

D. B. College (Jaynagar)

Lect - 25

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Ex. 24 The rate of chemical reaction (except zero order)

(A) decreases from moment to moment

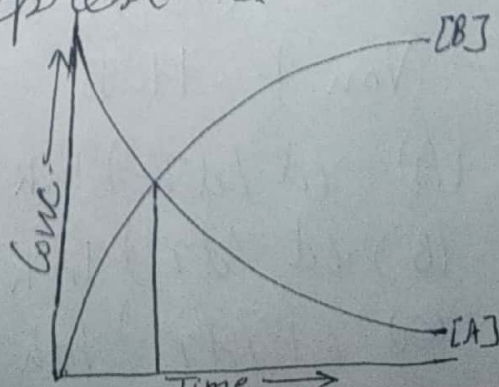
(B) remains constant throughout

(C) depends upon the order of reaction

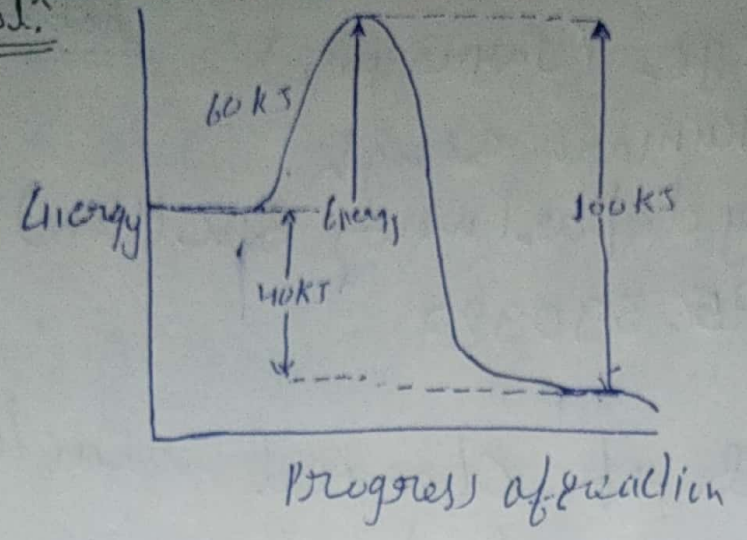
(D) none of the above

Sol.ⁿ (A) and (C)

Ex. 25 The accompanying figure depicts the change in concentration of species A and B for the reaction $A \rightarrow B$, as a function of time. The point of intersection of the two curves represents



Sol.



Activation energy for backward reaction = ~~160~~
= 100 kJ

Hence, (D) is the correct answer.

Ex. 92 The rate of reaction is doubled for every 10 rise in temperature. The increase in reaction rate as a result of temperature rise from 10 to 100 is.

- (A) 112 (B) 512 (C) 400 (D) 614

Sol. Increase in steps of 10 has been made 9 times. Hence, rate of reaction should increase 2^9 times i.e., 512 times.

Hence, (B) is the correct answer.

Ex. 93 'Van't Hoff' equation is

(A) $(d/dT) \ln k = (-\Delta E/RT^2)$
 (B) $(d/dT) \ln k = +(\Delta E/RT^2)$
 (C) $(d/dT) \ln k = -(\Delta E/RT)$

(D) $k = Ae^{-E_a/R}$
Sol. (B) and (D)

Other things being equal?

Sol.ⁿ $k = Ae^{\frac{-E_a}{RT}}$, $k_1 = Ae^{\frac{-100}{RT}}$, $k_2 = Ae^{\frac{-25}{RT}}$

$$\therefore \frac{k_1}{k_2} = \frac{e^{\frac{-100}{RT}}}{e^{\frac{-25}{RT}}} = e^{\frac{-75}{RT}}$$

$$\log_e \frac{k_2}{k_1} = \log_e e^{\frac{75}{RT}}$$

$$\therefore \log \frac{k_2}{k_1} = \frac{75}{RT} = \frac{75 \times 10^3}{8.314 \times 298}$$

$$\frac{k_2}{k_1} = 1.4020 \times 10^{13}, \text{ As } r = k(\text{conc})^n$$

$$\frac{r_2}{r_1} = \frac{k_2}{k_1} = 1.4020 \times 10^{13}$$

Ex. 3 Show that for a first order reaction, time required for 99% completion is twice for the time required for the completion of 90% of the reaction.

Sol.ⁿ $t_{99\%} = \frac{2.303}{k} \log_{10} \frac{100}{100-99}$ ————— (1)

$$t_{90\%} = \frac{2.303}{k} \log_{10} \frac{100}{100-90} \quad (\because a=100; x=99) \quad \text{--- (2)}$$

$(\because a=100; x=90)$
 \therefore By Eqs. (1) and (2),
 $\frac{t_{99\%}}{t_{90\%}} = \frac{\log_{10} 100}{\log_{10} 10} = 2 \quad \therefore t_{99\%} = 2 t_{90\%}$

[A] $t_{1/2}$

[B] $t_{3/4}$

[C] $t_{2/3}$

[D] data insufficient to predict

Sol.ⁿ The intersection point indicates that half-life of the reactant A is converted into B.

Hence the answer is [A]

SUBJECTIVE PROBLEMS

Ex-1 For the non-equilibrium process, $A + B \rightarrow$ Products, the rate is first order with respect to A and second order with respect to B. If 1.0 mol each of A and B are introduced into a 1 litre vessel, and the initial rate were 1.0×10^{-2} mol/litre sec, calculate the rate when half of the reactants have been used.

Sol.ⁿ

$$\text{Rate}_I = k[A][B]^2$$

$$\therefore 10^{-2} = k[1][1]^2$$

$$\text{or } k = 10^{-2} \text{ litre}^2 \text{ mol}^{-2} \text{ sec}^{-1}$$

$$\text{Now Rate}_{II} = 10^{-2} \times 0.5 (0.5)^2$$

$$\text{or } \text{New rate} = 1.2 \times 10^{-3} \text{ mol/litre-sec}$$

Ex-2 The energy of activation for a certain reaction is 100 kJ/mol. Presence of catalyst lowers the energy of activation by 75%. What will be effect on rate of reaction at 25°C,