

JEE MAIN CHEMICAL KINETICS — TEMPERATURE DEPENDENCE OF THE RATE OF A REACTION AND ARRHENIUS EQUATION — PYQS

Max. Marks: 40

Questions: 10

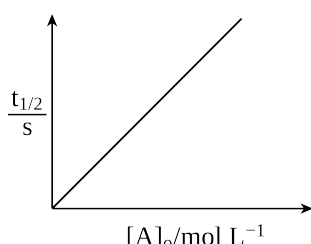
Section A (MCQ) — 4 questions

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

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Q.2 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]

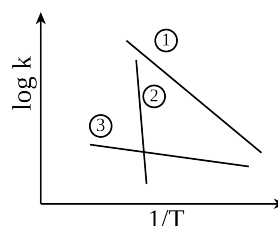
- (1) A and B Only
- (2) B and D Only
- (3) B and C Only
- (4) A and C Only

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Q.3 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.4 Consider the following statements related to temperature dependence of rate constants.

- A. The Arrhenius equation holds true only for an elementary homogeneous reaction.
- B. The unit of A is same as that of k in Arrhenius equation.
- C. At a given temperature, a low activation energy means a fast reaction.
- D. A and E_a as used in Arrhenius equation depend on temperature.
- E. 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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Section B (Numerical) — 6 questions

Q.5 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.6** For reaction $A \longrightarrow P$, rate constant $k = 1.5 \times 10^3 \text{ s}^{-1}$ at 27°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.7** $A \rightarrow B$ (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.8** The temperature at which the rate constants of the given below two gaseous reactions become equal is _____ K . (Nearest integer)
- $X \longrightarrow Y, \quad k_1 = 10^6 e^{\frac{-30000}{T}}$
 $P \longrightarrow Q, \quad k_2 = 10^4 e^{\frac{-24000}{T}}$
- Given : $\ln 10 = 2.303$

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

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- Q.9** 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
- $$\log_{10} k = 14.34 - \frac{1.5 \times 10^4}{T/\text{K}}$$
- 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.10** 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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ANSWER KEY

Section A (MCQ) — 4 questions

Ques.	1	2	3	4						
Ans.	3	3	1	3						

Section B (Numerical) — 6 questions

Ques.	5	6	7	8	9	10	
Ans.	232	41	5	1303	57	8	