Question

The decomposition of N_2O_5 in CCl_4 at 318K has been studied by monitoring the concentration of N_2O_5 in the solution. Initially the concentration of N_2O_5 is 2.33 mol L^{-1} and after 184 min, it is reduced to 2.08 mol L^{-1}. The reaction takes place according to the equation:

$$2N_2O_5(g) \rightarrow 4NO_2(g) + O_2(g)$$

Calculate the average rate of this reaction in terms of hours, minutes and seconds. What is the rate of production of NO_2 during this period?

Ans:

i) Average rate $= \frac{1}{2}\left(-\frac{\Delta[N_2O_5]}{t}\right)$

$= \frac{1}{2}\left(-\frac{(2.08 - 2.33)\ mol\ L^{-1}}{184\ min}\right)$

$= 6.79 \times 10^{-4}\ \frac{mol}{L\ min}$

$= 6.79 \times 10^{-4}\ \frac{mol}{L\ 60s}$

$= 1.13 \times 10^{-5}\ \frac{mol}{L\ s}$

$= 1.13 \times 10^{-5}\ \frac{mol}{L\ \frac{1}{3600}\ h}$

$= 4.07 \times 10^{-2}\ \frac{mol}{L\ h}$

ii) Average rate $= \frac{1}{4}\left(\frac{\Delta[NO_2]}{t}\right)$

$\frac{\Delta[NO_2]}{t} = 4 \times$ Average rate

$= 4 \times 6.79 \times 10^{-4}$

$= 2.72 \times 10^{-3}\ \frac{mol}{L\ min}$

$\overline{\quad\quad}$
L min

Question

For the reaction $R \rightarrow P$, the concentration of a reactant changes from 0.03M to 0.02M in 25 min. Calculate the average rate of reaction using units of time both in minutes and seconds.

Answer

$$\text{Average rate} = -\frac{\Delta[R]}{t} = -\frac{(0.02 - 0.03)}{25\ \text{min}} \frac{\text{mol}}{L}$$

$$= 4 \times 10^{-4} \frac{\text{mol}}{L\,\text{min}}$$

$$= 4 \times 10^{-4} \frac{\text{mol}}{L\ 60s}$$

$$= 6.67 \times 10^{-6}\ \text{mol}\ L^{-1} s^{-1}$$

Question

In a reaction, $2A \rightarrow$ products, the concentration of A decreases from 0.5 mol L^{-1} to 0.4 mol L^{-1} in 10 min. Calculate the rate during this time interval.

Answer:

$$\text{Average rate} = \frac{1}{2}\left(-\frac{\Delta[A]}{t}\right)$$

$$= \frac{1}{2}\left(-\frac{(0.4 - 0.5)}{10\ \text{min}} \frac{\text{mol}}{L}\right)$$

$$= 5 \times 10^{-3}\ \text{mol}\ L^{-1}\ \text{min}^{-1}$$