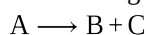


JEE MAIN CHEMICAL KINETICS — INTEGRATED RATE LAW OF FIRST ORDER REACTION — PYQS

Max. Marks: 56

Questions: 14

Section A (MCQ) — 11 questions

Q.1 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) $\frac{1}{t} \ln \frac{3p_i}{4p_i - p_t}$

Scan or tap for the full solution

**Q.2** Consider the first order reaction $R \longrightarrow P$.

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) $1 - e^{-k_1 t}$

Scan or tap for the full solution



Q.3 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.4 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.5 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) $\frac{2}{3}$

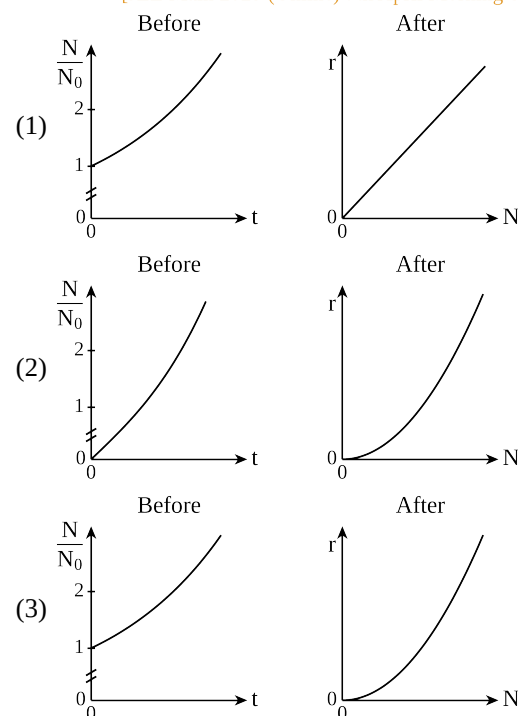
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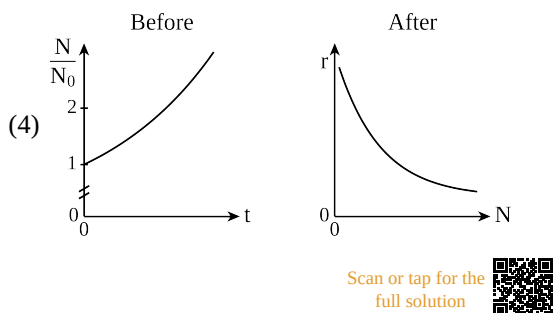


Q.6 A person's wound was exposed to some bacteria and then bacterial growth started to happen at the same place. The wound was later treated with some antibacterial medicine and the rate of bacterial decay (r) was found to be proportional with the square of the existing number of bacteria at any instance. 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 1st order kinetics.]

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





Q.7 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}

Scan or tap for the full solution

Q.8 $A(g) \longrightarrow B(g) + C(g)$ 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]

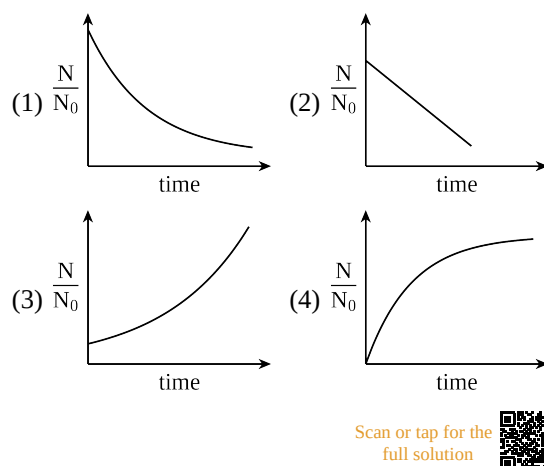
- (1) $k = \frac{1}{t} \ln \frac{P_{\infty}}{P_t}$
- (2) $k = \frac{1}{t} \ln \frac{P_{\infty}}{2(P_{\infty} - P_t)}$
- (3) $k = \frac{1}{t} \ln \frac{2(P_{\infty} - P_t)}{P_t}$
- (4) $k = \frac{1}{t} \ln \frac{P_{\infty}}{(P_{\infty} - P_t)}$

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Q.9 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]



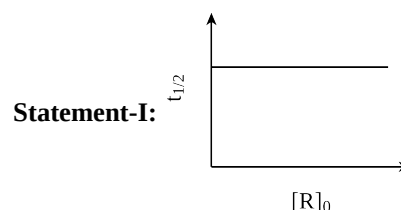
Q.10 For a reaction, $N_2O_5(g) \longrightarrow 2NO_2(g) + \frac{1}{2}O_2(g)$ in a constant volume container, no products were present initially. The final pressure of the system when 50% of reaction gets completed is

[JEE Main 2025 (Online) 24th January Morning Shift]

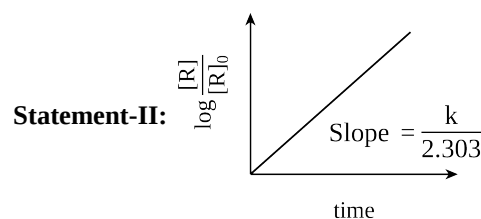
- (1) $5/2$ times of initial pressure
- (2) $7/2$ times of initial pressure
- (3) $7/4$ times of initial pressure
- (4) 5 times of initial pressure

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Q.11 Given below are two statements :



is valid for first order reaction.



is valid for first order reaction.

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

[JEE Main 2025 (Online) 24th January Evening Shift]

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

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Section B (Numerical) — 3 questions

- Q.12** 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.13** For a first order reaction $A \rightarrow B$

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

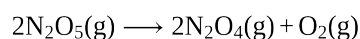
x = _____ min. (Nearest integer)

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

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- Q.14** For the thermal decomposition of $N_2O_5(g)$ at constant volume, the following table can be formed, for the reaction mentioned below.



Sr. No.	Time/s	Total pressure/(atm)
1	0	0.6
2	100	'x'

x = _____ $\times 10^{-3}$ atm [nearest integer]

Given : Rate constant for the reaction is $4.606 \times 10^{-2} \text{ s}^{-1}$.

[JEE Main 2025 (Online) 23rd January Morning Shift]

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ANSWER KEY

Section A (MCQ) — 11 questions

Ques.	1	2	3	4	5	6	7	8	9	10	11
Ans.	1	4	2	2	4	3	4	2	3	3	2

Section B (Numerical) — 3 questions

Ques.	12	13	14				
Ans.	46	7	897				