D.B. College (Jaynagar) Lecture-15
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Ex.3 The term $\frac{dx}{dt}$ in the rate expression refers to the -

[A] Concentration of the reactants

[B] increase in Concentration of the reactants

[C] instantaneous rate of the reaction

[D] average rate of the reaction.

Soln [C]

It is expression for instantaneous rate.

Ex.4 which of the following expression can be used to describe the Intantaneous rate of the reaction? $2A + B \longrightarrow A_2B$

[A] $-\frac{1}{2}\frac{d[A]}{dt}$ [B] $-\frac{d[A]}{dt}$ [C] $\frac{1}{2}\frac{d[A_2B]}{dt}$ [D] $-\frac{1}{2}\frac{d[A]}{dt}\cdot\frac{d[B]}{dt}$

Soln [A]

The instantaneous rate of the reaction can

be expressed by any of the following expressions $-\frac{1}{2}\frac{d[A]}{dt}$ or $-\frac{d[B]}{dt}$ or $\frac{d[A_2B]}{dt}$

EX.5 Which of the following will react at the highest rate?

[A] 1 mol of A and 1 mol of B in a 1 L vessel

[B] 2 mol of A and 2 mol of B in a 2 L vessel

[C] 3 mol of A and 3 mol of B in a 3 L vessel

[D] All would react at the same rate

Soln [D]

Since all have same Conc. of reactants, all would react at same rate.

5. FACTORS AFFECTING THE RATE OF REACTION

(i) Concentration: Law of mass action enunciates that greater is the Conc. of the reactants, the more rapidly the reaction Proceeds

(ii) Pressure (Gaseous reaction): on increasing the Pressure, volume decreases and Conc. increases and hence the rate increases.

(iii) Temperature: It is generally observed

that rise in temperature increases the reaction rate.

(iv) Nature of the reactants: The rate depends upon specific bonds involved and hence on the nature of reactants.

$g > l > s$

(v) Surface area of reactants: In heterogeneous reactions, more powdered is the form of reactants, more is the velocity. [as more active centres are provided]

(vi) Catalyst: Affects the rate immensely.

Ex.6 For the reaction:

$$4NH_3(g) + 5O_2(g) \longrightarrow 4NO(g) + 6H_2O(g)$$

Given: $\frac{d[NO]}{dt} = 3.6 \quad 10^{-3} \text{ mol } L^{-1} s^{-1}$

Calculate: (i) rate of disappearance of ammonia

(ii) rate of formation of water

Sol: From the eqn. it is clear that

$$\text{Rate} = -\frac{1}{4}\frac{d[NH_3]}{dt} = \frac{1}{4}\frac{d[NO]}{dt} = \frac{1}{6}\frac{d[H_2O]}{dt}$$ Thus $-\frac{1}{4}\frac{d[NH_3]}{dt}$

$$= \frac{1}{4}\frac{d[NO]}{dt}$$

Or, $-\frac{d[NH_3]}{dt} = \frac{d[NO]}{dt} = 3.6\ 10^{-3}\ mol\,L^{-1}s^{-1}$ Also $\frac{1}{4}\frac{d[NO]}{dt} = \frac{1}{6}\frac{d[H_2O]}{dt}$

$$\frac{3}{2}\frac{d[NO]}{dt} = \frac{d[H_2O]}{dt}$$

$$\frac{3}{2}\ 3.6\ 10^{-3} = \frac{d[H_2O]}{dt}$$

$$\frac{d[H_2]}{dt} = 5.4\ 10^{-3}\ mol\,L^{-1}\,s^{-1}$$