

PYQSide

JEE MAIN CHEMICAL KINETICS — PYQS

Max. Marks: 176

Questions: 44

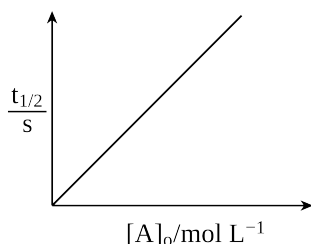
Section A (MCQ)

Q.1 Given below are two statements :

$R = 8.314 \text{ J K}^{-1} \text{ mol}^{-1}$ and $1 \text{ cal} = 4.2 \text{ J}$

Statement-I: When $E_a = 12.6 \text{ kcal/mol}$, the room temperature rate constant is doubled by a 10°C increase in temperature (298 K to 308 K)

Statement-II: For a first order reaction $A \rightarrow B$,



Here $[A]_0$ is the initial concentration of A and $t_{1/2}$ is half life of reaction.

In the light of the above statements, choose the correct answer from the options given below :

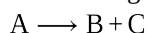
[JEE Main 2026 (Online) 8th April Evening Shift]

- (1) Both Statement-I and Statement-II are true
- (2) Both Statement-I and Statement-II are false
- (3) Statement-I is true but Statement-II is false
- (4) Statement-I is false but Statement-II is true

Scan or tap for the full solution



Q.2 First order gas phase reaction



p_i = initial pressure of gas A, p_t = total pressure of the reaction mixture at time t

Expression of rate constant (k) is

[JEE Main 2026 (Online) 5th April Morning Shift]

- (1) $\frac{1}{t} \ln \frac{p_i}{2p_i - p_t}$
- (2) $\frac{1}{t} \ln \frac{2p_i}{p_i - p_t}$
- (3) $\frac{1}{t} \ln \frac{p_i}{3p_i - 2p_t}$
- (4) $\frac{1}{t} \ln \frac{3p_i}{4p_i - p_t}$

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Q.3 Consider the first order reaction $R \rightarrow P$.

The fraction of molecules decomposed in the given first order reaction can be expressed as

[JEE Main 2026 (Online) 4th April Morning Shift]

- (1) $1 - e^{k_1 t}$
- (2) $1 + e^{k_1 t}$
- (3) $1 + e^{-k_1 t}$
- (4) $1 - e^{-k_1 t}$

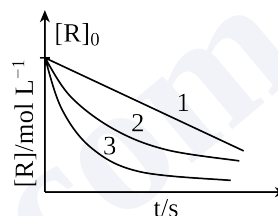
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Q.4 Consider the given graph showing variation of reactant concentration with time.

Three different reactions were started with identical initial concentration of reactants. Which of the following statement is correct?

[JEE Main 2026 (Online) 4th April Evening Shift]



- (1) The order of all the three reactions is same.
- (2) The rate constant of reaction 3 is larger than the rate constant of reaction 2 if the order of reaction is same for both.
- (3) The SI unit of rate constant of reaction 1 is s^{-1} .
- (4) Thermal decomposition of HI on gold surface is an example of reaction 2.

Scan or tap for the full solution



Q.5 $t_{100\%}$ is the time required for the 100% completion of the reaction while $t_{1/2}$ is the time required for 50% of the reaction to be completed. Which of the following option correctly represents the relation between $t_{100\%}$ and $t_{1/2}$ for zero and first order reactions respectively ?

[JEE Main 2026 (Online) 2nd April Morning Shift]

- (1) $t_{100\%} = (t_{1/2})^2$ and $t_{100\%} = (t_{1/2})^{-\infty}$
- (2) $t_{100\%} = 2t_{1/2}$ and $t_{100\%} = (t_{1/2})^\infty$
- (3) $t_{100\%} = 2t_{1/2}$ and $t_{100\%} = (2t_{1/2})^2$
- (4) $t_{100\%} = (t_{1/2})^\infty$ and $t_{100\%} = 2t_{1/2}$

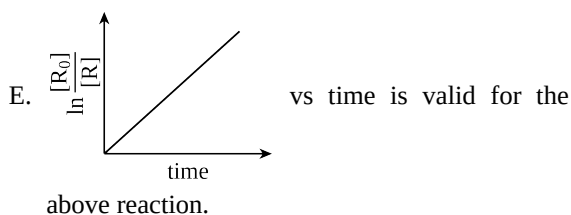
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Q.6 Consider the reaction $aX \rightarrow bY$, for which the rate constant at 30°C is $1 \times 10^{-3} \text{ mol}^{-1} \text{ L s}^{-1}$. Which of the following statements are true?

- A. When concentration of 'X' is increased to four times, the rate of reaction becomes 16 times.
- B. The reaction is a second order reaction.

- C. The half-life period is independent of the concentration of X.
 D. Decomposition of N_2O_5 is an example of the above reaction.



Choose the **correct** answer from the options given below: [JEE Main 2026 (Online) 2nd April Evening Shift]

- (1) A and B Only (2) A, B and C Only
 (3) A, B, D and E Only (4) C and D Only

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- Q.7** An organic compound undergoes first order decomposition. The time taken for decomposition to $\left(\frac{1}{8}\right)^{\text{th}}$ and $\left(\frac{1}{10}\right)^{\text{th}}$ of its initial concentration are $t_{1/8}$ and $t_{1/10}$ respectively.

What is the value of $\frac{t_{1/8}}{t_{1/10}} \times 10$?

($\log 2 = 0.3$)

[JEE Main 2026 (Online) 28th January Morning Shift]

- (1) 30 (2) 9 (3) 3 (4) 0.9

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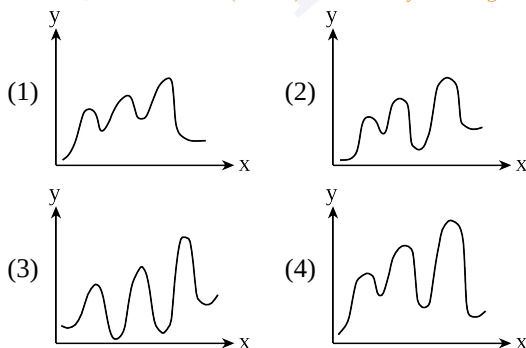


- Q.8** $\text{A} \longrightarrow \text{D}$ is an endothermic reaction occurring in three steps (elementary).

- (i) $\text{A} \longrightarrow \text{B}$, $\Delta H_i = +ve$
 (ii) $\text{B} \longrightarrow \text{C}$, $\Delta H_{ii} = -ve$
 (iii) $\text{C} \longrightarrow \text{D}$, $\Delta H_{iii} = -ve$

Which of the following graphs between potential energy (y-axis) vs reaction coordinate (x-axis) correctly represents the reaction profile of $\text{A} \longrightarrow \text{D}$?

[JEE Main 2026 (Online) 24th January Morning Shift]



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- Q.9** At 27°C in presence of a catalyst, activation energy of a reaction is lowered by 10 kJ mol^{-1} . The logarithm of ratio of $\frac{k(\text{catalysed})}{k(\text{uncatalysed})}$ is....

(Consider that the frequency factor for both the reactions is same)

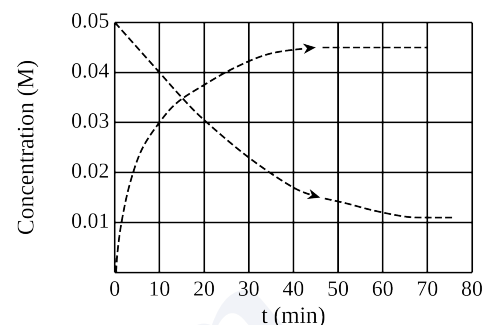
[JEE Main 2026 (Online) 24th January Morning Shift]

- (1) 1.741 (2) 0.1741 (3) 17.41 (4) 3.482

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Q.10



Given above is the concentration vs time plot for a dissociation reaction: $\text{A} \longrightarrow n\text{B}$.

Based on the data of the initial phase of the reaction (initial 10 min), the value of n is ____.

[JEE Main 2026 (Online) 23rd January Evening Shift]

- (1) 2 (2) 5 (3) 4 (4) 3

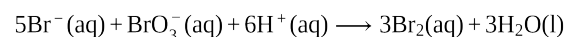
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- Q.11** Observe the following reactions at $T(\text{K})$.

I. $\text{A} \longrightarrow \text{products}$.

II.



Both the reactions are started at 10.00 am. The rates of these reactions at 10.10 am are same. The value of $-\frac{\Delta[\text{Br}^-]}{\Delta t}$ at 10.10 am is $2 \times 10^{-4} \text{ mol L}^{-1} \text{ min}^{-1}$.

The concentration of A at 10.10 am is $10^{-2} \text{ mol L}^{-1}$. What is the first order rate constant (in min^{-1}) of reaction I?

[JEE Main 2026 (Online) 23rd January Evening Shift]

- (1) 4×10^{-3} (2) 2×10^{-3} (3) 10^{-3} (4) 10^{-2}

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- Q.12** $\text{A} \longrightarrow \text{product}$ (First order reaction).

Three sets of experiments were performed for a reaction under similar experimental conditions:

Run 1 $\Rightarrow$

100 mL of 10 M solution of reactant A

Run 2

$\Rightarrow$

200 mL of 10 M solution of reactant A

Run 3

$\Rightarrow$

100 mL of 10 M solution of reactant A + 100 mL of H_2O added.

The correct variation of rate of reaction is

[JEE Main 2026 (Online) 22nd January Morning Shift]

- (1) $\text{Run 1} = \text{Run 2} = \text{Run 3}$
- (2) $\text{Run 3} < \text{Run 1} < \text{Run 2}$
- (3) $\text{Run 1} < \text{Run 2} < \text{Run 3}$
- (4) $\text{Run 3} < \text{Run 1} = \text{Run 2}$

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Q.13 Correct statements regarding Arrhenius equation among the following are :

- A. Factor $e^{-E_a/RT}$ corresponds to fraction of molecules having kinetic energy less than E_a .
- B. At a given temperature, lower the E_a , faster is the reaction.
- C. Increase in temperature by about 10°C doubles the rate of reaction.

D. Plot of $\log k$ vs $\frac{1}{T}$ gives a straight line with

$$\text{slope} = -\frac{E_a}{R}$$

Choose the correct answer from the options given below :

[JEE Main 2026 (Online) 22nd January Evening Shift]

- (1) A and B Only
- (2) B and D Only
- (3) B and C Only
- (4) A and C Only

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Q.14 Decomposition of A is a first order reaction at $T(K)$ and is given by $A(g) \longrightarrow B(g) + C(g)$.

In a closed 1 L vessel, 1 bar $A(g)$ is allowed to decompose at $T(K)$. After 100 minutes, the total pressure was 1.5 bar. What is the rate constant (min^{-1}) of the reaction? ($\log 2 = 0.3$)

[JEE Main 2026 (Online) 21st January Evening Shift]

- (1) 6.9×10^{-4}
- (2) 6.9×10^{-3}
- (3) 6.9×10^{-1}
- (4) 6.9×10^{-2}

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Q.15 In a first order decomposition reaction, the time taken for the decomposition of reactant to one fourth and one eighth of its initial concentration are t_1 and t_2 (s), respectively. The ratio t_1/t_2 will be:

[JEE Main 2025 (Online) 8th April Evening Shift]

- (1) $\frac{4}{3}$
- (2) $\frac{3}{2}$
- (3) $\frac{3}{4}$
- (4) $\frac{2}{3}$

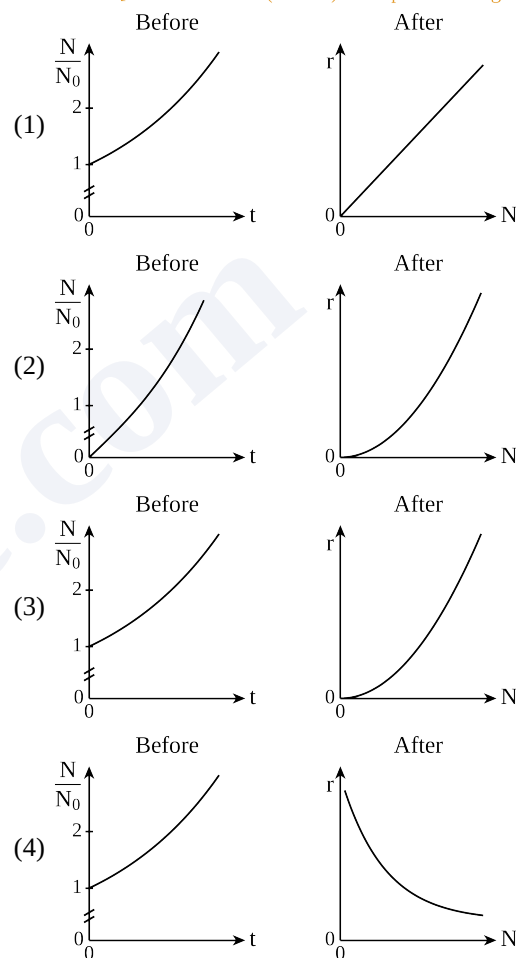
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Q.16 A person's wound was exposed to some bacteria and then bacterial growth started to happen at the same place. The wound was later treated with some antibacterial medicine and the rate of bacterial decay (r) was found to be proportional with the square of the existing number of bacteria at any instance. Which of the following set of graphs correctly represents the 'before' and 'after' situation of the application of the medicine?

[Given: N = No. of bacteria, t = time, bacterial growth follows 1^{st} order kinetics.]

[JEE Main 2025 (Online) 7th April Morning Shift]



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Q.17 Reaction $A(g) \longrightarrow 2B(g) + C(g)$ is a first order reaction. It was started with pure A.

t/min	Pressure of system at time t/mm Hg
10	160
∞	240

Which of the following option is incorrect?

[JEE Main 2025 (Online) 7th April Morning Shift]

- (1) Initial pressure of A is 80 mm Hg
- (2) The reaction never goes to completion
- (3) Partial pressure of A after 10 minutes is 40 mm Hg
- (4) Rate constant of the reaction is 1.693 min^{-1}

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Q.18 $A(g) \longrightarrow B(g) + C(g)$ is a first order reaction.

Time	t	∞
P_{system}	P_t	P_{∞}

The reaction was started with reactant A only. Which of the following expressions is correct for rate constant k?

[JEE Main 2025 (Online) 7th April Evening Shift]

- (1) $k = \frac{1}{t} \ln \frac{P_{\infty}}{P_t}$
- (2) $k = \frac{1}{t} \ln \frac{P_{\infty}}{2(P_{\infty} - P_t)}$
- (3) $k = \frac{1}{t} \ln \frac{2(P_{\infty} - P_t)}{P_t}$
- (4) $k = \frac{1}{t} \ln \frac{P_{\infty}}{(P_{\infty} - P_t)}$

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Q.19 For $A_2 + B_2 \rightleftharpoons 2AB$

E_a for forward and backward reaction are 180 and 200 kJ mol^{-1} respectively.

If catalyst lowers E_a for both reactions by 100 kJ mol^{-1} .

Which of the following statement is correct?

[JEE Main 2025 (Online) 4th April Morning Shift]

- (1) Catalyst does not alter the Gibbs energy change of a reaction.
- (2) The enthalpy change for the reaction is $+20 \text{ kJ mol}^{-1}$.
- (3) Catalyst can cause non-spontaneous reactions to occur.
- (4) The enthalpy change for the catalysed reaction is different from that of uncatalysed reaction.

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Q.20 Rate law for a reaction between A and B is given by $r = k[A]^n[B]^m$

If concentration of A is doubled and concentration of B is halved from their initial value, the ratio of new rate of reaction to the initial rate of reaction

$\left(\frac{r_2}{r_1}\right)$ is [JEE Main 2025 (Online) 4th April Morning Shift]

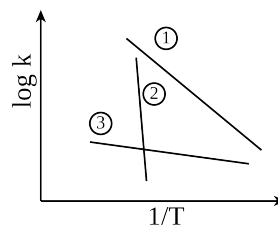
- (1) $(n-m)$
- (2) $2^{(n-m)}$
- (3) $\frac{1}{2^{m+n}}$
- (4) $(m+n)$

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Q.21 Consider the following plots of log of rate constant k ($\log k$) vs $\frac{1}{T}$ for three different reactions. The correct order of activation energies of these reactions is :

[JEE Main 2025 (Online) 4th April Evening Shift]



- (1) $E_{a2} > E_{a1} > E_{a3}$
- (2) $E_{a1} > E_{a3} > E_{a2}$
- (3) $E_{a3} > E_{a2} > E_{a1}$
- (4) $E_{a1} > E_{a2} > E_{a3}$

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Q.22 Half life of zero order reaction $A \longrightarrow$ product is 1 hour, when initial concentration of reactant is 2.0 mol L^{-1} . The time required to decrease concentration of A from 0.50 to 0.25 mol L^{-1} is :

[JEE Main 2025 (Online) 4th April Evening Shift]

- (1) 0.5 hour
- (2) 15 min
- (3) 60 min
- (4) 4 hour

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Q.23 In a reaction $A + B \longrightarrow C$, initial concentrations of A and B are related as $[A]_0 = 8[B]_0$. The half-lives of A and B are 10 min and 40 min, respectively. If they start to disappear at the same time, both following first order kinetics, after how much time will the concentration of both the reactants be same?

[JEE Main 2025 (Online) 3rd April Morning Shift]

- (1) 20 min
- (2) 40 min
- (3) 80 min
- (4) 60 min

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Q.24 Consider the following statements related to temperature dependence of rate constants.

- The Arrhenius equation holds true only for an elementary homogeneous reaction.
- The unit of A is same as that of k in Arrhenius equation.
- At a given temperature, a low activation energy means a fast reaction.
- A and E_a as used in Arrhenius equation depend on temperature.
- When $E_a \gg RT$, A and E_a become interdependent.

Identify the correct statements.

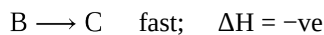
Choose the correct answer from the options given below: [JEE Main 2025 (Online) 3rd April Evening Shift]

- (1) A, C and D Only
- (2) B, D and E Only
- (3) B and C Only
- (4) A and B Only

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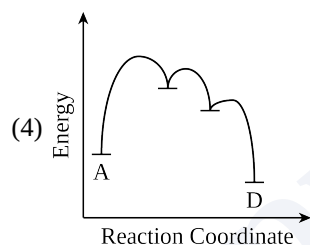
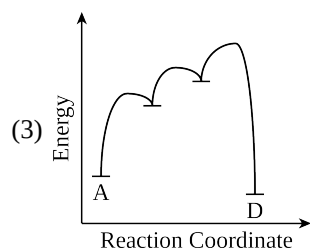
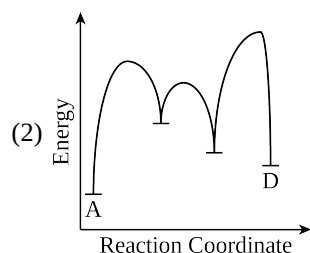
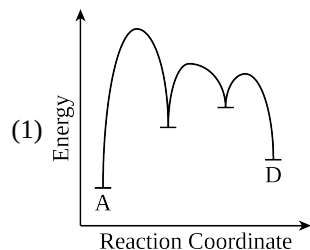


Q.25 Reactant A converts to product D through the given mechanism (with the net evolution of heat):



Which of the following represents the above reaction mechanism?

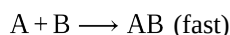
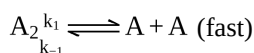
[JEE Main 2025 (Online) 2nd April Evening Shift]



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Q.26 The reaction $A_2 + B_2 \longrightarrow 2AB$ follows the mechanism:



The overall order of the reaction is:

[JEE Main 2025 (Online) 29th January Morning Shift]

- (1) 3 (2) 2.5 (3) 1.5 (4) 2

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Q.27

$[A]_0/\text{mol L}^{-1}$	$t_{1/2}/\text{min}$
0.100	200
0.025	100

For a given reaction $R \longrightarrow P$, $t_{1/2}$ is related to $[A]_0$ as given in table.

Given: $\log 2 = 0.30$

Which of the following is true?

- A. The order of the reaction is $1/2$.
 B. If $[A]_0$ is 1 M, then $t_{1/2}$ is $200\sqrt{10}$ min
 C. The order of the reaction changes to 1 if the concentration of reactant changes from 0.100 M to 0.500 M.
 D. $t_{1/2}$ is 800 min for $[A]_0 = 1.6$ M

Choose the correct answer from the options given below:

[JEE Main 2025 (Online) 28th January Morning Shift]

- (1) A and C Only (2) A, B and D Only
 (3) A and B Only (4) C and D Only

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Q.28 Consider an elementary reaction



If the volume of reaction mixture is suddenly reduced to $\frac{1}{3}$ of its initial volume, the reaction rate will become 'x' times of the original reaction rate. The value of x is :

[JEE Main 2025 (Online) 28th January Evening Shift]

- (1) 3 (2) 9 (3) $\frac{1}{3}$ (4) $\frac{1}{9}$

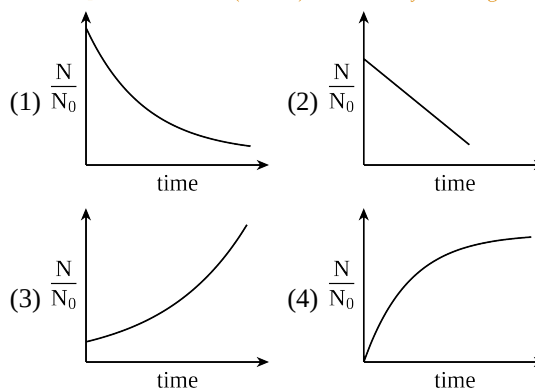
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Q.29 For bacterial growth in a cell culture, growth law is very similar to the law of radioactive decay. Which of the following graphs is most suitable to represent bacterial colony growth?

Where N - Number of bacteria at any time, N_0 - Initial number of bacteria.

[JEE Main 2025 (Online) 28th January Evening Shift]



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Section B (Numerical)

- Q.30** Sucrose hydrolyses in acidic medium into glucose and fructose by first order rate law with $t_{1/2} = 3$ hour. The percentage of sucrose remaining after 6 hours is _____. (Nearest integer)
(Given : $\log 2 = 0.3010$ and $\log 3 = 0.4771$)

[JEE Main 2026 (Online) 6th April Morning Shift]

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- Q.31** Decomposition of a hydrocarbon follows the equation $k = (5.5 \times 10^{11} \text{ s}^{-1}) e^{-28000 \text{ K/T}}$. The activation energy of reaction is _____ kJ mol^{-1} . (Nearest Integer)

Given : $R = 8.3 \text{ J K}^{-1} \text{ mol}^{-1}$

[JEE Main 2026 (Online) 6th April Evening Shift]

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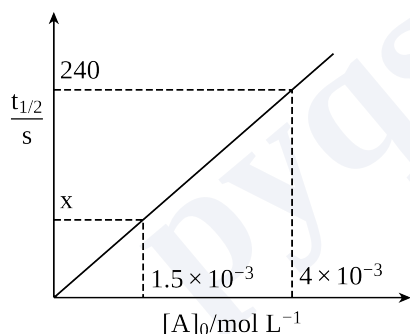
- Q.32** If the half life of a first order reaction is 6.93 minutes then the time required for completion of 99% of the reaction will be _____ minutes. (Given : $\log 2 = 0.3010$)

[JEE Main 2026 (Online) 5th April Morning Shift]

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- Q.33** For a reaction $A \rightarrow P$ at $T \text{ K}$, the half life ($t_{1/2}$) is plotted as a function of initial concentration $[A]_0$ of A as given below.



The value of x in the given figure is _____ s (Nearest integer)

[JEE Main 2026 (Online) 5th April Evening Shift]

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- Q.34** For a first order reaction $A \rightarrow B$

t/min	[A]/M
0	0.6500
x	0.0650
20	0.00065

$x =$ _____ min. (Nearest integer)

[JEE Main 2026 (Online) 4th April Evening Shift]

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- Q.35** For reaction $A \rightarrow P$, rate constant

$$k = 1.5 \times 10^3 \text{ s}^{-1} \text{ at } 27^\circ\text{C}$$

If activation energy for the above reaction is 60 kJ mol^{-1} , then the temperature (in $^\circ\text{C}$) at which rate constant, $k = 4.5 \times 10^3 \text{ s}^{-1}$ is _____. (Nearest integer)

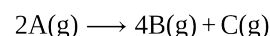
Given : $\log 2 = 0.30$, $\log 3 = 0.48$, $R = 8.3 \text{ J K}^{-1} \text{ mol}^{-1}$, $\ln 10 = 2.3$

[JEE Main 2026 (Online) 2nd April Morning Shift]

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- Q.36** Consider the following gas phase reaction being carried out in a closed vessel at 25°C .



time (min)	total pressure of the system (mm Hg)
30	300
∞	600

The pressure of $C(g)$ at 30 minutes time interval would be _____ mm Hg. (nearest integer)

[JEE Main 2026 (Online) 2nd April Evening Shift]

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- Q.37** $A \rightarrow B$

(first reaction)

$C \rightarrow D$

(second reaction)

Consider the above two first-order reactions. The rate constant for first reaction at 500 K is double of the same at 300 K . At 500 K , 50% of the reaction becomes complete in 2 hours. The activation energy of the second reaction is half of that of first reaction. If the rate constant at 500 K of the second reaction becomes double of the rate constant of first reaction at the same temperature; then rate constant for the second reaction at 300 K is _____ $\times 10^{-1} \text{ hour}^{-1}$ (nearest integer).

[JEE Main 2026 (Online) 28th January Evening Shift]

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- Q.38** The half-life of ^{65}Zn is 245 days. After x days, 75% of original activity remained. The value of x in days is _____. (Nearest integer)

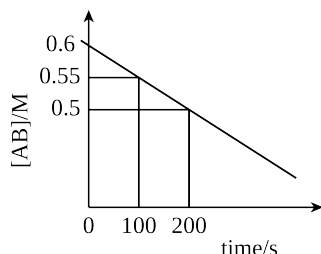
(Given: $\log 3 = 0.4771$ and $\log 2 = 0.3010$)

[JEE Main 2026 (Online) 24th January Evening Shift]

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- Q.39** For the thermal decomposition of reactant $AB(g)$, the following plot is constructed.



The half-life of the reaction is 'x' min.

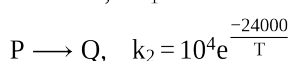
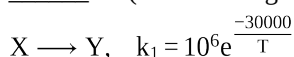
x = _____ min. (Nearest integer)

[JEE Main 2026 (Online) 23rd January Morning Shift]

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Q.40 The temperature at which the rate constants of the given below two gaseous reactions become equal is _____ K. (Nearest integer)



Given : $\ln 10 = 2.303$

[JEE Main 2026 (Online) 22nd January Morning Shift]

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Q.41 Consider $A \xrightarrow{k_1} B$ and $C \xrightarrow{k_2} D$ are two reactions. If the rate constant (k_1) of the $A \longrightarrow B$ reaction can be expressed by the following equation

$$\log_{10} k = 14.34 - \frac{1.5 \times 10^4}{T/K} \text{ and activation energy of}$$

$C \longrightarrow D$ reaction (E_{a_2}) is $\frac{1}{5}$ th of the $A \longrightarrow B$ reaction (E_{a_1}), then the value of (E_{a_2}) is _____ kJ mol^{-1} . (Nearest Integer)

[JEE Main 2026 (Online) 22nd January Evening Shift]

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Q.42 Pre-exponential factors of two different reactions of same order are identical. Let activation energy of first reaction exceed the activation energy of second reaction by 20 kJ mol^{-1} . If k_1 and k_2 are the rate constants of first and second reaction respectively at 300 K , then $\ln \frac{k_2}{k_1}$ will be _____. (nearest integer)

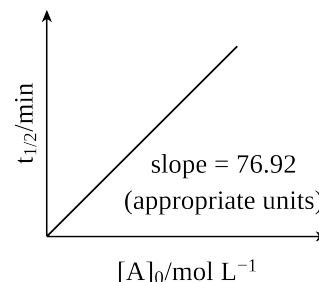
[$R = 8.3 \text{ J K}^{-1} \text{ mol}^{-1}$]

[JEE Main 2026 (Online) 21st January Morning Shift]

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Q.43 For the reaction $A \longrightarrow \text{products}$.



The concentration of A at 10 minutes is _____ $\times 10^{-3} \text{ mol L}^{-1}$ (nearest integer). The reaction was started with 2.5 mol L^{-1} of A.

[JEE Main 2025 (Online) 2nd April Morning Shift]

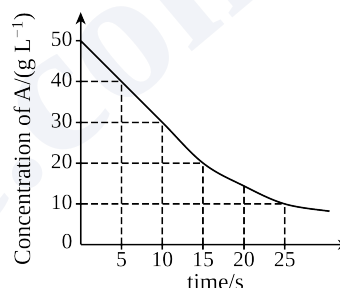
Scan or tap for the full solution



Q.44 For the reaction $A \longrightarrow B$ the following graph was obtained. The time required (in seconds) for the concentration of A to reduce to 2.5 g L^{-1} (if the initial concentration of A was 50 g L^{-1}) is _____. (Nearest integer)

Given : $\log 2 = 0.3010$

[JEE Main 2025 (Online) 2nd April Evening Shift]



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ANSWER KEY

Section A (MCQ)

Ques.	1	2	3	4	5	6	7	8	9	10	11
Ans.	3	1	4	2	2	1	2	4	1	4	1
Ques.	12	13	14	15	16	17	18	19	20	21	22
Ans.	4	3	2	4	3	4	2	1	2	1	2
Ques.	23	24	25	26	27	28	29				
Ans.	2	3	4	3	2	2	3				

Section B (Numerical)

Ques.	30	31	32	33	34	35	36
Ans.	25	232	46	90	7	41	20
Ques.	37	38	39	40	41	42	43
Ans.	5	102	10	1303	57	8	2435
Ques.	44						
Ans.	43						