Q.1.

Δ [ ]	Δ R.O.R.	Order
2	2	1
3	9	2
3	27	3
3	3	1
8	2	1/3
8	4	2/3
27	3	1/3
4	8	3/2
2		

$2 \cdot \sqrt{2} = 2 \cdot 2^{1/2} = 2^{3/2}$

$2^{3/2} = 2^x$

$x = 3/2$

$A \rightarrow B$

$R = k[A]^x$

$2R = 2^x \cdot R$

$x = 1$

$9R = 3^x \cdot R$

$3^2 = 3^x \Rightarrow x = 2$

$2R = 8^x \cdot R$

$2^1 = (2^3)^x$

$2^1 = 2^{3x} \Rightarrow 1 = 3x$

$x = 1/3$

$2^2 = 2^{3x} \Rightarrow 3x = 2$

$x = 2/3$

Q.1. $\Delta[\ ]$ Δ R.O.R. Order

3 $5 \cdot 2$ 3/2

$= 3 \cdot \sqrt{3} = 3^{3/2}$

Mechanism of Reaction :-

(1) Elementary Reaction (2) Complex Reaction.

(1) Elementary Reaction :- Those reaction's which are Completed in a Single Step and which have exponents/Coefficients/Power of reactant's in rate law if equal Stoichiometry Coefficients of reactants

Ex:- If $A + 2B \longrightarrow C$, if elementary reaction.

$r = k[A]^1 \cdot [B]^2$ → rate law.

Order of rexn = 1+2 = 3.

Zero-order reaction can never be elementary reaction.
/ Zero-order reaction always complex reaction.

For elementary reaction fractional order is not possible.

(2)* Complex reaction :-

Those reactions which are completed in a multiple step's (more then one step), for these reactions a mechanism is propoled.

For complex reaction overall rate of reaction is controlled by it's slowest step. Which is called rate determining step

In rate law expression, rate of reaction depend on Concentration of reactant of slowest Step, which must be free from intermediate.

ex :-

(A) 1. $2NO_2Cl \longrightarrow 2NO_2 + Cl_2$, The mechanism of reaction is-

mech :- (i) $NO_2Cl \rightleftharpoons NO_2 + Cl$ (slowest Step.)

(ii) $NO_2Cl + Cl \longrightarrow NO_2 + Cl_2$ (fast Step.)

So determined rate law.?

Sol. Apply rate law in R.d.S. (rate determining Step.)

$$r = k[NO_2Cl]^1$$ → rate law.

order = 1

Q.2. $2NO_{(g)} + 2H_{2(g)} \longrightarrow N_{2(g)} + 2H_2O_{(g)}$

mecha:- (i) $2NO \rightleftharpoons N_2O_2$ (fast step)

(ii) $N_2O_2 + H_2 \longrightarrow N_2O + H_2O$ (slow)

(iii) $N_2O + H_2 \longrightarrow N_2 + H_2O$ (fast)

① Determine rate law.

Sol. Apply rate law is slowest step. (R.D.S)

$r = k[N_2O_2]^1 \cdot [H_2]^1$ — ①

N_2O_2 → intermediate

Apply L.M.A in step-(i)

$K_1 = \frac{[N_2O_2]}{[NO]^2} \Rightarrow [N_2O_2] = K_1 \cdot [NO]^2$ — ②

Put $[N_2O_2]$ in eq. ① —

$r = k K_1 \cdot [NO]^2 \cdot [H_2]$

$r = k' [NO]^2 \cdot [H_2]$ → rate law

Order of rexn = 2 + 1 = 3

Q.3. following mechanism has been proposed for the reaction :- $2A + B \longrightarrow D + E$.

mechanism :- (i) $A + B \longrightarrow C + D$ (slow)

(ii) $A + C \longrightarrow E$ (fast)

Determine Rate law.

Sol. Apply rate law in R.D.S. – Step-(i)

$r = k[A]^1 \cdot [B]^1$ ✓ ✓ → rate law ⇒ Order of rexn = 1+1 = 2.

Q.4. A Hypothetical Reactin. $A_2 + B_2 \longrightarrow 2AB$; follows the mechanism as given below

Determine rate law.

Mech. :- (i) $A_2 \rightleftharpoons A + A$ (fast)

(ii) $A + B_2 \longrightarrow AB + B$ (slow)

(iii) $A + B \longrightarrow AB$ (fast.