Nishant Jindal

1, 6, 8, 10, 11, 17

$$A + B \longrightarrow C + D$$

$$\frac{d[C]}{dt} = 2$$

$$9 = \frac{d[D]}{dt} = \frac{3}{2}\left(-\frac{d[B]}{dt}\right)$$

$r_4 = 9$

$r_3 = 2$

$r_2 = 6$

$$\frac{1}{r_3}\frac{d[C]}{dt} = \frac{1}{r_4}\frac{d[D]}{dt}$$

$$\frac{1}{r_3} \times 2 = \frac{1}{r_4} \times 9$$

$$\frac{r_4}{r_3} = \frac{9}{2}$$

$$\frac{1}{r_2}6 = \frac{1}{r_3}2 \qquad \frac{r_3}{r_2} = \frac{2}{6}$$

6

$$\frac{\ln 2}{3.33} = \frac{1}{9}\ln\frac{[A]_t}{[A]_0}$$

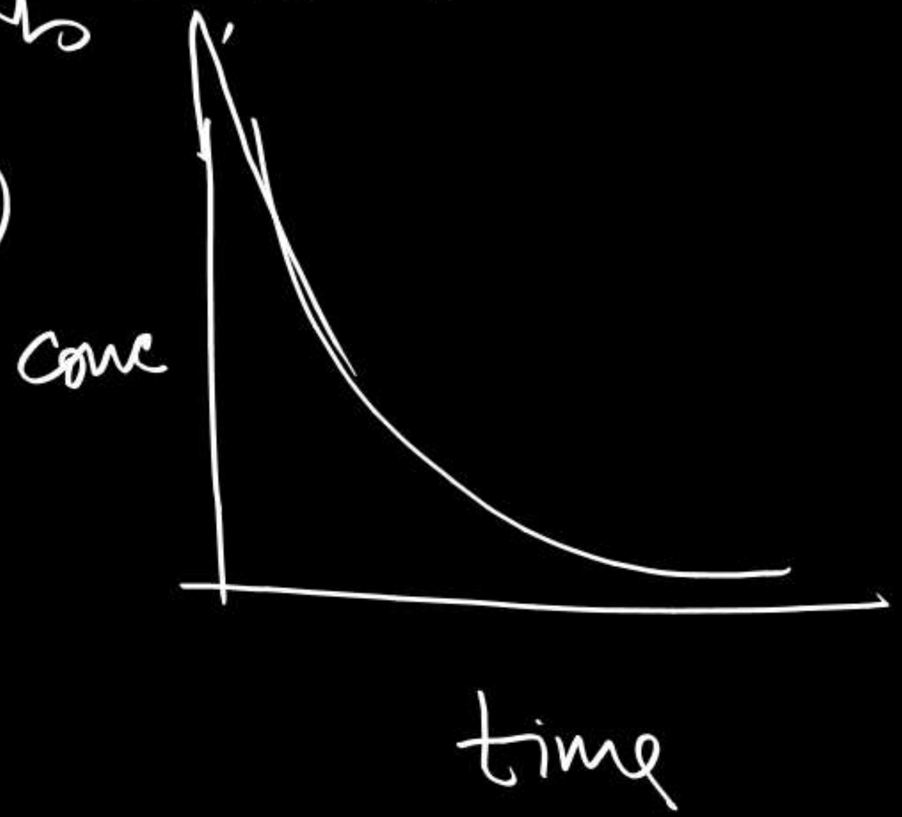
$$\frac{K_f = 4.8\times10^{-5}}{K_b = 2.4\times10^{-3}}$$

10

$$A \underset{k_b}{\overset{k_f}{\rightleftharpoons}} B$$

$$-\frac{d[A]}{dt} = k_f[A] - k_b[B]$$

c



a zero

b zero

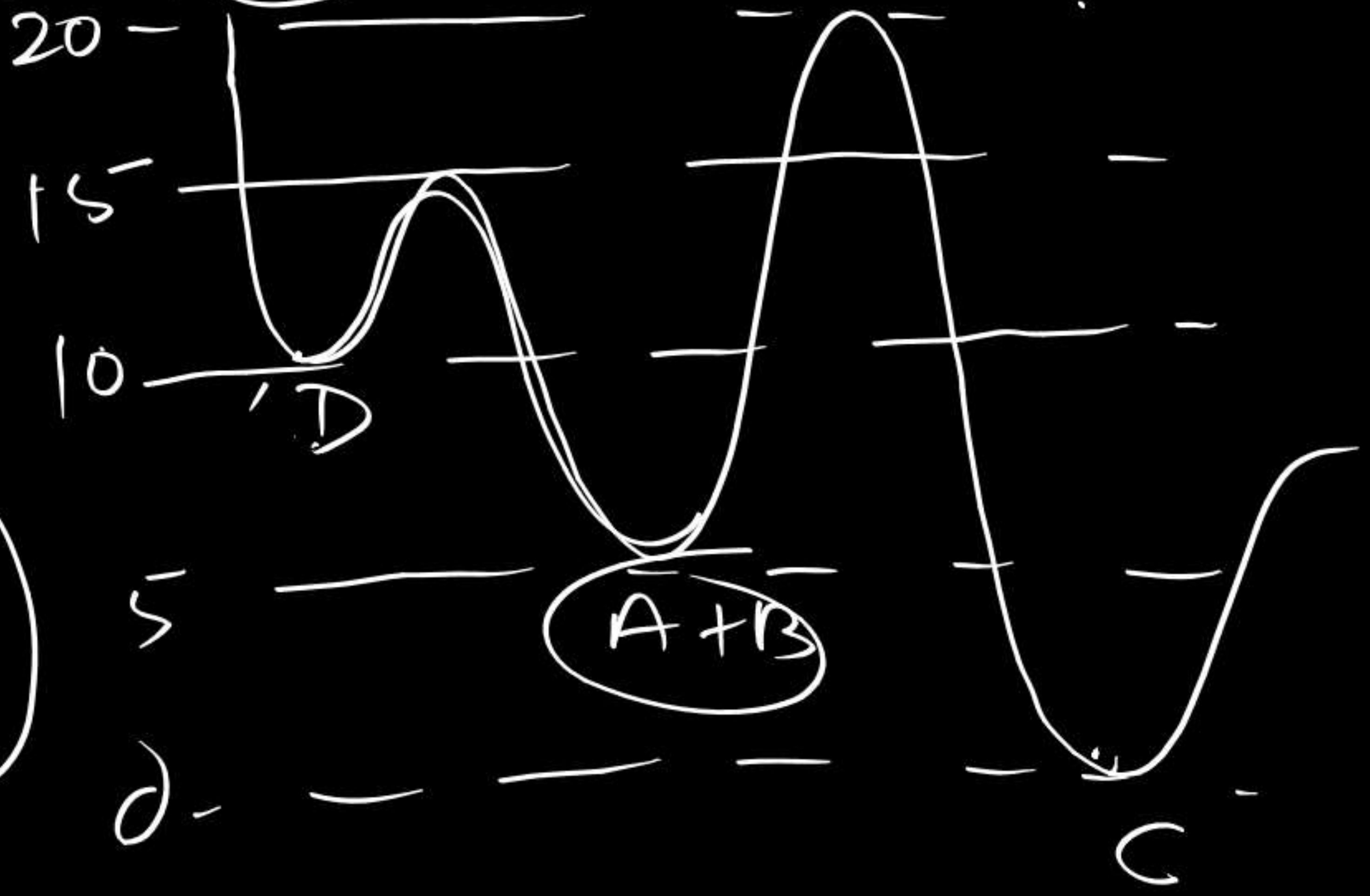
d

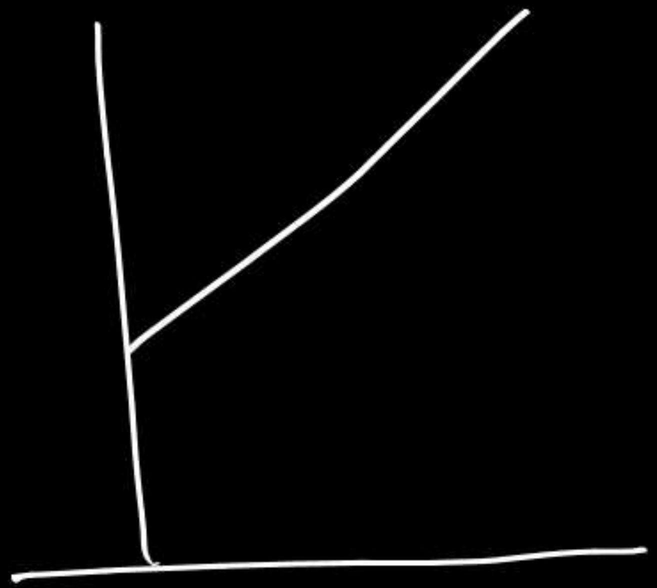
e 1^{st} order

17 c a d b 6

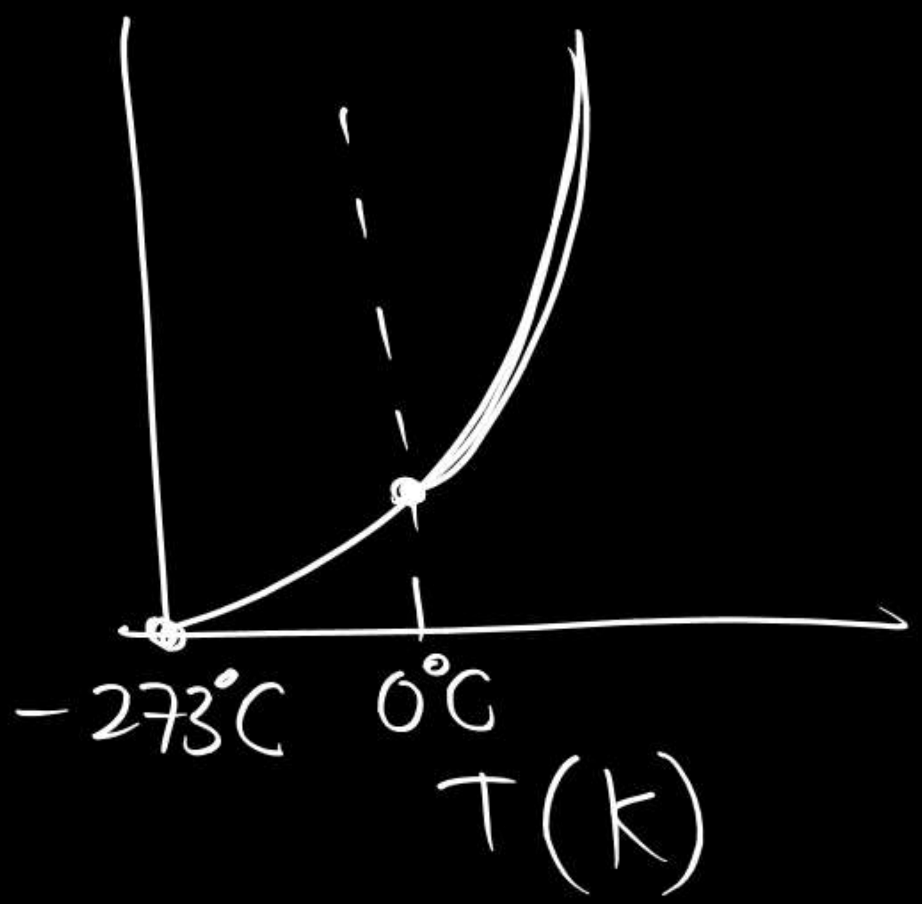
$$-\frac{dN}{dt} = 5N^2$$

$$\frac{1}{N_t} - \frac{1}{N_0} = 5t$$





21, 24



(21) $2A + B \rightarrow \text{Product}$

$$ROR = k_r[A]^1$$

$$6.93 \times 10^{-3} = k_r(0.1)$$

$$6.93 \times 10^{-2} = k_r$$

$$\frac{k_A}{2} = k_r \qquad k_A = 2 \times 6.93 \times 10^{-2}$$

$$t_{1/2} = \frac{\cancel{\ln 2}\ 10}{2 \times \underset{10}{\cancel{6.93}} \times \cancel{10^{-2}}} = 5$$

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pH of a solution containing strong monoprotic acid or base

Case-I if $C \geq 10^{-6}\,M$

H^+ contribution due to H_2O can be neglected

strong $\alpha = 100\%$

$[HCl] = C$

$[H^+] = C$

monohydroxic

HCl
HBr
HI
HNO_3
$HClO_4$

KOH
NaOH
CsOH

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Case – II if $C < 10^{-6} M$

H^+ due to H_2O can't be neglected

$[HCl] = C$

$H_2O(l) \longrightarrow H^+_{(aq)} + OH^-_{(aq)}$

$C + x \quad x$

$K_w = 10^{-14} = (C + x)(x)$

$[H^+] = C + x$

$\sqrt{5} = 2.23$
$\simeq 2.24$

find $[H^+]$ & pH of

① $0.1 M\ HNO_3$ $pH = 1$

② $10^{-3} M\ HCl$ $pH = 3$

③ $10^{-5} M\ NaOH$

④ $10^{-7} M\ HCl$

$[OH^-] = 10^{-5}$ $[H^+] = \frac{10^{-14}}{10^{-5}} = 10^{-9}$

$pOH = 5$ $pH = 9$

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$$H_2O \longrightarrow H^+ + OH^-$$

$$(10^{-7}+x)(x) = 10^{-14}$$

$$x^2 + 10^{-7}x - 10^{-14} = 0$$

$$x = \frac{-10^{-7} \pm \sqrt{10^{-14} + 4 \times 10^{-14}}}{2}$$

$$= \frac{-10^{-7} + \sqrt{5} \times 10^{-7}}{2}$$

$$x = 0.62 \times 10^{-7}$$

$$[H^+] = C + x$$

$$= 10^{-7} + 0.62 \times 10^{-7}$$

$$= 1.62 \times 10^{-7}$$

$$pH = 7 - \log 1.62$$

$$= 6.78$$

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② pH of a solution containing weak monoprotic acid or base

K_a K_b

Weak acid 10^{-4} 10^{-6} 10^{-8} 10^{-9}

V. Weak acid 10^{-11}, 10^{-12}, 10^{-13}, 10^{-14}

→ V. V Weak acid 10^{-17} 10^{-20}, 10^{-24} CH_4

strong acid $K_a >> 1$

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Case-I if $C \geq 10^{-6}$ M & $K_aC \geq 10^{-12}$

H^+ contribution due to H_2O can be neglected

let $C = 10^{-4}$

$K_aC = 10^{-10}$

$K_a = 10^{-6}$

e.g. CH_3COOH

$HCOOH$

C_6H_5COOH

$$HA(aq) \longrightarrow H^+(aq) + A^-(aq)$$
$$C - x \qquad x \qquad x$$

$$\boxed{K_a = \frac{x^2}{C - x}}$$

if $\frac{K_a}{C} \leq 10^{-3}$

x can be neglected wrt C

$x = \sqrt{K_aC}$

$[H^+] = \sqrt{K_aC}$

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find $[H^+]$ & pH of

(I) 0.1M CH_3COOH $(K_a = 10^{-5} M)$

(II) 10^{-5} M CH_3COOH $(K_a = 10^{-5} M)$

Kinetic

Remaining J-M

J-Adv 1-7