration of substrate is increased.

The induced fit model assumes that the substrate plays a role in determining the final shape of the enzyme and that the enzymes are partially flexible. This explains why certain compounds can bind to the enzyme but do not react because the enzyme has been distorted too much. Other molecules may be too small to induce the proper alignment and therefore cannot react. Only the proper substrate is capable of inducing the proper alignment of the active site.

Q:17 Among the following, the surfactant that will form micelles in aqueous solution at lowest molar concentration at ambient condition is-

a. $CH_3(CH_2)_{15}N(CH_3)_3Br$

b. $CH_3(CH_2)_{11}OSO_3Na$

c. $CH_3(CH_2)_6COONa$

d. $CH_3(CH_2)_{11}N(CH_3)_3Br$

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