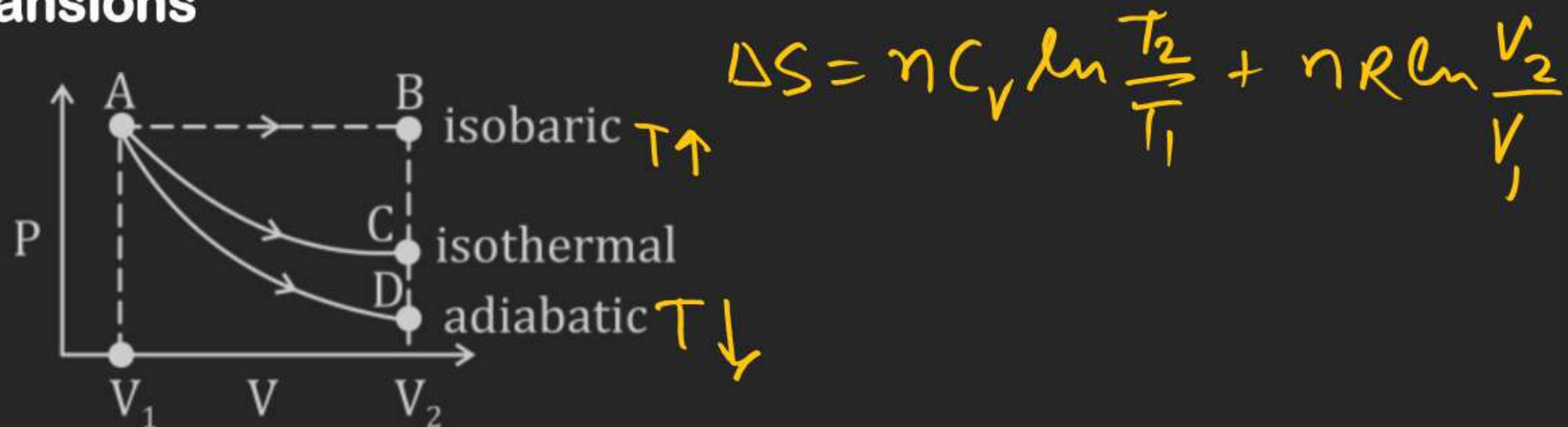


JEE Main Paper

Q.61 Starting with same initial conditions, an ideal gas expands from volume V_1 to volume V_2 in three different paths AB, AC & AD as shown. Compare the entropy change during these expansions



✓ (A) $\Delta S_{AB} > \Delta S_{AC} > \Delta S_{AD}$

(C) $\Delta S_{AC} > \Delta S_{AD} > \Delta S_{AB}$

(B) $\Delta S_{AB} > \Delta S_{AD} > \Delta S_{AC}$

(D) $\Delta S_{AD} > \Delta S_{AC} > \Delta S_{AB}$

Q.64 Standard entropy of X_2 , Y_2 and X_2Y_3 are 60, 40 and 150 in J/K mol



The temperature at which reaction will attain equilibrium is :

(A) 250 K

(B) 1000 K

(C) 750 K

(D) 200 K

$$\Delta H - T \Delta S = 0$$

Q.67 Select the correct relationship for a reaction-

(A) $\Delta G = \Delta G^\circ + RT \ln K_p$

(B) $\Delta G^\circ = RT \ln K_p$

✓ (C) $\Delta G = RT \ln \frac{Q_p}{K_p}$

(D) $\Delta G = T(\Delta S)_{\text{uni.}}$

$$\Delta G = -RT \ln K_p + RT \ln Q$$

Q.70 If the enthalpy of combustion of benzene(l), carbon (s) & hydrogen (g) are Q_1 , Q_2 & Q_3 respectively. What will be enthalpy of formation of Benzene –

(A) $Q_1 + 6Q_2 + Q_3$

(B) $6Q_2 + Q_1 + 3Q_3$

(C) $6Q_2 - 3Q_3 - Q_1$

(D) $6Q_2 + 3Q_3 - Q_1$



$$\Delta H_r = 6Q_2 + 3Q_3 - Q_1$$

Q.73 Boron exist in different allotropic forms. All allotropic form contains icosahedral units (icosahedral is a regular shape with 12 corners & 20 faces) with boron atoms at all 12 corners and all bonds are equivalent.

Calculate ΔH (in kJ) per mole of boron atoms forming gaseous icosahedral if $\Delta H_{BE} (B-B) = 200 \text{ kJ/mol}$.

(A) 1000

(B) 600

☒ (C) 500

(D) 250

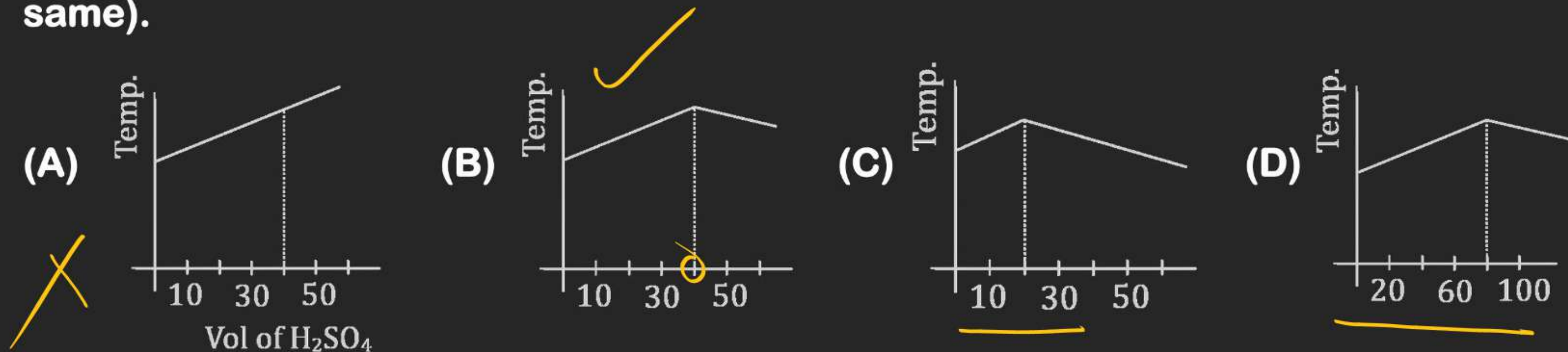


Icosahedral

$$50 \times 0.4 = \underline{20 \text{ mmol NaOH}}$$

$$0.25 \times V = 10$$

Q.76 In an experiment the enthalpy of neutralisation of sodium hydroxide with sulphuric acid, 50 cm³ of 0.4M sodium hydroxide were titrated thermometrically with 0.25M sulphuric acid. Which of the following plots give the most probable correct representation temperature of solution (initial temperature of NaOH & H₂SO₄ are same).



Q.79 How much energy should be supplied to change 36 gm of ice at 0°C to liquid water at room temperature 25°C ?

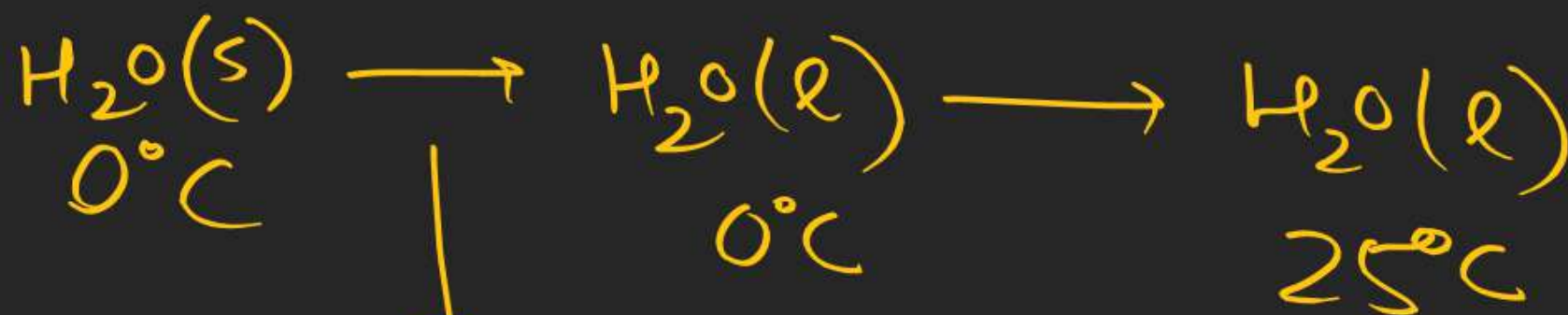
Given: $\Delta H^{\circ}_{\text{fusion}} = \underline{6 \text{ kJ/mol}}$; $C_{P(\text{H}_2\text{O})} = \underline{4 \text{ J/K-gm}}$ 9×18

(A) 12 kJ

(B) 15.6 kJ

(C) 12.2 kJ

(D) 212 kJ



$$6 \times 2 \text{ kJ}$$

$$\underline{12}$$

$$\frac{2 \times 4 \times 25 \times 18}{1000}$$

$$= \underline{3.6}$$

✓

Q.84 Calculate magnitude of ΔH in calorie for 1 mole of an ideal gas undergoing adiabatic reversible process from 8 atm, 300 K to 2 atm. (Given: $\gamma = 2$, $R = 2 \text{ Cal/K/mol}$)

$$T_2 = ?$$



$$\frac{1}{x} \left(- \frac{d[A]}{dt} \right) = \frac{1}{y} \left(+ \frac{d[B]}{dt} \right)$$

$$\cancel{\log} \left(- \frac{d[A]}{dt} \right) = \cancel{\log} \left[\left(\frac{d[B]}{dt} \right) \times 2 \right]$$

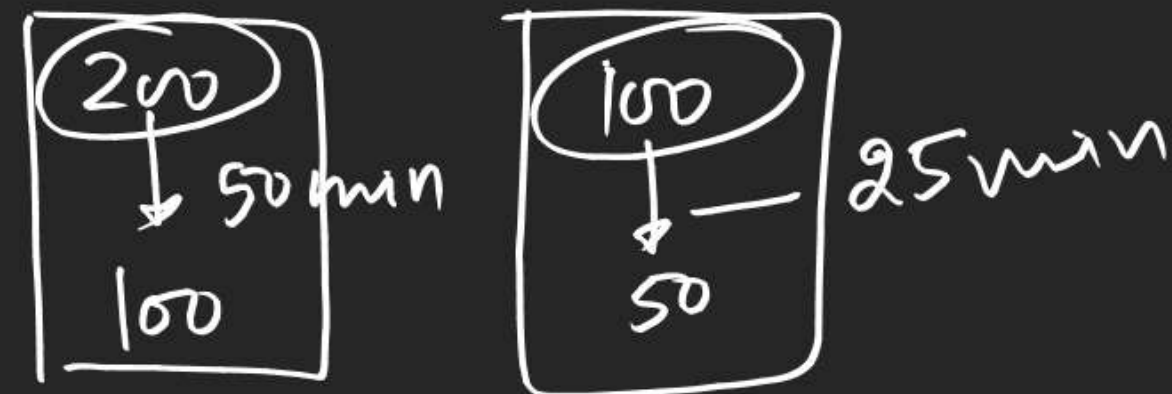
$$x=2 \quad y=1$$

$$\underline{\text{rate}} = k \underline{[A]}^{p=1} [B]^{q=0}$$



$$\begin{aligned} \alpha &= 10^{-3} \times 100 \\ &= \underline{\underline{0.1}} \end{aligned}$$

}



- ① Units of k
- ② Completion time $= \frac{[A]_0}{k}$
- ③ $t_{1/2}$ (half life time) \rightarrow time in which 50% reactant reacts

$$[A]_t = \frac{[A]_0}{2} = [A]_0 - kt_{1/2} \quad t_{1/2} = \frac{[A]_0}{2k}$$

④ $t_{3/4}$ or $t_{75\%}$

$$[A]_t = \frac{[A]_0}{4} = [A]_0 - kt_{75\%}$$

$$t_{75\%} = \frac{3}{4} \frac{[A]_0}{k}$$

$$t_{3/4} = t_{1/2} + t'_{1/2}$$

$$= t_{1/2} + \frac{1}{2} t_{1/2}$$

$$= \frac{3}{2} t_{1/2}$$

$$(5) \quad -\frac{d[A]}{dt} = k = \text{const}$$

Rate is independent of conc as well as time.

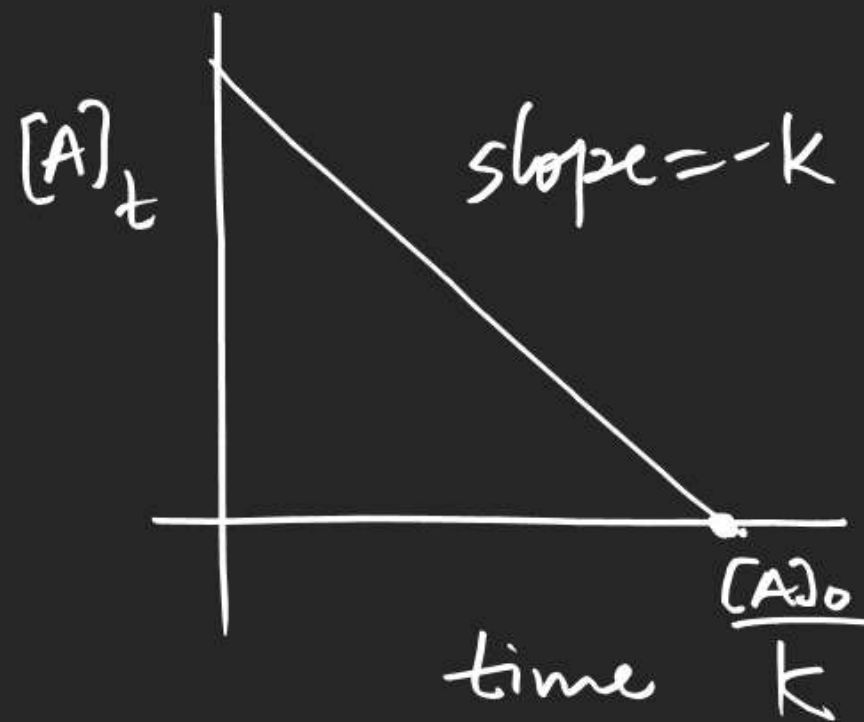
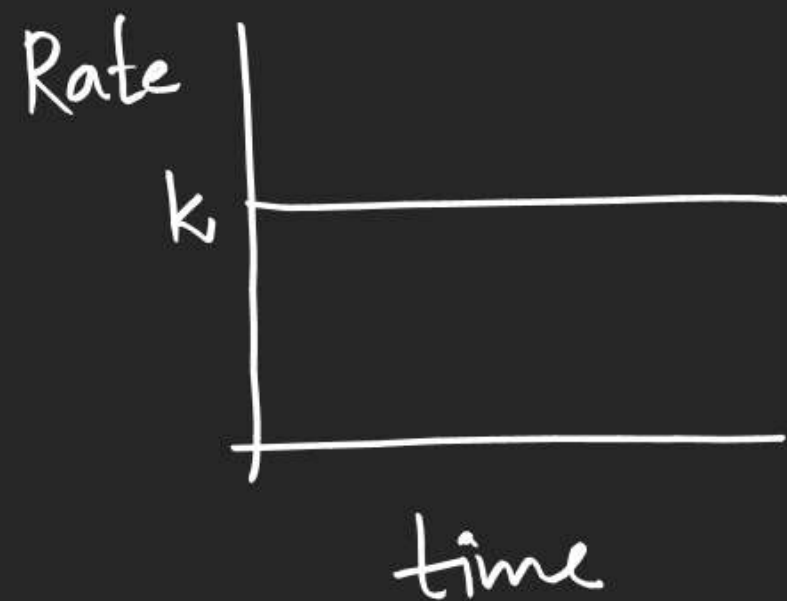
(6)

<u>time</u>	0	t	2t	3t
	100	90	80	70
conc	$[A]_0$	$[A]_0 - kt$	$[A]_0 - 2kt$	

conc. of reactant after equal interval of time constitute an A.P with common diff $-kt$

(7) In equal interval of time equal amount of reactant reacts.

⑧



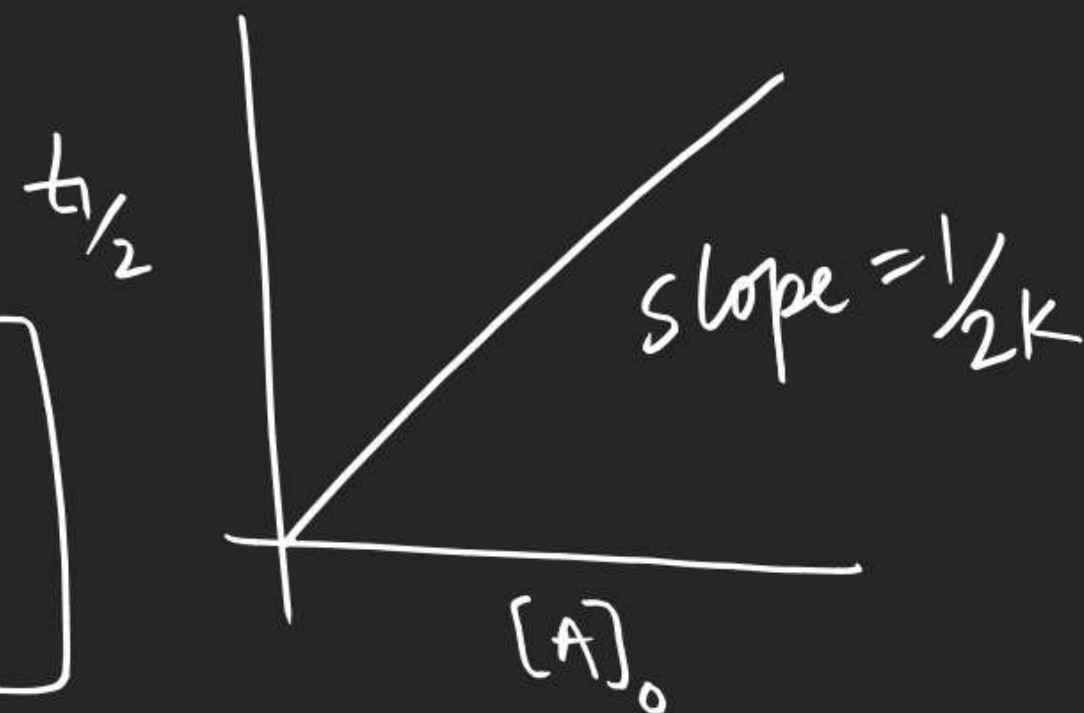
$$\text{Rate} = -\frac{d[A]}{dt} = k$$

$$[A]_t = [A]_0 - kt$$

Amt reacted

$$x = kt$$

$$t_{1/2} = \frac{[A]_0}{2k}$$



1st order Rxn

$$-\frac{d[A]}{dt} = k[A]$$

$$\int_{[A]_0}^{[A]_t} \frac{d[A]}{[A]} = -k \int_0^t dt$$

$$\ln \frac{[A]_t}{[A]_0} = -kt$$

$$[A]_t = [A]_0 e^{-kt}$$

$$kt = \ln \frac{[A]_0}{[A]_t} = \ln \frac{a}{a-x}$$

$$kt = 2.303 \log \frac{[A]_0}{[A]_t}$$

$$x = [A]_0 - [A]_t$$

$$= [A]_0 \{1 - e^{-kt}\}$$

$$[A]_t = [A]_0 - kt$$

Q. find conc of 'A' after 3 sec. Given $k = \ln 2 \text{ sec}^{-1}$

$$[A]_0 = 4 \text{ M}$$

$$\Rightarrow [A]_t = 4 \times e^{-\ln 2 \times 3}$$

$$= 4 \times e^{\ln 1/8}$$

$$= 4 \times 1/8 = 1/2$$

$$\begin{array}{c} 1/8 \\ 1/2 \\ 3/2 \\ 4/e^2 \end{array}$$

Q. find time required to reduce the conc of A to $1/8^{\text{th}}$ of its initial conc. Given $k = \ln 2 \text{ sec}^{-1}$

$$t = \frac{1}{k} \ln \frac{[A]_0}{[A]_t} = \frac{1}{\ln 2} \ln \frac{a}{1/8^a}$$

$$a \rightarrow 1/8^a$$

$$= \frac{\ln 8}{\ln 2} = \frac{3 \ln 2}{\ln 2} = 3$$

$$\begin{array}{l} e^{\ln x} = x \\ e^{-\ln x} = e^{\ln 1/x} = 1/x \end{array}$$

$$\frac{3}{4}$$

75%.

$$\frac{1}{5}$$

reactant reacts mean

20% reactant react

Q. find the time required to react 99% reactant.
Given $k = 0.1 \text{ sec}^{-1}$.

$$t = \frac{1}{0.1} \ln \frac{100}{1} = 10 \ln 100 = 2.303 \times 10 \log 100 \\ = \underline{\underline{46.06}}$$

$$\frac{[A]_t}{[A]_0} = \text{fraction remaining}$$

$$\text{fraction reacted} = 1 - \frac{[A]_t}{[A]_0}$$

$$\frac{[A]_t}{[A]_0} \times 100 = \% \text{ remaining}$$

$$\% \text{ reacted} = \left(1 - \frac{[A]_t}{[A]_0} \right) \times 100$$

S-I

4-20