

D. B. College (Jaynagar) Lect - 22

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Ex-10 The inversion of Cane sugar proceeds with half-life of 250 minutes at pH = 4 for any concentration of sugar. However, if pH = 5, the half-life changes to 25 minutes. The rate law expression for the sugar inversion can be written as

$$(A) \text{Rate} = k [\text{sugar}]^2 [H^+]^6 \quad (B) \text{Rate} = k [\text{sugar}]^2 [H^+]^6$$

$$(C) \text{Rate} = k [\text{sugar}]^2 [H^+]^2 \quad (D) \text{Rate} = k [\text{sugar}]^0 [H^+]^2$$

Sol: At pH = 4, the half-life is 250 minutes for all concentrations of sugar that is $t_{1/2} \propto [\text{sugar}]^0$.

The reaction is first order with respect to sugar.

$$\text{Let, Rate} = k [\text{sugar}]^x [H^+]^x$$

$$\text{For } [H^+] t_{1/2} \propto [H^+]^{1-x}$$

$$\Rightarrow 250 \propto (10^{-4})^{(1-x)}$$

At pH = 5, the half-life is 25 minutes so so
 $\propto (10^{-5})^{1-x}$ —— (2)

$$\therefore 10 = 10^{(1-x)} \Rightarrow (1-x) \ln 10 = 0$$

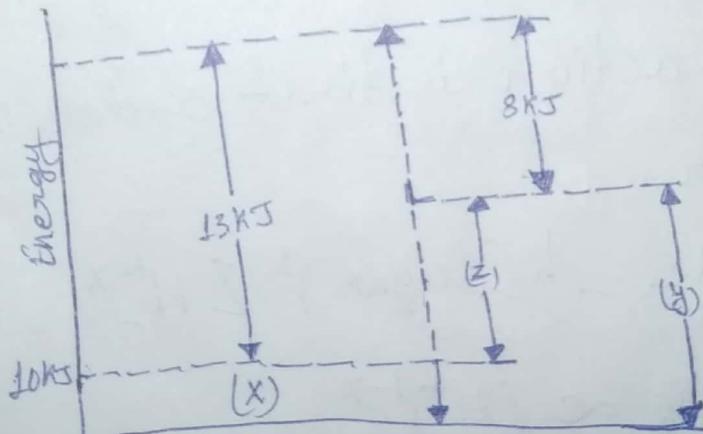
Therefore, rate = $k [\text{sugar}]^{\frac{1}{2}} [\text{H}^+]^0$

Hence, (B) is the correct answer.

Ex. 11 In a hypothetical reaction $X \rightarrow Y$, the activation energies for the forward and backward reactions are 13 and 8 kJ/mol respectively. The potential energy of X is 10 kJ/mol, then

- (A) the threshold energy of the reaction is 23 kJ/mol
- (B) Potential energy of Y is +5 kJ
- (C) heat of reaction is 5 kJ
- (D) the reaction is endothermic

Sol.



Hence, (A), (B), (C), and (D) are correct answers

Ex. 12 The reactions, $\text{CH}_3\text{COOC}_2\text{H}_5 + \text{NaOH} \rightarrow \text{CH}_3\text{COONa} + \text{C}_2\text{H}_5\text{OH}$, is

- (A) biomolecular reaction (B) second order reaction
(C) third order reaction (D) none of the above

Sol. (A) and (B)

Ex. 13 The activation energies of the reactions are E_a and E'_a with $E'_a > E_a$. If the temperature of the reacting systems is increased from T_1 and T_2 predict which alternative is correct. k_1' and k_2' are rate constants at higher temperature. Assume A being the same for both the reactions.

$$(A) \frac{k_1'}{k_1} = \frac{k_2'}{k_2} \quad (B) k_1' < k_2 \text{ and } k_1' < k_2' \quad (C) k_1' > k_2 \text{ and } k_1' > k_2'$$

$$(D) \frac{k_1'}{k_1} < \frac{2k_2'}{k_2}$$

Sol. More is energy of activation lesser is rate constant.

$$k = Ae^{-E_a/RT}$$

$$k_1' < k_2 \text{ and } k_1' < k_2'$$

Hence, (B) is the correct answer.