From the rate expression for the following reactions determine their order of reaction and the dimensions of the rate constants:

(*i*) $3\,NO\,(g) \longrightarrow N_2O\,(g) + NO_2\,(g)$

$\text{Rate} = k\,[NO]^2$

(*ii*) $H_2O_2\,(aq) + 3I^-\,(aq) + 2H^+ \longrightarrow 2H_2O\,(\ell) + I_3^-$

$\text{Rate} = k\,[H_2O_2]\,[I^-]$

(*iii*) $CH_3CHO(g) \longrightarrow CH_4(g) + CO(g)$

$\text{Rate} = k\,[CH_3CHO]^{3/2}$

(*iv*) $C_2H_5Cl\,(g) \longrightarrow C_2H_4\,(g) + HCl\,(g)$

$\text{Rate} = k\,[C_2H_5Cl]$

Sol:

(*i*) Order = 2, dimension of

$$k = \frac{\text{Rate}}{[NO]^2} = \frac{\text{mol L}^{-1}\,\text{s}^{-1}}{(\text{mol L}^{-1})^2} = \text{L mol}^{-1}\,\text{s}^{-1}$$

(*ii*) Order = 2, dimension of

$$k_I = \frac{\text{Rate}}{[H_2O_2]\,[I^-]}$$

$$= \frac{\text{mol L}^{-1}\,\text{s}^{-1}}{(\text{mol L}^{-1})\,(\text{mol L}^{-1})} = \text{L mol}^{-1}\text{s}^{-1}$$

(*iii*) Order $= \frac{3}{2}$, dimension of

$$k = \frac{\text{Rate}}{[CH_3CHO]^{3/2}} = \frac{\text{mol L}^{-1}\,\text{s}^{-1}}{(\text{mol L}^{-1})\,(\text{mol L}^{-1})^{1/2}}$$

$$= L^{1/2}\,\text{mol}^{-1/2}\,\text{s}^{-1}$$

(*iv*) Order = 1, dimension of

$$k = \frac{\text{Rate}}{[C_2H_5Cl]} = \frac{\text{mol L}^{-1}\,\text{s}^{-1}}{(\text{mol L}^{-1})} = \text{s}^{-1}$$