Q1 - 25 July - Shift 1

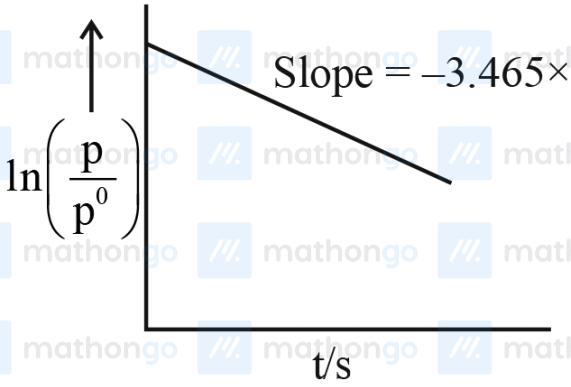
The half life for the decomposition of gaseous compound A is 240 s when the gaseous pressure was 500 Torr initially. When the pressure was 250 Torr, the half life was found to be 4.0 min. The order of the reaction is……. (Nearest integer)

Space for your notes:

Q2 - 25 July - Shift 2

For the decomposition of azomethane.

$CH_3N_2CH_3(g) \rightarrow CH_3CH_3(g)+N_2(g)$ a first order reaction, the variation in partial pressure with time at 600 K is given as



The half life of the reaction is _____ × 10^{-5}s. [Nearest integer]

Space for your notes:

Q3 - 26 July - Shift 1

For a reaction $A \rightarrow 2B + C$ the half lives are 100 s and 50 s when the concentration of reactant A is 0.5 and 1.0 mol L^{-1} respectively. The order of the reaction is___ _____. (Nearest Integer)

Space for your notes:

Q4 - 26 July - Shift 2

At 30°C, the half life for the decomposition of AB_2 is 200 s and is independent of the initial concentration of AB_2. The time required for 80% of the AB_2 to decompose is (Given: log 2 = 0.30; log 3 = 0.48)

(A) 200 s (B) 323 s

(C) 467 s (D) 532 s

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Q5 - 27 July - Shift 1

$2NO + 2H_2 \rightarrow N_2 + 2H_2O$

The above reaction has been studied at 800°C. The related data are given in the table below

Reaction serial number	Initial pressure of H_2 / kPa	Initial Pressure of NO/ kPa	Initial rate $\left(\frac{-dp}{dt}\right)/(kPa/s)$
1	65.6	40.0	0.135
2	65.6	20.1	0.033
3	38.6	65.6	0.214
4	19.2	65.6	0.106

The order of the reaction with respect to NO is____

Space for your notes:

Q6 - 27 July - Shift 2

[A] $\rightarrow$ [B]

Reactant Product

If formation of compound [B] follows the first order of kinetics and after 70 minutes the concentration of [A] was found to be half of its initial concentration. Then the rate constant of the reaction is $x \times 10^{-6}$ s^{-1}. The value of x is_____. (Nearest Integer)

Space for your notes:

Q7 - 28 July - Shift 1

For the given first order reaction

$A \rightarrow B$

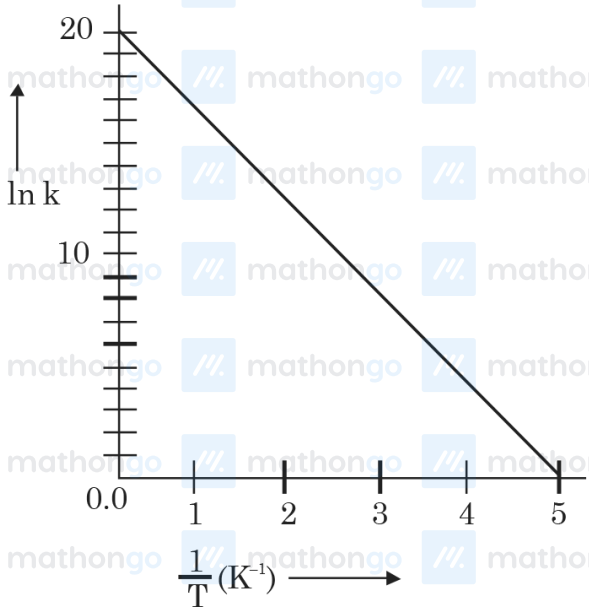
the half life of the reaction is 0.3010 min. The ratio of the initial concentration of reactant to the concentration of reactant at time 2.0 min will be equal to _____. (Nearest integer)

Space for your notes:

Q8 - 28 July - Shift 2

For a reaction, given below is the graph of $\ln k$ vs $\frac{1}{T}$. The activation energy for the reaction is equal to _____ cal mol^{-1}. (Nearest integer).

(Given : R = 2 cal K^{-1} mol^{-1})



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Q9 - 29 July - Shift 1

The reaction between X and Y is first order with respect to X and zero order with respect to Y.

Experiment	[X] / mol L^{-1}	[Y] / mol L^{-1}	Initial rate / mol L^{-1} min^{-1}
I.	0.1	0.1	2×10^{-3}
II.	L	0.2	4×10^{-3}
III.	0.4	0.4	$M\times10^{-3}$
IV.	0.1	0.2	2×10^{-3}

Examine the data of table and calculate ratio of numerical values of M and L. (Nearest Inetger)

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Q10 - 29 July - Shift 2

Assuming 1μg of trace radioactive element X with a half life of 30 years is absorbed by a growing tree. The amount of X remaining in the tree after 100 years is___$\times 10^{-1}$μg.

[Given : ln 10 = 2.303; log2 = 0.30]

Space for your notes:

Answer Key

Q1 (1) **Q2** (2) **Q3** (2) **Q4** (C)

Q5 (2) **Q6** (165) **Q7** (100) **Q8** (8)

Q9 (40) **Q10** (1)

Q1 (1)

$(t_{1/2})_{500\ torr} = 240\ sec = 4\ min.$

$(t_{1/2})_{250\ torr} = 4\ min.$

$t_{1/2} \propto a^{1-n}$

As $t_{1/2}$ is independent of initial pressure. Hence, order is 1st order.

Q2 (2)

For first order reaction

$$k = \frac{1}{t}\ln\left(\frac{P_0}{P}\right)$$

$$\ln\left(\frac{P_0}{P}\right) = kt$$

$$t_{1/2} = \frac{\ln 2}{k} = \frac{0.693}{3.465\times10^{4}} = 2\times10^{-5}$$

Q3 (2)

$$t_{\frac{1}{2}} \propto \frac{1}{[A_0]^{n-1}}$$

$$[100] \propto \frac{1}{(0.5)^{n-1}}$$

$$(50) \propto \frac{1}{(1)^{n-1}}$$

$$[2]^1 = \left[\frac{1}{0.5}\right]^{n-1}$$

$$[2]^1 = [2]^{n-1}$$

$$n - 1 = 1$$

$$n = 2$$

$$\text{order} = 2$$

Q4 (C)

$T_{1/2} = 200\ s$ and 1^{st} order reaction

$$K = \frac{2.303 \log 2}{200} = \frac{2.303}{t} \log \frac{A_0}{0.2A_0}$$

$$\frac{\log 2}{200} = \frac{1}{t} \log 5$$

$$t = \frac{7}{3} \times 200 = 466.67s = 467\ s$$

Q5 (2)

On decreasing pressure of NO by a factor of '2' the rate of reaction decreases by a factor of '4'.

$\therefore$ Order of reaction w.r.t. 'NO' = 2

Q6 (165)

$$K = \frac{0.693}{t_{1/2}} = \frac{0.693}{70 \times 60}$$

$$= \frac{6930}{7 \times 6} \times 10^{-6}$$

$$= 165 \times 10^{-6}\ s^{-1}$$

Q7 (100)

$$A \rightarrow B \qquad t_{1/2} = 0.3010 \text{ min}$$

$$A_0/A_t \text{ at time } 2 \text{ min} = ?$$

$$K = \frac{2.303}{t}\log\left[\frac{A_0}{A_t}\right]$$

$$\Rightarrow \frac{0\cdot 693}{t_{\frac{1}{2}}} = \frac{2\cdot 303}{2}\log\left(\frac{A_0}{A_t}\right)$$

$$\text{Or } \frac{2.303\times 0.3010}{0.3010} = \frac{2.303}{2}\log\frac{A_0}{A_t}$$

$$\log\frac{A_0}{A_t} = 2$$

$$\therefore \frac{A_0}{A_t} = 10^2 = 100$$

Q8 (8)

$$K = Ae^{-Ea/RT}$$

$$\ln k = \frac{-Ea}{RT} + \ln A$$

$$\text{Slope} = \frac{Ea}{R} = \frac{20}{5}$$

$$E_a = 4R = 8 \text{ Cal/mol}$$

Q9 (40)

$$r = k\,[x]\,[y]^0 = k\,[x]$$

Using I & II

$$\frac{4\times10^{-3}}{2\times10^{-3}} = \left(\frac{L}{0.1}\right) \Rightarrow L = 0.2$$

Using I & III

$$\frac{M\times10^{-3}}{2\times10^{-3}} = \frac{0.4}{0.1} \Rightarrow M = 8$$

$$\frac{M}{L} = \frac{8}{0.2} = 40$$

Ans. 40

Q10 (1)

$$t = \frac{1}{\lambda} \ell n \left(\frac{a}{a - x} \right)$$

$$100 = \frac{30}{\ell n 2} \ell n \left(\frac{1}{w} \right)$$

$$\frac{1}{w} = 10$$

$$W = 0.1 \times \mu g$$

$$\text{Ans. } 1 \times 10^{-1} \mu g$$