CHEMISTRY (CODE – 043)

Chapter-wise Test: Chemical Kinetics

(NCERT Class XII Chemistry, Unit 3: Chemical Kinetics)

PRACTICE QUESTION PAPER

CLASS XII (2026-27)

Time: 1½ hours **Max. Marks: 35**

GENERAL INSTRUCTIONS: Read the following instructions carefully.

1. There are 17 questions in this question paper with internal choice. All questions are based on Unit 3: Chemical Kinetics.
2. SECTION A consists of 8 multiple-choice questions carrying 1 mark each.
3. SECTION B consists of 3 very short answer questions carrying 2 marks each.
4. SECTION C consists of 4 short answer questions carrying 3 marks each.
5. SECTION D consists of 1 case-based question carrying 4 marks.
6. SECTION E consists of 1 long answer question carrying 5 marks.
7. All questions are compulsory. Internal choice is provided in Questions 9 to 15, 16(iii) and 17.
8. Questions 2, 3, 9, 12, 13, 14 and 16 are based on figures, structures or data tables given in the paper.
9. Use of log tables and calculators is not allowed.

SECTION A

Questions 1 to 8 are multiple choice questions. Only one of the choices is correct. Select and write the correct choice as well as the answer to these questions. Each question carries 1 mark.

1 The unit of the rate constant (k) of a zero order reaction is: 1

A. s^{-1}
B. L mol^{-1} s^{-1}
C. mol L^{-1} s^{-1}
D. L^2 mol^{-2} s^{-1}

2 For a reaction R → P, a plot of ln [R] against time (t) gave the straight line shown in Fig. 1. 1

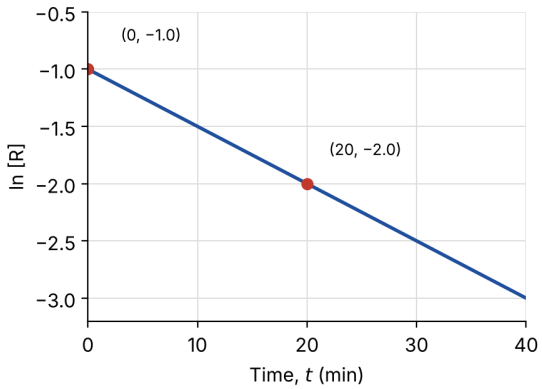


Fig. 1

The order of the reaction and the value of the rate constant are:

A. zero order, k = 0.05 mol L^{-1} min^{-1}
B. first order, k = 0.05 min^{-1}
C. first order, k = 0.5 min^{-1}
D. second order, k = 0.05 L mol^{-1} min^{-1}

3 (1)

The initial rates of a reaction A + B → Products were measured at different initial concentrations, as given in the table.

Experiment	[A] (mol L^{-1})	[B] (mol L^{-1})	Initial rate (mol L^{-1} s^{-1})
1	0.10	0.10	2.0×10^{-3}
2	0.20	0.10	4.0×10^{-3}
3	0.10	0.20	8.0×10^{-3}

The rate law for the reaction is:

A. rate = $k[A]^2[B]$
B. rate = $k[A][B]$
C. rate = $k[A]^2[B]^2$
D. rate = $k[A][B]^2$

4 (1)

The rate constant of a first order reaction is 0.0693 min^{-1}. The half-life of the reaction is:

A. 1 min
B. 100 min
C. 0.693 min
D. 10 min

5 (1)

Which of the following statements is correct?

A. The order of a reaction can be zero or fractional, but molecularity cannot.
B. The order of a reaction is always equal to its molecularity.
C. Molecularity of a reaction can be zero.
D. Molecularity of a reaction is determined experimentally.

6 (1)

A catalyst increases the rate of a reaction because it:

A. increases the activation energy of the reaction
B. makes ΔG of the reaction more negative
C. provides an alternative pathway of lower activation energy
D. increases the equilibrium constant

7 (1)

A first order reaction is 50% complete in 20 minutes. The time required for it to be 75% complete is:

A. 30 min
B. 40 min
C. 60 min
D. 80 min

8 (1)

Assertion (A): The hydrolysis of ethyl ethanoate in the presence of a large excess of water is a pseudo first order reaction.

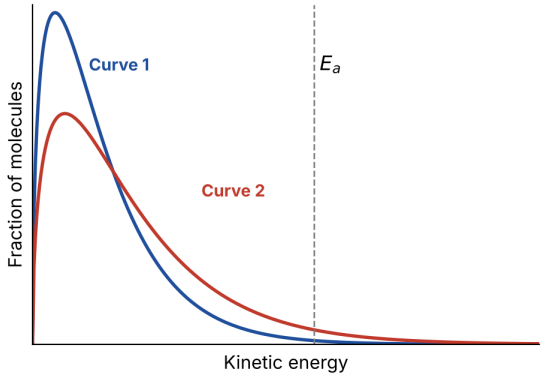
Reason (R): The concentration of water remains almost constant during the reaction, so the rate depends only on the concentration of the ester.

Select the most appropriate answer from the options given below:

A. Both A and R are true, and R is the correct explanation of A.
B. Both A and R are true, and R is not the correct explanation of A.
C. A is true but R is false.
D. A is false but R is true.

SECTION B

Question Nos. 9 to 11 are very short answer questions carrying 2 marks each.

9	**Attempt either A or B.** **(A)** Fig. 2 shows the distribution of kinetic energy among the molecules of a gas at two temperatures, T and $(T + 10)$ K. The dashed line marks the activation energy (E_a).  **Fig. 2** (i) Which curve represents the higher temperature? Give a reason. (ii) Why does the rate of a reaction nearly double for a 10 K rise in temperature? **OR** **(B)** (i) Write the Arrhenius equation and name the terms A and E_a. (ii) What does the factor $e^{-Ea/RT}$ represent?	1+1
10	**Attempt either A or B.** **(A)** Write any two differences between the molecularity and the order of a reaction. **OR** **(B)** (i) What are pseudo first order reactions? (ii) Give one example.	1+1
11	**Attempt either A or B.** **(A)** A first order reaction has a rate constant of 2.31×10^{-2} min^{-1}. Calculate its half-life and the time required for 8 g of the reactant to reduce to 1 g. (Take $0.693 = 2.31 \times 0.3$.) **OR** **(B)** For a zero order reaction the initial concentration of the reactant is 0.8 mol L^{-1} and the rate constant is 2×10^{-2} mol L^{-1} s^{-1}. Calculate the half-life and the time taken for the reaction to go to completion.	1+1

SECTION C

Question Nos. 12 to 15 are short answer questions carrying 3 marks each.

12 **Attempt either A or B.** 1+1+1

(A) The initial rate of the reaction A + B → Products was measured for different initial concentrations of A and B as given in the table.

Experiment	[A] (mol L^{-1})	[B] (mol L^{-1})	Initial rate (mol L^{-1} s^{-1})
1	0.10	0.10	0.004
2	0.20	0.10	0.016
3	0.20	0.20	0.016
4	0.30	0.20	0.036

(i) Find the order of the reaction with respect to A and with respect to B.
(ii) Write the rate law and the overall order of the reaction.
(iii) Calculate the rate constant and give its unit.

OR

(B) The rate law of a reaction is: rate = $k[A]^{1/2}[B]^{2}$.
(i) What is the overall order of the reaction?
(ii) What is the unit of k if concentration is in mol L^{-1} and time in s?
(iii) How will the rate change if [A] is quadrupled and [B] is halved?

13 **Attempt either A or B.** 1+1+1

(A) Fig. 3 shows a plot of ln k against $1/T$ for a reaction. P and Q are two points on the straight line.

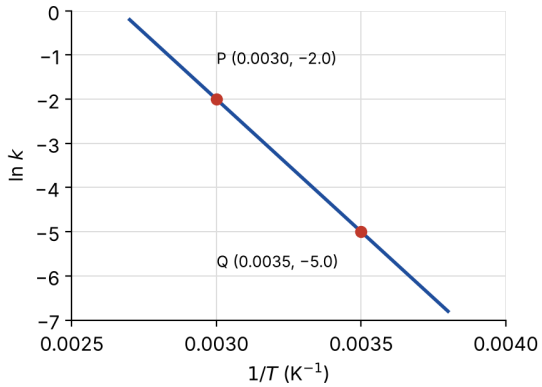
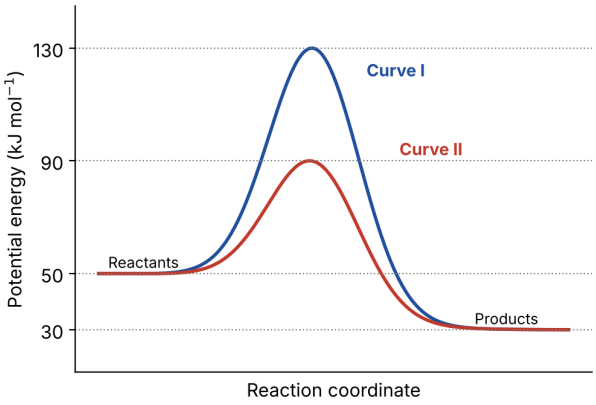


Fig. 3

(i) What does the slope of this line represent?
(ii) Calculate the activation energy of the reaction from the graph. (R = 8.314 J K^{-1} mol^{-1})
(iii) What does the intercept obtained on extrapolating the line to $1/T = 0$ represent? What is its value?

OR

(B) The rate constant of a reaction doubles when the temperature is raised from 300 K to 310 K. Calculate the activation energy of the reaction. (log 2 = 0.301; R = 8.314 J K^{-1} mol^{-1})

14	**Attempt either A or B.** **(A)** Fig. 4 shows the potential energy diagrams for the same reaction taking place by two different paths, Curve I and Curve II. One of the paths is in the presence of a catalyst.  **Fig. 4** (i) Which curve represents the catalysed reaction? Give a reason. (ii) Calculate the activation energy of the forward reaction for Curve I and for Curve II. (iii) Calculate ΔH of the reaction. How does the catalyst affect ΔH and the equilibrium constant? **OR** **(B)** Derive the integrated rate equation $k = (2.303/t)\ \log\ ([R]_0/[R])$ for a first order reaction R → P.	1+1+1
15	**Attempt either A or B.** **(A)** Show that for a first order reaction the time required for 99% completion is twice the time required for 90% completion. **OR** **(B)** A first order reaction has a rate constant of $1.15 \times 10^{-3}\ s^{-1}$. How long will 5 g of the reactant take to reduce to 3 g? (log 5 = 0.6990; log 3 = 0.4771)	1+1+1

SECTION D

Question No. 16 is a case-based/data-based question carrying 4 marks.

16 **Decomposition of hydrogen peroxide** 1+1+2

A student studied the decomposition of hydrogen peroxide in the presence of a catalyst at constant temperature: $2H_2O_2 \rightarrow 2H_2O + O_2$. The concentration of H_2O_2 was measured at regular intervals and recorded in the table.

Time (min)	0	15	30	45
$[H_2O_2]$ (mol L^{-1})	0.80	0.40	0.20	0.10

Answer the following questions:

(i) What is the order of the reaction? Justify your answer from the data in the table.
(ii) Calculate the rate constant of the reaction. (Take 0.693 = 0.0462 × 15)
(iii) **Attempt either A or B.**
(A) Calculate the concentration of H_2O_2 remaining after 60 minutes.
OR
(B) Calculate the time taken for the concentration of H_2O_2 to fall to 0.025 mol L^{-1}.

SECTION E

Question No. 17 is a long answer question carrying 5 marks.

17 **Attempt either A or B.** 5

(A) (i) Write the Arrhenius equation in the logarithmic form for the rate constants k_1 and k_2 at two temperatures T_1 and T_2.
(ii) The rate constant of a reaction doubles when the temperature rises from 300 K to 310 K. Calculate the activation energy. (log 2 = 0.301; R = 8.314 J K^{-1} mol^{-1})
(iii) What is the effect of a catalyst on the activation energy and on the Gibbs energy change (ΔG) of a reaction?
(iv) How can E_a be determined graphically from the rate constants measured at different temperatures?

OR

(B) (i) Define half-life of a reaction. Show that the half-life of a first order reaction is independent of the initial concentration.
(ii) A first order reaction takes 40 minutes for 30% decomposition. Calculate its half-life. (log 7 = 0.8451; log 10 = 1)

— End of Question Paper —