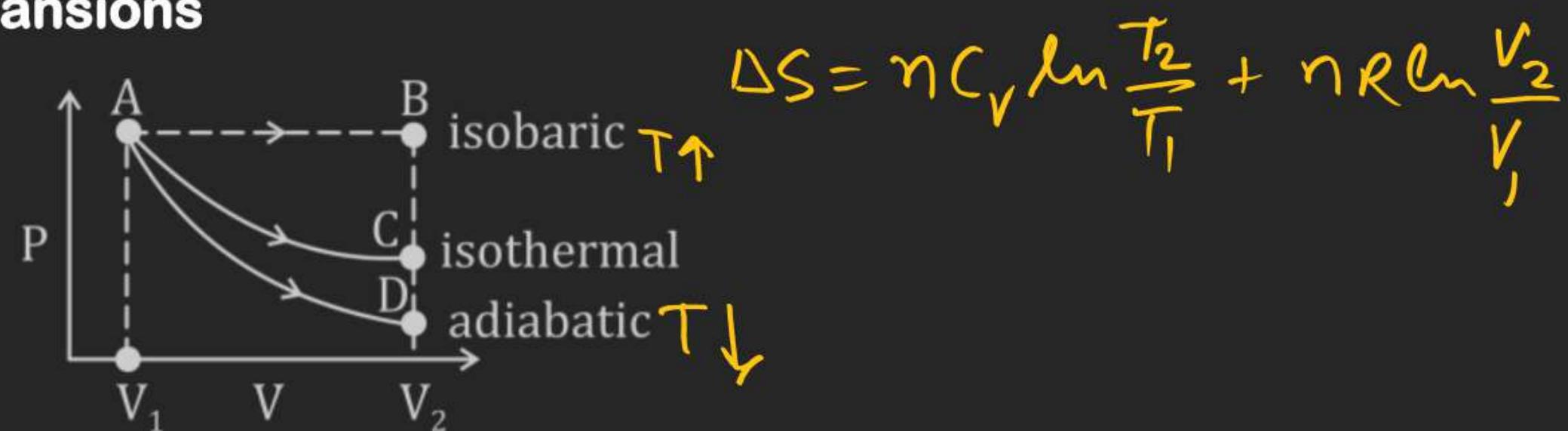


## JEE Main Paper

**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)  $\Delta S_{AB} > \Delta S_{AC} > \Delta S_{AD}$
- (B)  $\Delta S_{AB} > \Delta S_{AD} > \Delta S_{AC}$
- (C)  $\Delta S_{AC} > \Delta S_{AD} > \Delta S_{AB}$
- (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)  $\Delta G = T(\Delta S)_{uni.}$

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

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)  $6Q_2 + 3Q_3 - Q_1$



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

**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  $\Delta H$  (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

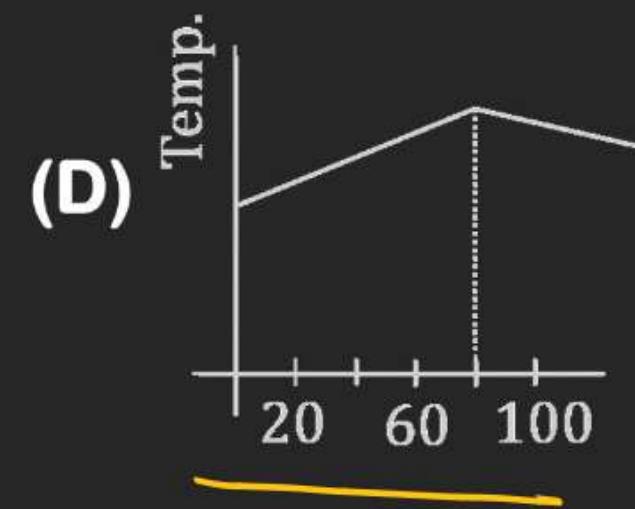
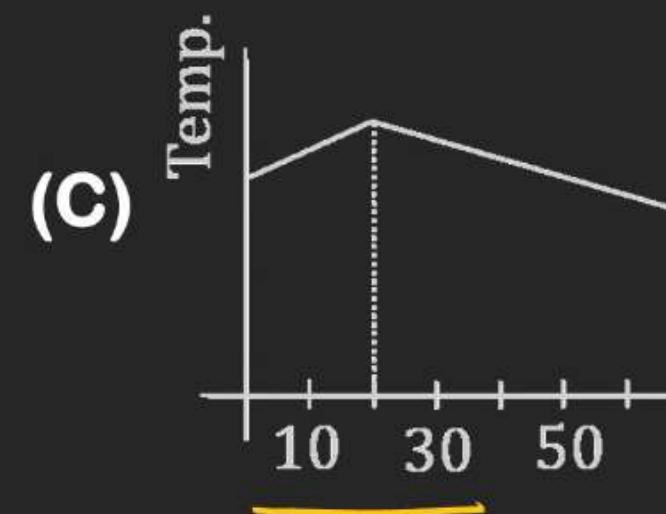
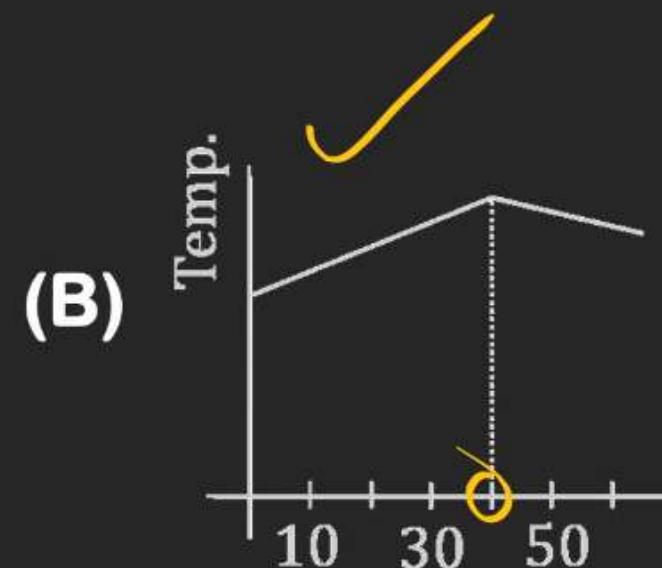
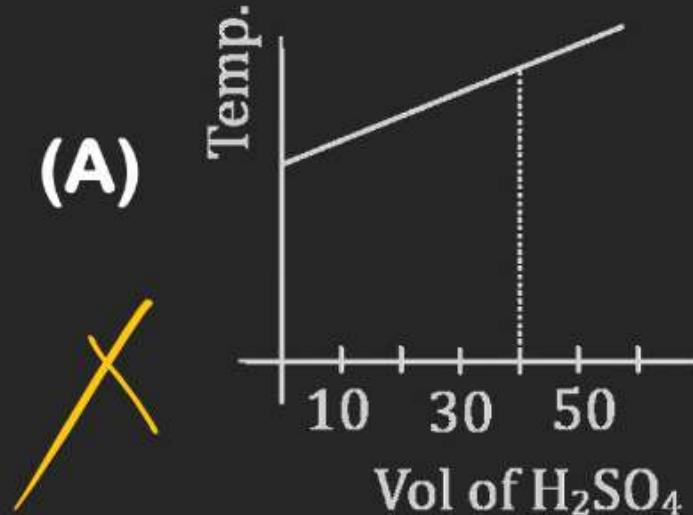
(D) 250



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

$$0.25 \times V = 10$$

**Q.76** In an experiment the enthalpy of neutralisation of sodium hydroxide with sulphuric acid,  $50\text{cm}^3$  of  $0.4\text{M}$  sodium hydroxide were titrated thermometrically with  $0.25\text{M}$  sulphuric acid. Which of the following plots give the most probable correct representation temperature of solution (initial temperature of  $\text{NaOH}$  &  $\text{H}_2\text{SO}_4$  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?**

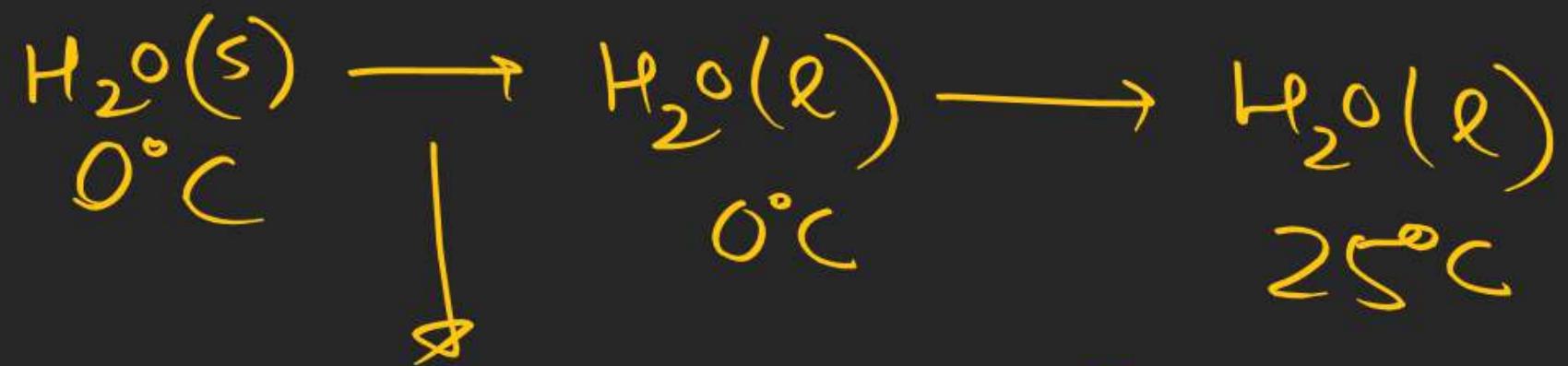
Given:  $\Delta H^\circ_{\text{fusion}} = \underline{\underline{6 \text{ kJ/mol}}}$ ;  $C_{P(\text{H}_2\text{O})} = 4 \text{ J/K-gm}$        $q \times 18$

(A) 12 kJ

(B) 15.6 kJ

(C) 12.2 kJ

(D) 212 kJ



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

$$\frac{12}{-}$$

$$\begin{aligned} & \frac{2 \times 4 \times 25 \times 18}{1000} \\ & = 3.6 \end{aligned}$$

5

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

$$T_2 = ?$$



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

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

$$x=2 \quad \gamma = 1$$

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



$$\chi = 10^3 \times 100$$

$$= 0.1$$

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∴

① Units of  $k$

② Completion time =  $\frac{[A]_0}{k}$

③  $t_{1/2}$  (half life time) → time in which 50% reactant reacts

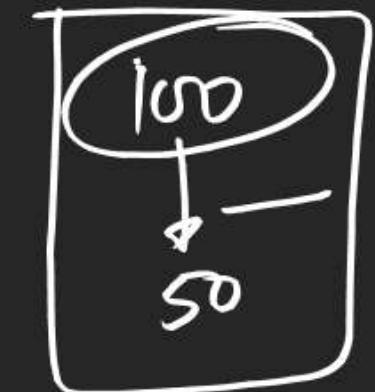
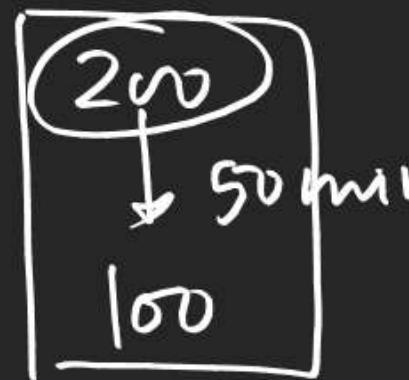
$$[A]_t = \frac{[A]_0}{2} = [A]_0 e^{-kt_{1/2}} \quad t_{1/2} = \frac{\ln 2}{k}$$

④

$t_{3/4}$   
or  
 $t_{75\%}$

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

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



25 min

$$\begin{aligned} t_{3/4} &= t_{1/2} + t'_{1/2} \\ &= t_{1/2} + \frac{1}{2} t_{1/2} \\ &= \frac{3}{2} t_{1/2} \end{aligned}$$

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

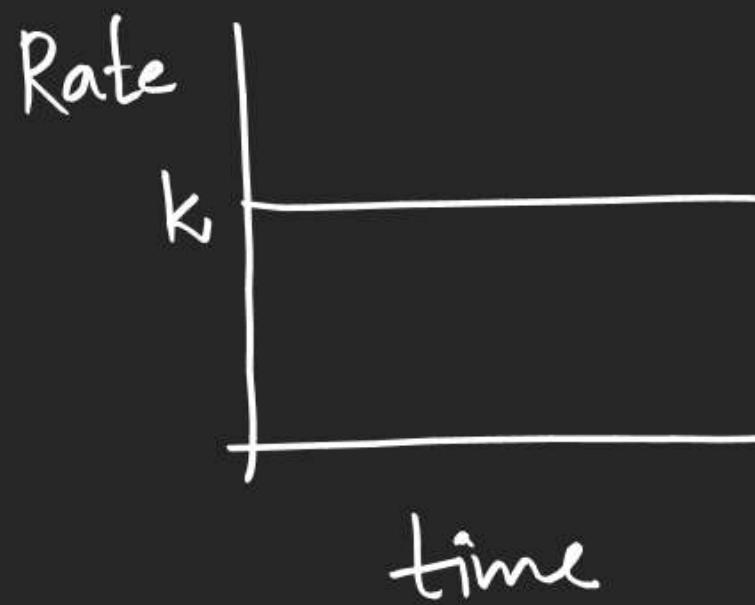
Rate is independent of conc as well as time.

<u>time</u>	0	t	2t	3t
<u>conc</u>	100	$[A]_0 e^{-kt}$	$[A]_0 e^{-2kt}$	$[A]_0 e^{-3kt}$

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

\textcircled{7} In equal interval of time equal amount of reactant reacts.

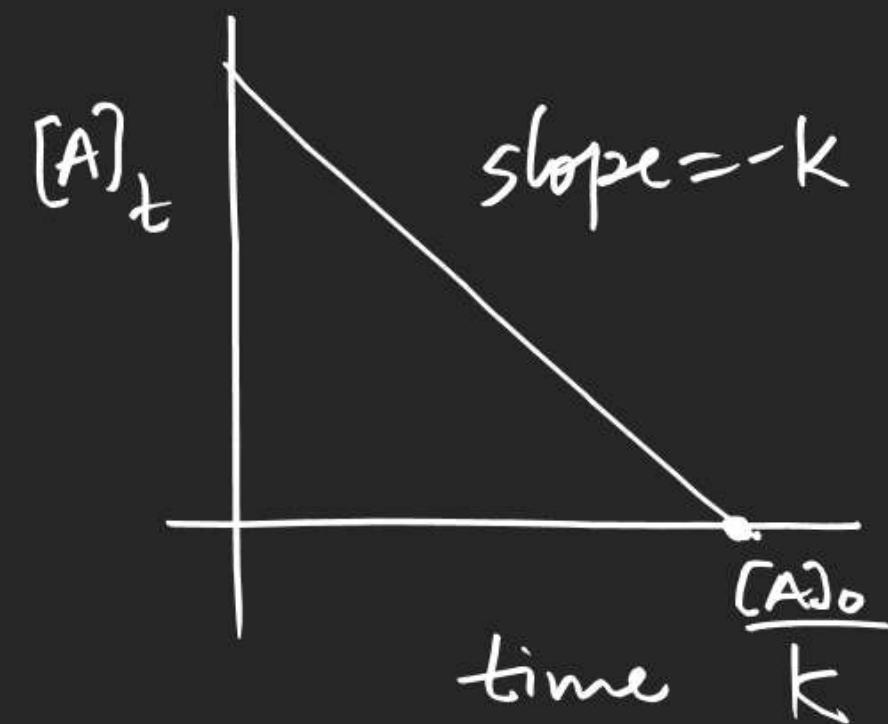
③



time

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

amt reacted

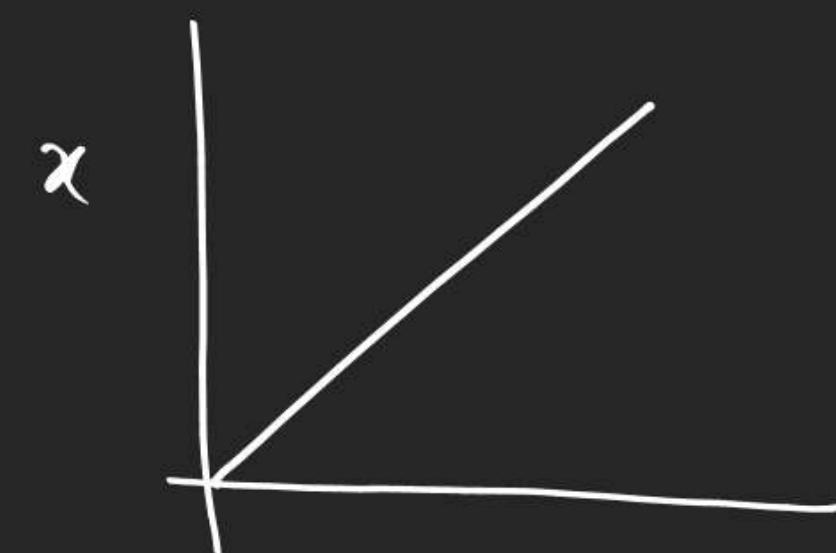


time

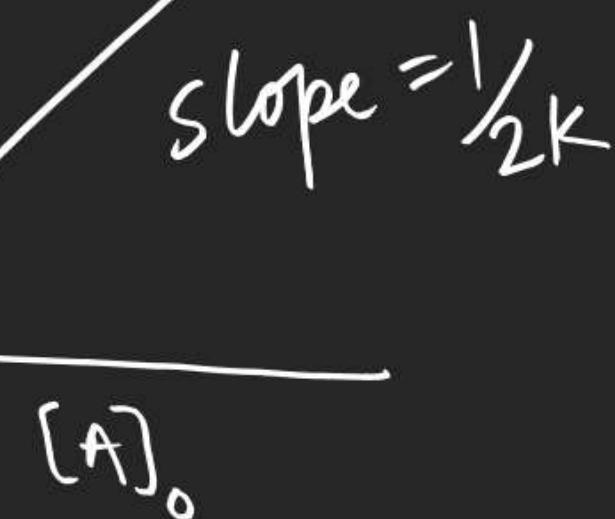
$$[A]_t = [A]_0 - kt$$

$$x = kt$$

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



time



1<sup>st</sup> order Rxn $nA \rightarrow \text{Product}$ 

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

$$\left\{ \frac{[A]_t}{[A]} \cdot \frac{d[A]}{dt} = -k \int_0^t dt \right.$$

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

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

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

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

$$\begin{aligned} x &= [A]_0 - [A]_t \\ &= [A]_0 \{ 1 - e^{-kt} \} \end{aligned}$$

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

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

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

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

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

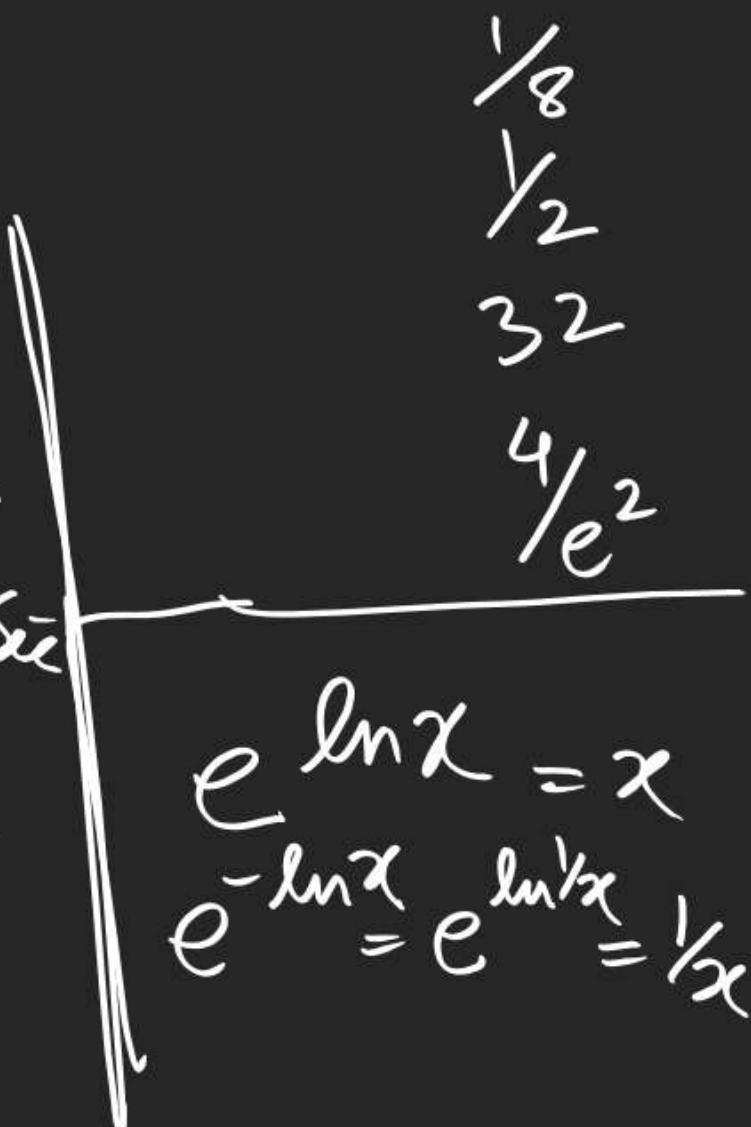
$$= 4 \times \frac{1}{8} = \frac{1}{2}$$

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

$$t = \frac{1}{k} \ln \frac{[A]_0}{[A]_t} = \frac{1}{\ln 2} \ln \frac{9}{\frac{1}{8}a}$$

$a \rightarrow \frac{1}{8}a$

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



$$e^{\ln x} = x$$

$$e^{-\ln x} = e^{\ln \frac{1}{x}} = \frac{1}{x}$$

$\frac{3}{4}$

75%.

$\frac{1}{5}$

reactant reacts mean 20% reactant react

Q. find the time required to react 99% reactant.

Given  $k = 0.1 \text{ sec}^{-1}$ .

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

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

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

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

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

S-I 4-20