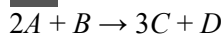


**DEFINITION, RATE CONSTANT, RATE LAW - LEVEL I**

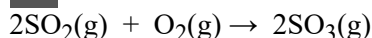
**1** For the reaction



An incorrect expression for the rate of reaction is:

1.  $-\frac{d[C]}{3} dt$
2.  $-\frac{d[B]}{dt}$
3.  $\frac{d[D]}{dt}$
4.  $-\frac{d[A]}{2dt}$

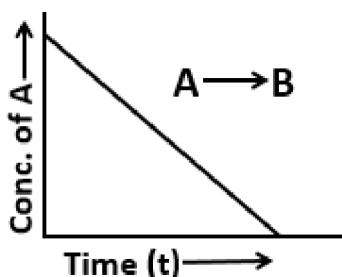
**2** The following reaction was carried out at 300 K.



The rate of formation of  $SO_3$  is related to the rate of disappearance of  $O_2$  by the following expression:

1.  $-\frac{\Delta[O_2]}{\Delta t} = +\frac{1}{2} \frac{\Delta[SO_3]}{\Delta t}$
2.  $-\frac{\Delta[O_2]}{\Delta t} = \frac{\Delta[SO_3]}{\Delta t}$
3.  $-\frac{\Delta[O_2]}{\Delta t} = -\frac{1}{2} \frac{\Delta[SO_3]}{\Delta t}$
4. None of the above.

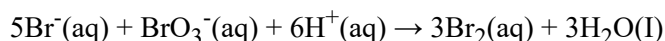
**3** For a general reaction  $A \rightarrow B$ , the plot of the concentration of A vs. time is given in the figure.



The slope of the curve will be:

1. -k
2. -k/2
3. -k<sup>2</sup>
4. -k/3

**4** The correct expression for the rate of reaction given below is:



1.  $\frac{\Delta[Br^-]}{\Delta t} = 5 \frac{\Delta[H^+]}{\Delta t}$
2.  $\frac{\Delta[Br^-]}{\Delta t} = \frac{6}{5} \frac{\Delta[H^+]}{\Delta t}$
3.  $\frac{\Delta[Br^-]}{\Delta t} = \frac{5}{6} \frac{\Delta[H^+]}{\Delta t}$
4.  $\frac{\Delta[Br^-]}{\Delta t} = 6 \frac{\Delta[H^+]}{\Delta t}$

**5** A reaction is first-order with respect to A and second-order with respect to B. The concentration of B is increased three times. The new rate of the reaction would:

1. Decrease 9 times.
2. Increase 9 times.
3. Increase 6 times.
4. Decrease 6 times.

**6** For the reaction,



the value of the rate of disappearance of  $N_2O_5$  is given as  $6.25 \times 10^{-3} \text{ mol L}^{-1} \text{ s}^{-1}$ . The rate of formation of  $NO_2$  and  $O_2$  is given respectively as:

1.  $6.25 \times 10^{-3} \text{ mol L}^{-1} \text{ s}^{-1}$  and  $6.25 \times 10^{-3} \text{ mol L}^{-1} \text{ s}^{-1}$
2.  $1.25 \times 10^{-2} \text{ mol L}^{-1} \text{ s}^{-1}$  and  $3.125 \times 10^{-3} \text{ mol L}^{-1} \text{ s}^{-1}$
3.  $6.25 \times 10^{-3} \text{ mol L}^{-1} \text{ s}^{-1}$  and  $3.125 \times 10^{-3} \text{ mol L}^{-1} \text{ s}^{-1}$
4.  $1.25 \times 10^{-2} \text{ mol L}^{-1} \text{ s}^{-1}$  and  $6.25 \times 10^{-3} \text{ mol L}^{-1} \text{ s}^{-1}$

**7** During the formation of ammonia by Haber's process  $N_2 + 3H_2 \rightarrow 2NH_3$ , the rate of appearance of  $NH_3$  was measured as  $2.5 \times 10^{-4} \text{ mol L}^{-1} \text{ s}^{-1}$ . The rate of disappearance of  $H_2$  will be:

1.  $2.5 \times 10^{-4} \text{ mol L}^{-1} \text{ s}^{-1}$
2.  $1.25 \times 10^{-4} \text{ mol L}^{-1} \text{ s}^{-1}$
3.  $3.75 \times 10^{-4} \text{ mol L}^{-1} \text{ s}^{-1}$
4.  $15.00 \times 10^{-4} \text{ mol L}^{-1} \text{ s}^{-1}$

**8** For the reaction,  $N_2 + 3H_2 \rightarrow 2NH_3$ , if,  $\frac{d[NH_3]}{dt} = 2 \times 10^{-4} \text{ mol L}^{-1} \text{ s}^{-1}$ , the value of  $\frac{-d[H_2]}{dt}$  would be:

1.  $3 \times 10^{-4} \text{ mol L}^{-1} \text{ s}^{-1}$
2.  $4 \times 10^{-4} \text{ mol L}^{-1} \text{ s}^{-1}$
3.  $6 \times 10^{-4} \text{ mol L}^{-1} \text{ s}^{-1}$
4.  $1 \times 10^{-4} \text{ mol L}^{-1} \text{ s}^{-1}$

**9** The rate constant of a particular reaction has the dimension of frequency. The order of the reaction is:

1. Zero.
2. First.
3. Second.
4. Fractional.

**10** The incorrect statement regarding the order of reaction is:

1.	Order is not influenced by the stoichiometric coefficient of the reactants.
2.	Order of reaction is the sum of power to the concentration terms of reactants to express the rate of reaction.
3.	The order of reaction is always a whole number.
4.	Order can be determined by experiments only.

**11** The decomposition of  $\text{NH}_3$  on a platinum surface is a zero-order reaction. The rates of production of  $\text{N}_2$  and  $\text{H}_2$  will be respectively:

(given ;  $k = 2.5 \times 10^{-4} \text{ mol}^{-1} \text{ L s}^{-1}$ )

1.  $2.5 \times 10^{-4} \text{ mol L}^{-1} \text{ s}^{-1}$  and  $5.5 \times 10^{-4} \text{ mol L}^{-1} \text{ s}^{-1}$
2.  $2.5 \times 10^{-4} \text{ mol L}^{-1} \text{ s}^{-1}$  and  $7.5 \times 10^{-4} \text{ mol L}^{-1} \text{ s}^{-1}$
3.  $1.5 \times 10^{-4} \text{ mol L}^{-1} \text{ s}^{-1}$  and  $4.5 \times 10^{-4} \text{ mol L}^{-1} \text{ s}^{-1}$
4.  $0.5 \times 10^{-4} \text{ mol L}^{-1} \text{ s}^{-1}$  and  $3.5 \times 10^{-4} \text{ mol L}^{-1} \text{ s}^{-1}$

**12** Match the items in Column I with Column II:

Column I	Column II
A. Diamond to graphite conversion	1. Short interval of time
B. Instantaneous rate	2. Ordinarily rate of conversion is imperceptible
C. Average rate	3. Long duration of time

Codes

	A	B	C
1.	2	1	3
2.	1	2	3
3.	3	2	1
4.	1	3	2

**13** Rate law for the reaction  $\text{A} + 2\text{B} \rightarrow \text{C}$  is found to be

$$\text{Rate} = k[\text{A}][\text{B}]$$

If the concentration of reactant 'B' is doubled, keeping the concentration of A constant, then the value of the rate of the reaction will be:

1. The same.
2. Doubled.
3. Quadrupled.
4. Halved.

**14** For a reaction,  $2\text{A} + \text{B} \rightarrow \text{C} + \text{D}$ , the following observations were recorded:

Experiment	[A]/mol L <sup>-1</sup>	[B]/mol L <sup>-1</sup>	Initial rate of formation of D/mol L <sup>-1</sup> min <sup>-1</sup>
I	0.1	0.1	$6.0 \times 10^{-3}$
II	0.3	0.2	$7.2 \times 10^{-2}$
III	0.3	0.4	$2.88 \times 10^{-1}$
IV	0.4	0.1	$2.40 \times 10^{-2}$

The rate law applicable to the above mentioned reaction would be:

1.  $\text{Rate} = k[\text{A}]^2[\text{B}]^3$
2.  $\text{Rate} = k[\text{A}][\text{B}]^2$
3.  $\text{Rate} = k[\text{A}]^2[\text{B}]$
4.  $\text{Rate} = k[\text{A}][\text{B}]$

**15** The rate equation of a reaction is expressed as,

$$\text{Rate} = k(P_{\text{CH}_3\text{OCH}_3})^{\frac{3}{2}}$$

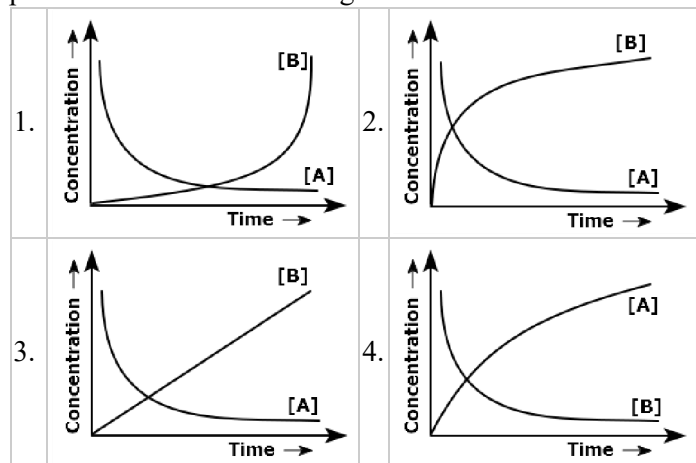
(Unit of rate = bar min<sup>-1</sup>)

The units of the rate constant will be:

1. bar<sup>1/2</sup> min
2. bar<sup>2</sup> min<sup>-1</sup>
3. bar<sup>-1</sup> min<sup>-2</sup>
4. bar<sup>-1/2</sup> min<sup>-1</sup>

**16** Consider the reaction  $A \rightarrow B$ . The concentration of both the reactants and the products varies exponentially with time.

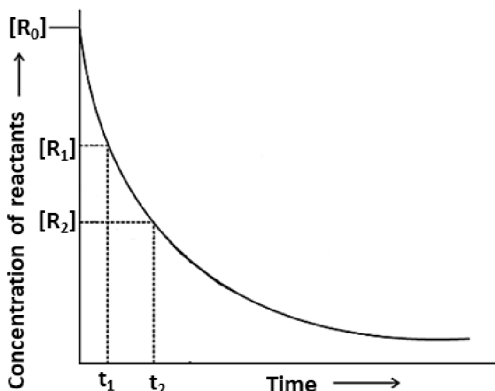
The graph that accurately depicts how reactant and product concentrations change with time is:



**17** True statement among the following is:

- The rate of a reaction decreases with the passage of time as the concentration of reactants decreases.
- The rate of a reaction is the same at any time during the reaction.
- The rate of a reaction is independent of temperature change.
- The rate of a reaction decreases with an increase in the concentration of the reactants.

**18** Based on the graph below, the average rate of reaction will be:



- $\frac{[R_2] - [R_1]}{t_2 - t_1}$
- $-\left(\frac{[R_2] - [R_1]}{t_2 - t_1}\right)$

- $\frac{[R_2]}{t_2}$
- $-\left(\frac{[R_1] - [R_2]}{t_2 - t_1}\right)$

**19** The average rate of reaction between the time interval of 30 to 60 seconds in the below mentioned pseudo 1st order reaction is:

t/s	0	30	60	90
[Ester]/mol L <sup>-1</sup>	0.55	0.31	0.17	0.085

- $6.67 \times 10^{-2} \text{ mol L}^{-1} \text{ s}^{-1}$
- $2.67 \times 10^{-4} \text{ mol L}^{-1} \text{ s}^{-1}$
- $4.67 \times 10^{-3} \text{ mol L}^{-1} \text{ s}^{-1}$
- $4.27 \times 10^3 \text{ mol L}^{-1} \text{ s}^{-1}$

**20** If at a given instant, for the reaction  $2\text{N}_2\text{O}_5 \rightarrow 4\text{NO}_2 + \text{O}_2$  rate and rate constant are  $1.02 \times 10^{-4}$  and  $3.4 \times 10^{-5} \text{ sec}^{-1}$  respectively, then the concentration of  $\text{N}_2\text{O}_5$  at that time will be:

- $1.732 \text{ mol L}^{-1}$
- $3.0 \text{ mol L}^{-1}$
- $1.02 \times 10^{-4} \text{ mol L}^{-1}$
- $3.4 \times 10^5 \text{ mol L}^{-1}$

## DEFINITION, RATE CONSTANT, RATE LAW - LEVEL II

**21** The correct expression for the 3/4th life of a first-order reaction is:

- $\frac{k}{2.303} \log \frac{4}{3}$
- $\frac{2.303}{k} \log \frac{3}{4}$
- $\frac{2.303}{k} \log 4$
- $\frac{2.303}{k} \log 3$

**22** The rate of the reaction

$2\text{NO} + \text{Cl}_2 \rightarrow 2\text{NOCl}$  is given by the rate equation

$$\text{rate} = k[\text{NO}]^2[\text{Cl}_2]$$

The value of the rate constant can be increased by:

- Increasing the concentration of NO
- Increasing the concentration of  $\text{Cl}_2$
- Increasing the temperature
- All of the above

**23** In a reaction between A and B, the initial rate of reaction ( $r_0$ ) was measured for different initial concentrations of A and B as given below:

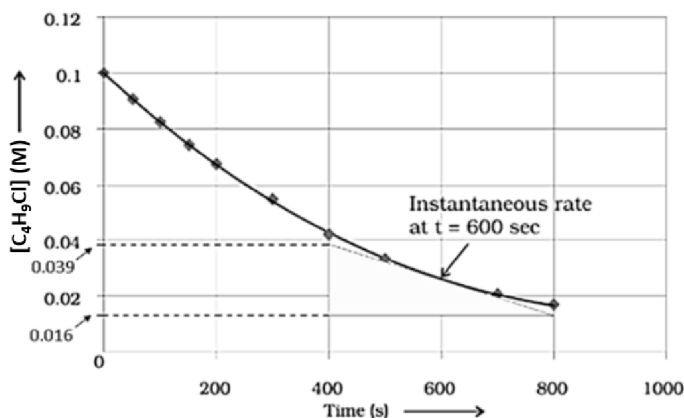
A / mol L <sup>-1</sup>	0.20	0.20	0.40
B / mol L <sup>-1</sup>	0.30	0.10	0.05
$r_0$ / mol L <sup>-1</sup> s <sup>-1</sup>	$5.07 \times 10^{-5}$	$5.07 \times 10^{-5}$	$1.43 \times 10^{-4}$

The order of the reaction with respect to A and B would be:

- The order with respect to A is 0.5 and with respect to B is zero.
- The order with respect to A is 1 and with respect to B is 0.5
- The order with respect to A is 2 and with respect to B is 1
- The order with respect to A is 1.5 and with respect to B is zero

**24**

Consider the following graph:



The instantaneous rate of reaction at  $t = 600$  sec will be:

- $-4.75 \times 10^{-4} \text{ mol L}^{-1}\text{s}^{-1}$
- $5.75 \times 10^{-5} \text{ mol L}^{-1}\text{s}^{-1}$
- $6.75 \times 10^{-6} \text{ mol L}^{-1}\text{s}^{-1}$
- $-6.75 \times 10^{-6} \text{ mol L}^{-1}\text{s}^{-1}$

**25** For the reaction  $2\text{N}_2\text{O}_5(\text{g}) \rightarrow 4\text{NO}_2(\text{g}) + \text{O}_2(\text{g})$ , the concentration of  $\text{NO}_2$  increases by  $2.4 \times 10^{-2} \text{ mol L}^{-1}$  in 6 seconds. The rate of appearance of  $\text{NO}_2$  and the rate of disappearance of  $\text{N}_2\text{O}_5$ , respectively, are:

- $2 \times 10^{-3} \text{ mol L}^{-1} \text{ sec}^{-1}$ ,  $4 \times 10^{-3} \text{ mol L}^{-1} \text{ sec}^{-1}$
- $2 \times 10^{-3} \text{ mol L}^{-1} \text{ sec}^{-1}$ ,  $1 \times 10^{-3} \text{ mol L}^{-1} \text{ sec}^{-1}$
- $2 \times 10^{-3} \text{ mol L}^{-1} \text{ sec}^{-1}$ ,  $2 \times 10^{-3} \text{ mol L}^{-1} \text{ sec}^{-1}$
- $4 \times 10^{-3} \text{ mol L}^{-1} \text{ sec}^{-1}$ ,  $2 \times 10^{-3} \text{ mol L}^{-1} \text{ sec}^{-1}$

**26** In the following reaction:  $x\text{A} \rightarrow y\text{B}$

$$\log\left(-\frac{d[\text{A}]}{dt}\right) = \log\left(\frac{d[\text{B}]}{dt}\right) + 0.3$$

where the -ve sign indicates the rate of disappearance of the reactant. Then,  $x : y$  equals:

- |    |     |    |      |
|----|-----|----|------|
| 1. | 1:2 | 2. | 2:1  |
| 3. | 3:1 | 4. | 3:10 |

**27** The decomposition of a gaseous compound yields the following information:

Initial pressure, atm	1.6	0.8	0.4
Time for 50 % reaction, min	80	113	160

The order of the reaction will be:

- |    |     |    |     |
|----|-----|----|-----|
| 1. | 1.0 | 2. | 1.5 |
| 3. | 2.0 | 4. | 0.5 |

**28** From the following data, the orders with respect to A, B, C, respectively, are :

[A] (mol/L)	[B] (mol/L)	[C] (mol/L)	rate (M/sec.)
0.2	0.1	0.02	$8.08 \times 10^{-3}$
0.1	0.2	0.02	$2.01 \times 10^{-3}$
0.1	1.8	0.18	$6.03 \times 10^{-3}$
0.2	0.1	0.08	$6.464 \times 10^{-2}$

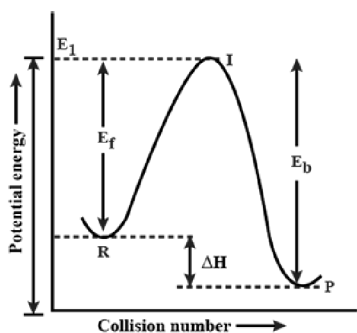
- 1, 1, 3/2
- 1, 1, 1/2
- 1, 3/2, -1
- 1, -1, 3/2

**29** A gaseous reaction  $\text{A}_2(\text{g}) \rightarrow \text{B}(\text{g}) + \frac{1}{2}\text{C}(\text{g})$  shows increase in pressure from 100 mm to 120 mm in 5 minutes. The rate of disappearance of  $\text{A}_2$  will be :

- |    |                          |    |                         |
|----|--------------------------|----|-------------------------|
| 1. | $4 \text{ mm min}^{-1}$  | 2. | $8 \text{ mm min}^{-1}$ |
| 3. | $16 \text{ mm min}^{-1}$ | 4. | $2 \text{ mm min}^{-1}$ |

### ARRHENIUS EQUATION - LEVEL I

**30** If a reaction  $A + B \rightarrow C$  is exothermic to the extent of  $30 \text{ kJ mol}^{-1}$  and the forward reaction has an activation energy of  $249 \text{ kJ mol}^{-1}$ , the activation energy for the reverse reaction in  $\text{kJ mol}$  will be:

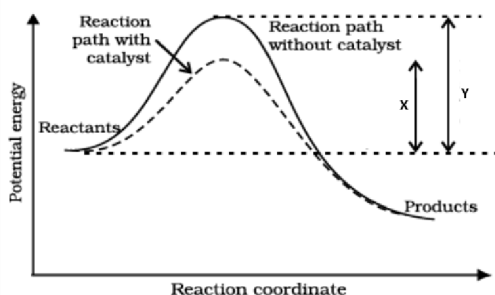


- |    |     |    |     |
|----|-----|----|-----|
| 1. | 324 | 2. | 279 |
| 3. | 40  | 4. | 100 |

**31** The correct statement about the rate constant of a reaction is:

- |    |  |
|----|--|
| 1. | Rate constant is nearly doubled with a rise in temperature by $10^\circ\text{C}$ |
| 2. | Rate constant becomes half with a rise in temperature by $10^\circ\text{C}$      |
| 3. | Rate constant remains unchanged with a rise in temperature by $10^\circ\text{C}$ |
| 4. | None of the above  |

**32** The correct statement about X in the below mentioned graph:



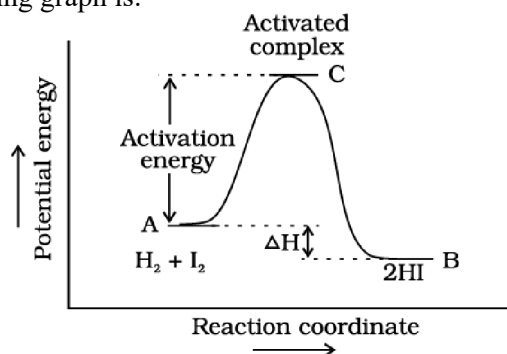
- |    |   |
|----|---|
| 1. | X represents activation energy without catalyst.              |
| 2. | X represents activation energy with catalyst.                 |
| 3. | X represents the enthalpy of the reaction without a catalyst. |
| 4. | X represents the enthalpy of the reaction with a catalyst.    |

**33** Select the correct option based on statements below:

<b>Assertion (A):</b>	All collisions of reactant molecules lead to product formation.
<b>Reason (R):</b>	Only those collisions in which molecules have the correct orientation and sufficient kinetic energy lead to the compound formation.

- |    |  |
|----|--|
| 1. | Both (A) and (R) are true and (R) is the correct explanation of (A).     |
| 2. | Both (A) and (R) are true but (R) is not the correct explanation of (A). |
| 3. | (A) is true but (R) is false.  |
| 4. | (A) is false but (R) is true.  |

**34** The nature of the reaction represented in the following graph is:

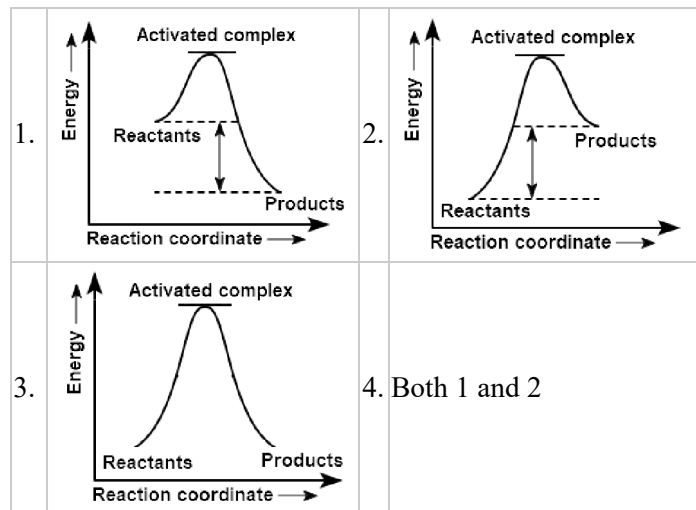


- |    |  |
|----|--|
| 1. | Endothermic reaction   |
| 2. | Exothermic reaction  |
| 3. | Both endothermic and exothermic reactions are represented by the same graph. |
| 4. | None of the above  |

**35** For a reaction  $A \rightarrow B$ , the Arrhenius equation is given as  $\log_e k = 4 - \frac{1000}{T}$  the activation energy in  $\text{J/mol}$  for the given reaction will be:

- 8314
- 2000
- 2814
- 3412

**36** The correct representation of an exothermic reaction is:



**37** The rate constant, the activation energy, and the Arrhenius parameter of a chemical reaction at 25 °C are  $3.0 \times 10^{-4} \text{ s}^{-1}$ ,  $104.4 \text{ kJ mol}^{-1}$  and  $6.0 \times 10^{14} \text{ s}^{-1}$  respectively.

The value of the rate constant as  $T \rightarrow \infty$  will be:

- $2.0 \times 10^{18} \text{ s}^{-1}$
- $6.0 \times 10^{14} \text{ s}^{-1}$
- $\infty$
- $3.6 \times 10^{30} \text{ s}^{-1}$

**38** For  $A + B \rightarrow C + D$ ,  $\Delta H = -20 \text{ kJ mol}^{-1}$ , the activation energy of the forward reaction is  $85 \text{ kJ mol}^{-1}$ . The activation energy for the backward reaction is....  $\text{kJ mol}^{-1}$ .

- 105
- 85
- 40
- 65

**39** If  $\Delta H$  of a reaction is  $100 \text{ kJ mol}^{-1}$ , then the activation energy for the forward reaction must be

- Greater than  $100 \text{ kJ mol}^{-1}$
- Less than  $100 \text{ kJ mol}^{-1}$
- Equal to  $100 \text{ kJ mol}^{-1}$
- None of the above.

**40** The decomposition of hydrocarbons follows the equation:  $k = (4.5 \times 10^{11} \text{ s}^{-1}) e^{-28000\text{K}/T}$   
The activation energy ( $E_a$ ) for the reaction would be:

1. $232.79 \text{ kJ mol}^{-1}$	2. $245.86 \text{ kJ mol}^{-1}$
3. $126.12 \text{ kJ mol}^{-1}$	4. $242.51 \text{ kJ mol}^{-1}$

**41** An increase in the concentration of the reactants of a reaction leads to a change in:

1. Heat of reaction	2. Threshold energy
3. Collision frequency	4. Activation energy

**42** In a first-order reaction  $A \rightarrow \text{products}$ , the concentration of the reactant decreases to 6.25 % of its initial value in 80 minutes. The value of the rate constant, if the initial concentration is 0.2 mole/litre, will be:

- $2.17 \times 10^{-2} \text{ min}^{-1}$
- $3.46 \times 10^{-2} \text{ min}^{-1}$
- $3.46 \times 10^{-3} \text{ min}^{-1}$
- $2.16 \times 10^{-3} \text{ min}^{-1}$

**43** Select the correct option based on statements below:

<b>Assertion (A):</b>	At very high temperatures (approaches to infinity), the rate constant becomes equal to the collision frequency.
<b>Reason (R):</b>	The collision in which molecules collide with proper orientation is called an ineffective collision.

1. Both (A) and (R) are true and (R) is the correct explanation of (A).
2. Both (A) and (R) are true but (R) is not the correct explanation of (A).
3. (A) is true but (R) is false.
4. Both (A) and (R) are false.

**44** The rate of a reaction doubles when its temperature changes from 300 K to 310 K. The activation energy of such a reaction will be:

( $R = 8.314 \text{ J K}^{-1} \text{ mol}^{-1}$  and  $\log 2 = 0.301$ )

- $53.6 \text{ kJ mol}^{-1}$
- $68.6 \text{ kJ mol}^{-1}$
- $59.5 \text{ kJ mol}^{-1}$
- $70.5 \text{ kJ mol}^{-1}$

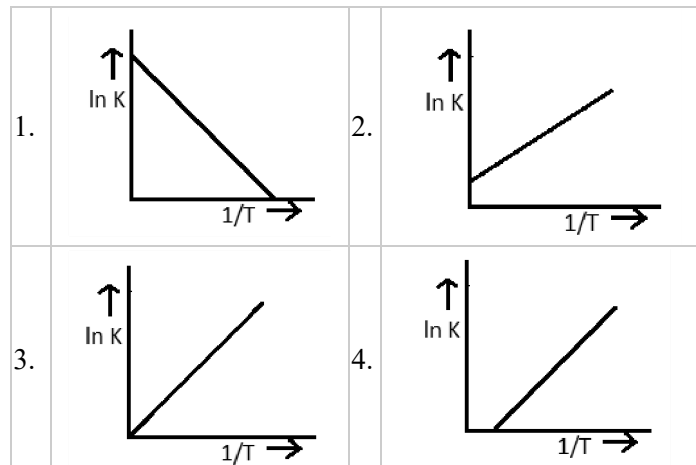
**45** If a reaction  $A + B \rightarrow C$  is exothermic to the extent of 30 kJ/mol and the forward reaction has an activation energy of 70 kJ/mol, the activation energy for the reverse reaction will be:

1. 30 kJ/mol
2. 40 kJ/mol
3. 70 kJ/mol
4. 100 kJ/mol

**46** The rate constant for a chemical reaction that takes place at 500 K is expressed as  $K = A e^{-1000}$ . The activation energy of the reaction will be:

1. 100 cal/mol
2. 1000 kcal/mol
3.  $10^4$  kcal/mol
4.  $10^6$  kcal/mol

**47** The correct graphical representation of relation between  $\ln k$  and  $1/T$  is:



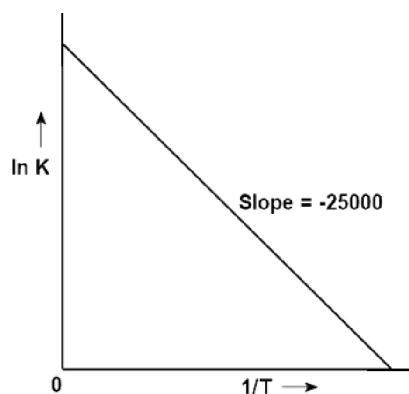
**48** A catalyst lowers the activation energy of a reaction from  $20 \text{ kJ mol}^{-1}$  to  $10 \text{ kJ mol}^{-1}$ . The temperature at which the uncatalysed reaction will have the same rate as that of the catalysed at  $27^\circ\text{C}$  will be:

1.  $-123^\circ\text{C}$
2.  $-327^\circ\text{C}$
3.  $327^\circ\text{C}$
4.  $23^\circ\text{C}$

**49** The rate of reaction triples when the temperature changes from  $20^\circ\text{C}$  to  $50^\circ\text{C}$ . The energy of activation for the reaction will be:

1.  $28.81 \text{ kJ mol}^{-1}$
2.  $38.51 \text{ kJ mol}^{-1}$
3.  $18.81 \text{ kJ mol}^{-1}$
4.  $8.31 \text{ kJ mol}^{-1}$

**50** The graph between  $\ln K$  and  $1/T$  is given below:



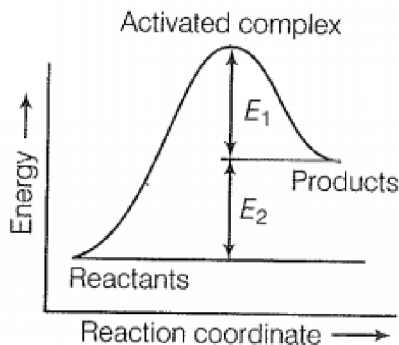
The value of activation energy would be:

1.  $207.8 \text{ KJ/mol}$
2.  $-207.8 \text{ KJ/mol}$
3.  $210.8 \text{ KJ/mol}$
4.  $-210.8 \text{ KJ/mol}$

**51** The decomposition of A into product has value of  $k$  as  $4.5 \times 10^3 \text{ s}^{-1}$  at  $10^\circ\text{C}$ . Energy of activation of the reaction is  $60 \text{ kJ mol}^{-1}$ . The temperature at which value  $k$  would become  $1.5 \times 10^4 \text{ s}^{-1}$  is :

1.  $12^\circ\text{C}$
2.  $24^\circ\text{C}$
3.  $48^\circ\text{C}$
4.  $36^\circ\text{C}$

52 The correct statement based on the graph below is:

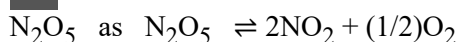


- |    |  |
|----|--|
| 1. | The activation energy of the forward reaction is $E_1 + E_2$ and the product is less stable than reactant.               |
| 2. | The activation energy of the forward reaction is $E_1 + E_2$ and the product is more stable than the reactant.           |
| 3. | The activation energy of both forward and backward reaction is $E_1 + E_2$ and reactant is more stable than the product. |
| 4. | The activation energy of the backward reaction is $E_1$ and the product is more stable than reactant.                    |

53 At 400 K, the energy of activation of a reaction is decreased by 0.8 kcal in the presence of a catalyst. As a result, the rate will be:

1. Increased by 2.71 times.
2. Increased by 1.18 times.
3. Decreased by 2.72 times.
4. Increased by 6.26 times.

54 Given the following reaction:



The values of rate constants for the above reaction are  $3.45 \times 10^{-5}$  and  $6.9 \times 10^{-3}$  at 27 °C and 67 °C respectively. The activation energy for the above reaction is :

1.  $102 \times 10^2 \text{ J}$
2. 488.5 kJ
3. 112 J
4. 112.5 kJ

55 The activation energy of a chemical reaction can be calculated by:

1. Determining the rate constant at standard temperature.
2. Determining the rate constant at two temperatures.
3. Determining probability of collision.
4. Using the catalyst.

56 When the temperature of a reaction increases from 27 °C to 37 °C, the rate increases by 2.5 times. The activation energy in the temperature range will be:

1. 53.6 kJ
2. 12.61 kJ
3. 7.08 kJ
4. 70.8 kJ

## ARRHENIUS EQUATION - LEVEL II

57 The rate constant for the first-order decomposition of  $\text{H}_2\text{O}_2$  is given by the equation:  $\log k = 14.34 - 1.25 \times 10^4 \frac{K}{T}$ . The value of  $E_a$  for the reaction would be:

1. 249.34 kJ mol<sup>-1</sup>
2. 242.64 J mol<sup>-1</sup>
3. -275.68 kJ mol<sup>-1</sup>
4. 239.34 kJ mol<sup>-1</sup>

58 Select the correct option based on statements below:

<b>Assertion (A):</b>	The rate constant determined from the Arrhenius equation is fairly accurate for simple as well as complex molecules.
<b>Reason (R):</b>	Reactant molecules undergo chemical change irrespective of their orientation during a collision.

- |    |  |
|----|--|
| 1. | Both (A) and (R) are true and (R) is the correct explanation of (A).     |
| 2. | Both (A) and (R) are true but (R) is not the correct explanation of (A). |
| 3. | (A) is true but (R) is false.  |
| 4. | Both (A) and (R) are false.  |

59 For the reaction,  $\text{C}_2\text{H}_5\text{I} + \text{OH}^- \rightarrow \text{C}_2\text{H}_5\text{OH} + \text{I}^-$  the rate constant was found to have a value of  $5.03 \times 10^{-2} \text{ mol}^{-1} \text{ dm}^3 \text{ s}^{-1}$  at 289 K and  $6.71 \text{ mol}^{-1} \text{ dm}^3 \text{ s}^{-1}$  at 333 K. The rate constant at 305 K will be:

1.  $1.35 \text{ mol}^{-1} \text{ dm}^3 \text{ s}^{-1}$
2.  $0.35 \text{ mol}^{-1} \text{ dm}^3 \text{ s}^{-1}$
3.  $3.15 \text{ mol}^{-1} \text{ dm}^3 \text{ s}^{-1}$
4.  $7.14 \text{ mol}^{-1} \text{ dm}^3 \text{ s}^{-1}$



**60** A first-order reaction's 10 percent completion time at 298 K is the same as its 25 percent completion time at 308 K. The value of  $E_a$  will be:

1. 76.64 J mol<sup>-1</sup>
2. 66.64 kJ mol<sup>-1</sup>
3. 76.64 kJ mol<sup>-1</sup>
4. 70.34 kJ mol<sup>-1</sup>

**61** For a given reaction, the presence of a catalyst reduces the energy of activation by 2 kcal at 27 °C. The rate of reaction will be increased by:

1. 20 times
2. 14 times
3. 28 times
4. 2 times

**62** The first order rate constant for a certain reaction increases from  $1.667 \times 10^{-6} \text{ s}^{-1}$  at 727 °C to  $1.667 \times 10^{-4} \text{ s}^{-1}$  at 1571 °C. The rate constant at 1150 °C is: (assume activation energy is constant over the given temperature range)

1.  $3.911 \times 10^{-5} \text{ s}^{-1}$
2.  $1.139 \times 10^{-5} \text{ s}^{-1}$
3.  $3.318 \times 10^{-5} \text{ s}^{-1}$
4.  $1.193 \times 10^{-5} \text{ s}^{-1}$

**63** Consider the Arrhenius equation given below and choose the correct option:

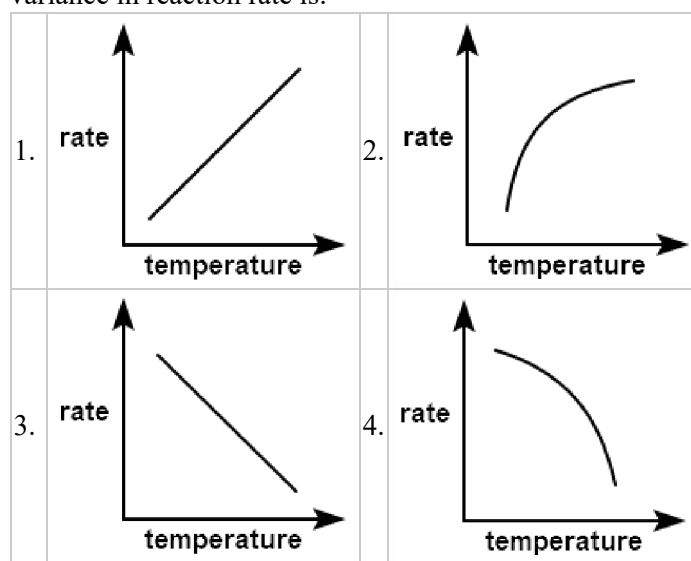
$$k = Ae^{-\frac{E_a}{RT}}$$

- |    |   |
|----|---|
| 1. | Rate constant increases exponentially with increasing activation energy and decreasing temperature. |
| 2. | Rate constant decreases exponentially with increasing activation energy and decreasing temperature. |
| 3. | Rate constant increases exponentially with decreasing activation energy and decreasing temperature. |
| 4. | Rate constant increases exponentially with decreasing activation energy and increasing temperature. |

**64** For a first-order reaction  $A \rightarrow P$ , rate constant (k) [dependent on temperature (T)] was found to follow the equation  $\log k = (-2000)\frac{1}{T} + 6.0$ . The pre-exponential factor A and the activation energy  $E_a$ , respectively, are:

1.  $1.0 \times 10^6 \text{ s}^{-1}$  and 9.2 kJ mol<sup>-1</sup>
2.  $6.0 \text{ s}^{-1}$  and 16.6 kJ mol<sup>-1</sup>
3.  $1.0 \times 10^6 \text{ s}^{-1}$  and 16.6 kJ mol<sup>-1</sup>
4.  $1.0 \times 10^6 \text{ s}^{-1}$  and 38.3 kJ mol<sup>-1</sup>

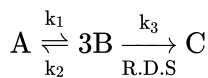
**65** The relationship between temperature and the variance in reaction rate is:



**66** In the Arrhenius equation  $K = Ae^{-E_a/RT}$ , the quantity  $e^{-E_a/kT}$  is referred as:

1. Boltzmann factor.
2. Frequency factor.
3. Activation factor.
4. None of the above.

**67** For a chemical reaction  $A \rightarrow \text{product}$ , the postulated mechanism of the reaction is as follows.



If the rate constants for individual reactions are  $k_1, k_2$  and  $k_3$ , and activation energies are

$$E_{a_1} = 180 \text{ kJ mol}^{-1},$$

$$E_{a_2} = 90 \text{ kJ mol}^{-1},$$

$$E_{a_3} = 40 \text{ kJ mol}^{-1}$$

then overall activation energy for the reaction given above is

1.  $70 \text{ kJ mol}^{-1}$
2.  $-10 \text{ kJ mol}^{-1}$
3.  $310 \text{ kJ mol}^{-1}$
4.  $130 \text{ kJ mol}^{-1}$

**68** The rate constant for the decomposition of hydrocarbons is  $2.418 \times 10^{-5} \text{ s}^{-1}$  at 546 K. If the energy of activation is 179.9 kJ/mol, the value of the pre-exponential factor will be:

1.  $4.0 \times 10^{12} \text{ s}^{-1}$
2.  $7.8 \times 10^{-13} \text{ s}^{-1}$
3.  $3.8 \times 10^{-12} \text{ s}^{-1}$
4.  $4.7 \times 10^{12} \text{ s}^{-1}$

**69** An incorrect statement about the collision theory of chemical reaction is:

- |    |   |
|----|---|
| 1. | It considers reacting molecules or atoms to be hard spheres and ignores their structural features.  |
| 2. | The number of effective collisions determines the rate of reaction.   |
| 3. | The collision of atoms or molecules possessing sufficient threshold energy results in product formation.                                      |
| 4. | Molecules should collide in the proper orientation for the collision to be effective with sufficient threshold energy and proper orientation. |

## FIRST ORDER REACTION KINETICS - LEVEL I

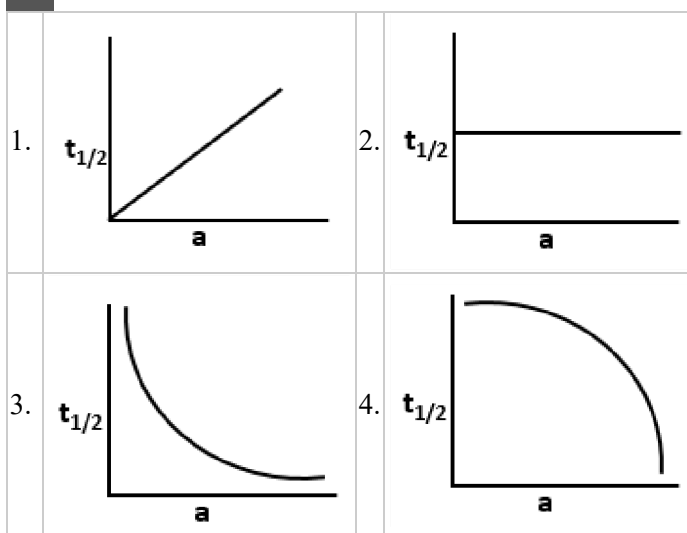
**70** The rate constant of a radioactive substance is  $4 \text{ years}^{-1}$ . The value of half-life will be :

1. 0.05 years
2. 0.17 years
3.  $0.26 \text{ years}^{-1}$
4. 1.6 years

**71** The rate constant for a first-order reaction is  $4.606 \times 10^{-3} \text{ s}^{-1}$ . The time required to reduce 2.0 g of the reactant to 0.2 g will be:

1. 200 s
2. 500 s
3. 1000 s
4. 100 s

**72** The graph that represents a first-order reaction is:



**73** The half-life period for a first-order reaction is 20 minutes. The time required to change the concentration of the reactants from 0.08 M to 0.01 M will be:

1. 20 minutes
2. 60 minutes
3. 40 minutes
4. 50 minutes

**74** The half-life of  $^{92}\text{U}_{238}$  against  $\alpha$ -decay is  $4.5 \times 10^9$  year. The time taken in a year for the decay of the 15/16 part of this isotope will be:

1.  $9.0 \times 10^9$
2.  $1.8 \times 10^{10}$
3.  $4.5 \times 10^9$
4.  $2.7 \times 10^{10}$

**75** The rate constant of a first-order reaction is  $4 \times 10^{-3} \text{ sec}^{-1}$ . At a reactant concentration of 0.02 M, the rate of reaction would be:

1.  $8 \times 10^{-5} \text{ M sec}^{-1}$
2.  $4 \times 10^{-3} \text{ M sec}^{-1}$
3.  $2 \times 10^{-1} \text{ M sec}^{-1}$
4.  $4 \times 10^{-1} \text{ M sec}^{-1}$

**76** The half-life time for the decomposition of a substance dissolved in  $\text{CCl}_4$  is 2.5 hours at  $30^\circ\text{C}$ . The amount of substance that will be left after 10 hours if the initial weight of the substance is 160 gm is:

1. 20 gm
2. 30 gm
3. 40 gm
4. 10 gm

**77** For a reaction of the type  $2\text{A} + \text{B} \rightarrow 2\text{C}$ , the rate of the reaction is given by  $k[\text{A}]^2[\text{B}]$ . When the volume of the reaction vessel is reduced to  $\frac{1}{4}$  th of the original volume, the rate of reaction changes by a factor of -

1. 0.25
2. 16
3. 64
4. 4

**78** For the elementary reaction  $\text{M} \rightarrow \text{N}$ , the rate of disappearance of M increases by a factor of 8 upon doubling the concentration of M. The order of the reaction with respect to M will be:

1. 4
2. 3
3. 2
4. 1

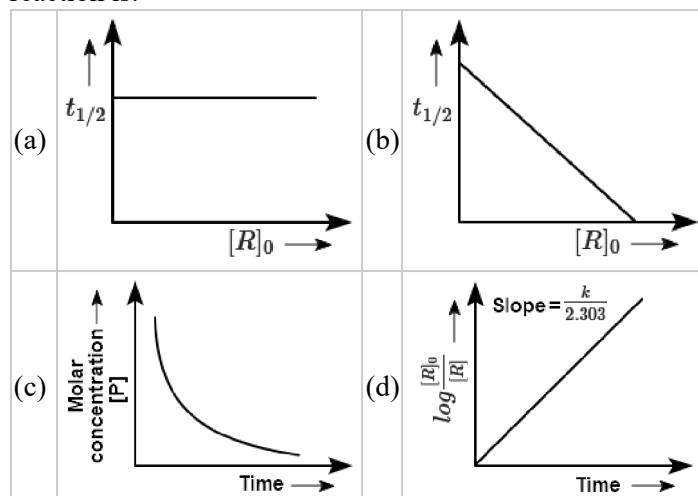
**79** If 'a' is the initial concentration of a substance which reacts according to zero-order kinetics and k is the rate constant, the time for the reaction to go to completion will be:

1. a/k
2. 2/ka
3. k/a
4. Infinite

**80** If 60 % of a first-order reaction is completed in 60 minutes, 50 % of the same reaction takes approximately: ( $\log 4 = 0.60$ ,  $\log 5 = 0.69$ )

1. 55 min
2. 45 min
3. 60 min
4. 30 min

**81** The correct graphical representation of first-order reaction is:



1. (a) and (b)
2. (b) and (c)
3. (c) and (d)
4. (a) and (d)

**82** The half-life for radioactive decay of  $^{14}\text{C}$  is 5730 y. An archaeological artifact containing wood had only 80 % of the  $^{14}\text{C}$  found in a living tree. The age of the sample will be:

1. 1657.3 y
2. 1845.4 y
3. 1512.4 y
4. 1413.1 y

**83** A first-order reaction was started with a decimolar solution of the reactant. After 8 minutes and 20 seconds, its concentration was found to be  $M/100$ . The rate constant of the reaction will be:

- $4.6 \times 10^{-3} \text{ sec}^{-1}$
- $16.6 \times 10^{-3} \text{ sec}^{-1}$
- $24.6 \times 10^{-3} \text{ sec}^{-1}$
- $40.6 \times 10^{-3} \text{ sec}^{-1}$

**84** Given the following observations:

Experiment	[A] / mol L <sup>-1</sup>	[B] / mol L <sup>-1</sup>	Initial rate / mol L <sup>-1</sup> min <sup>-1</sup>
I	0.1	0.1	$2.0 \times 10^{-2}$
II	X	0.2	$4.0 \times 10^{-2}$
III	0.4	0.4	Y

The reaction between A and B is first-order with respect to A and zero-order with respect to B. The values of X and Y are, respectively:

- $X = 0.2 \text{ mol L}^{-1}; Y = 0.08 \text{ mol L}^{-1}(\text{min})^{-1}$
- $X = 0.02 \text{ mol L}^{-1}; Y = 0.08 \text{ mol L}^{-1}(\text{min})^{-1}$
- $X = 0.01 \text{ mol L}^{-1}; Y = 0.8 \text{ mol L}^{-1}(\text{min})^{-1}$
- $X = 0.2 \text{ mol L}^{-1}; Y = 0.8 \text{ mol L}^{-1}(\text{min})^{-1}$

**85** A first-order reaction is 50 % completed in  $1.26 \times 10^{14}$  s. The time required for 100 % completion of the reaction will be:

- $1.26 \times 10^{15}$  s
- $2.52 \times 10^{14}$  s
- $2.52 \times 10^{28}$  s
- Infinite

**86** During a nuclear explosion, one of the products is  $^{90}\text{Sr}$  with a half-life of 28.1 years. If  $1\mu\text{g}$  of  $^{90}\text{Sr}$  was absorbed in the bones of a newly born baby instead of calcium, the amount of  $^{90}\text{Sr}$  that will remain after 10 years in the now grown up child would be -  
(Given,  $\text{antilog}(0.108)=1.28$ )

- $0.227 \mu\text{g}$
- $0.781 \mu\text{g}$
- $7.81 \mu\text{g}$
- $2.27 \mu\text{g}$

**87** A first-order reaction takes 40 min for 30 % decomposition. The half life of the reaction will be:

- 88.8 min
- 94.3 min
- 67.2 min
- 77.7 min

**88** If the rate of reaction doubles when the temperature is raised from 20 °C to 35 °C, then the activation energy for the reaction will be :

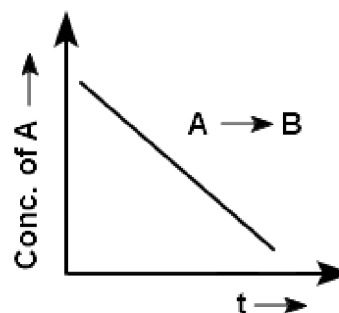
( $R = 8.314 \text{ J mol}^{-1} \text{ K}^{-1}$ )

- $342 \text{ kJ mol}^{-1}$
- $269 \text{ kJ mol}^{-1}$
- $34.7 \text{ kJ mol}^{-1}$
- $15.1 \text{ kJ mol}^{-1}$

**89** If in the fermentation of sugar in an enzymatic solution that is 0.12 M, the concentration of the sugar is reduced to 0.06 M in 10 h and to 0.03 M in 20 h, the order of the reaction will be:

- 1
- 2
- 3
- 0

**90** For a general reaction  $A \rightarrow B$ , the plot of concentration of A vs time is given below:



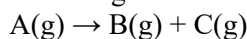
The unit of the rate constant would be:

- $\text{mol}^{-1} \text{ L}^{-1} \text{ s}^{-1}$
- $\text{s}^{-1}$
- $\text{mol L}^{-1} \text{ s}^{-1}$
- None of the above

**91** The thermal decomposition of a compound is of first order. If 50 % of a sample of the compound decomposes in 120 minutes, how long will it take for 90 % of the compound to decompose?

1. 399 min
2. 410 min
3. 250 min
4. 120 min

**92** Consider the first-order gas-phase decomposition reaction given below.



The initial pressure of the system before the decomposition of A was  $P_i$ . After the lapse of time  $t$ , the total pressure of the system increased by  $X$  units and became  $P_t$ . The rate constant  $k$  for the reaction is:

1.  $k = \frac{2.303}{t} \log \frac{P_i}{P_i - X}$
2.  $k = \frac{2.303}{t} \log \frac{P_i}{2P_i - P_t}$
3.  $k = \frac{2.303}{t} \log \frac{P_i}{2P_i + P_t}$
4.  $k = \frac{2.303}{t} \log \frac{P_i}{P_i + X}$

**93** The rate of a reaction increases 4-fold when concentration of reactant is increased 16 times.

If the rate of reaction is  $4 \times 10^{-6} \text{ mol L}^{-1} \text{ s}^{-1}$  when concentration of the reactant is  $4 \times 10^{-4} \text{ mol L}^{-1}$ , the rate constant of the reaction will be :

1.  $2 \times 10^{-4} \text{ m}^{1/2} \text{ L}^{-1/2} \text{ s}^{-1}$
2.  $1 \times 10^{-2} \text{ s}^{-1}$
3.  $4 \times 10^{-4} \text{ mol}^{-1/2} \text{ L}^{-1/2} \text{ s}^{-1}$
4.  $25 \text{ mol}^{-1} \text{ L min}^{-1}$

**94** The elementary reaction  $A + B \rightarrow \text{products}$  has  $k = 2 \times 10^{-5} \text{ M}^{-1} \text{ s}^{-1}$  at a temperature of  $27^\circ \text{C}$ . Several experimental runs are carried out using stoichiometric proportion. The reaction has a temperature coefficient value of 2.0. At what temperature should the reaction be carried out if, in spite of halving the concentrations, the rate of reaction is desired to be 50 % higher than in the previous run?

(Given  $\frac{\ln 6}{\ln 2} = 2.585$ )

1.  $47^\circ \text{C}$
2.  $53^\circ \text{C}$
3.  $57^\circ \text{C}$
4.  $37^\circ \text{C}$

**95** A first-order reaction takes 40 min for 30 % decomposition. The  $t_{1/2}$  for this reaction will be:

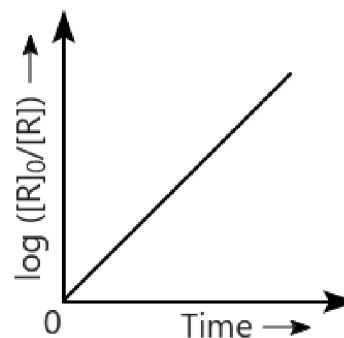
1.	77.7 min	2.	27.2 min
3.	55.3 min	4.	67.3 min

## FIRST ORDER REACTION KINETICS - LEVEL II

**96** The decomposition of sucrose follows the first-order rate law. For this decomposition,  $t_{1/2}$  is 3.00 hours. The fraction of a sample of sucrose that remains after 8 hours would be:

1.	0.13	2.	0.42
3.	0.16	4.	0.25

**97** The slope of the given below graph is -



1.  $\frac{k}{2.303}$
2.  $-\frac{k}{2.303}$
3.  $-\frac{2.303}{k}$
4.  $\frac{2.303}{k}$

**98** The half-life of the two samples is 0.1 and 0.4 seconds, respectively. Their concentrations are 200 and 50, respectively. The order of the reactions will be:

1. 0
2. 2
3. 1
4. 4

**99** The gas phase decomposition  $2\text{N}_2\text{O}_5 \rightarrow 4\text{NO}_2 + \text{O}_2$  follows the first order rate law,  $K = 7.5 \times 10^{-3} \text{ sec}^{-1}$ . The initial pressure of  $\text{N}_2\text{O}_5$  is 0.1 atm. The time of decomposition of  $\text{N}_2\text{O}_5$  so that the total pressure becomes 0.15 atm will be -

1. 54 sec	2. 5.4 sec
3. 3.45 sec	4. 34.55 sec

**100** 1 mole of a gas changes linearly from its initial state (2 atm, 10 lt) to its final state (8 atm, 4 lt). The maximum rate constant is equal to  $20 \text{ sec}^{-1}$  and the value of activation energy is 40 kJ, assuming that the activation energy does not change in this temperature range. The value of the rate constant, at the maximum temperature that the gas can attain, is:

- $0.56 \times 10^{-3} \text{ sec}^{-1}$
- $3.16 \times 10^{-3} \text{ sec}^{-1}$
- $1.56 \times 10^{-3} \text{ sec}^{-1}$
- $5.12 \times 10^{-3} \text{ sec}^{-1}$

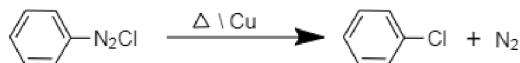
**101** From the plot of  $\log k$  vs  $1/T$ , following parameter can be calculated:

- Activation energy.
- Rate constant of reaction .
- Order of reaction.
- Activation energy as well as the frequency factor.

**102** For a first-order reaction  $A \rightarrow \text{Products}$ , the rate of reaction at  $[A] = 0.2 \text{ M}$  is  $1.0 \times 10^{-2} \text{ mol litre}^{-1} \text{ min}^{-1}$ . The half-life period for the reaction will be:

1. 832 sec	2. 440 sec
3. 416 sec	4. 14 sec

**103**



Half-life is independent of the concentration of a reactant. After 10 minutes, the volume of  $\text{N}_2$  gas is 10 L and after complete reaction, it is 50 L. Hence, the rate constant is:

- $\frac{2.303}{10} \log 5 \text{ min}^{-1}$
- $\frac{2.303}{10} \log 1.25 \text{ min}^{-1}$
- $\frac{2.303}{10} \log 2 \text{ min}^{-1}$
- $\frac{2.303}{10} \log 4 \text{ min}^{-1}$

**104** What is the percentage of the reactant molecules crossing over the energy barrier at 325 K?

Given that  $\Delta H_{325} = 0.12 \text{ kcal}$ ,  $E_{a(b)} = +0.02 \text{ kcal}$

1. 80.62 %	2. 85.23 %
3. 89.27 %	4. None of the above

**105** A first-order reaction is 15 % completed in 20 minutes. The amount of time required to complete 60 % of the reaction is:

1. 112.8 min	2. 120.7 min
3. 100.4 min	4. 140.7 min

**106** For a reaction  $A \rightarrow \text{Product}$ , with  $k = 2.0 \times 10^{-2} \text{ s}^{-1}$ , if the initial concentration of A is  $1.0 \text{ mol L}^{-1}$ , the concentration of A after 100 seconds would be :

1. $0.23 \text{ mol L}^{-1}$	2. $0.18 \text{ mol L}^{-1}$
3. $0.11 \text{ mol L}^{-1}$	4. $0.13 \text{ mol L}^{-1}$

**107** The following data were obtained during the first-order thermal decomposition of  $\text{SO}_2\text{Cl}_2$  at a constant volume.



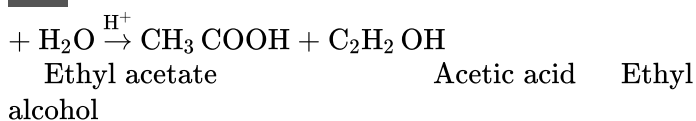
Experiment	Time/s	Total pressure/atm
1	0	0.5
2	100	0.6

The rate of the reaction when total pressure is 0.65 atm will be:

- $7.8 \times 10^{-4} \text{ s}^{-1} \text{ atm}$ .
- $0.8 \times 10^{-4} \text{ s}^{-1} \text{ atm}$ .
- $2.4 \times 10^{-2} \text{ s}^{-1} \text{ atm}$ .
- $6.1 \times 10^{-8} \text{ s}^{-1} \text{ atm}$ .

## ORDER, MOLECULARITY AND MECHANISM - LEVEL I

**108** The reaction below is an example of:  $\text{CH}_3\text{COOC}_2\text{H}_5$



- Pseudo-first-order reaction
- First-order reaction
- Second order reaction
- Third-order reaction

**109** Match the items in Column I and Column II:

Column I	Column II
A. Mathematical expression for the rate of reaction	1. Rate constant
B. Rate of reaction for zero-order reaction is equal to	2. Rate law
C. Units of rate constant for zero-order reaction is same as that of	3. Order of slowest step
D. Order of a complex reaction is determined by	4. Rate of reaction

Codes

	A	B	C	D
1.	3	4	1	2
2.	1	2	3	4
3.	2	1	4	3
4.	4	1	3	2

**110** When the initial concentration of a reactant is doubled in a reaction, its half-life period is not affected. The order of the reaction will be:

1.	0	2.	1
3.	1.5	4.	2

**111** The kinetic data for the reaction:  $2A + B_2 \rightarrow 2AB$  are as given below

[A]/mol L <sup>-1</sup>	[B <sub>2</sub> ]/mol L <sup>-1</sup>	Rate/mol L <sup>-1</sup> s <sup>-1</sup>
0.5	1.0	$2.5 \times 10^{-3}$
1.0	1.0	$5.0 \times 10^{-3}$
0.5	2.0	$1 \times 10^{-2}$

The order of reaction with respect to A and B<sub>2</sub> is, respectively:

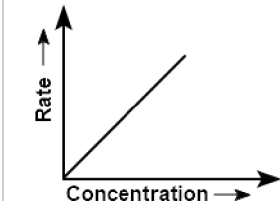
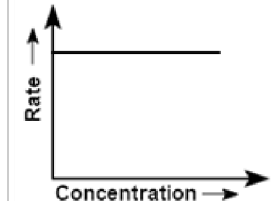
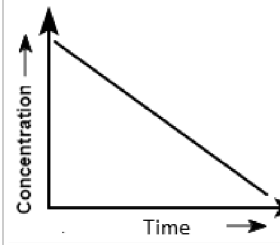
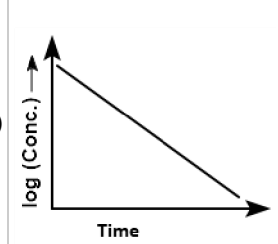
1.	1 and 2	2.	2 and 1
3.	1 and 1	4.	2 and 2

**112** Select the correct option based on statements below:

<b>Assertion (A):</b>	Order and molecularity are the same.
<b>Reason (R):</b>	Order is determined experimentally, and molecularity is the sum of the stoichiometric coefficient of the rate-determining the elementary step.
1.	Both (A) and (R) are true and (R) is the correct explanation of (A).
2.	Both (A) and (R) are true but (R) is not the correct explanation of (A).

3.	(A) is true but (R) is false.
4.	(A) is false but (R) is true.

**113** Match the graph given in Column I with the order of reaction given in Column II. More than one item in Column I may be linked to the same item in Column II:

Column I			
(i)		(ii)	
(iii)		(iv)	
Column II			
(a)	1st order	(b)	Zero order

Codes

	(i)	(ii)	(iii)	(iv)
1.	(a)	(b)	(a)	(b)
2.	(a)	(b)	(b)	(a)
3.	(a)	(a)	(b)	(b)
4.	(b)	(b)	(a)	(a)

**114** Select the correct option based on statements below:

<b>Assertion (A):</b>	For elementary reactions, the law of mass action and the rate of law expression are generally the same.
<b>Reason (R):</b>	The molecularity of an elementary reaction is always one.

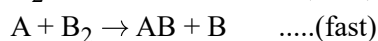
1.	Both (A) and (R) are true and (R) is the correct explanation of (A).
2.	Both (A) and (R) are true but (R) is not the correct explanation of (A).
3.	(A) is true but (R) is false.
4.	Both (A) and (R) are false.

**115** For a given reaction the concentration of the reactant plotted against time gave a straight line with negative slope.

The order of the reaction will be:

1. 3
2. 2
3. 1
4. 0

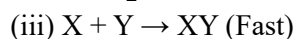
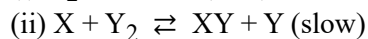
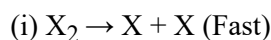
**116** A reaction  $A_2 + B_2 \rightarrow 2AB$  occurs by the following mechanism:



Its order would be:

1. 3/2
2. 1
3. 0
4. 2

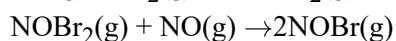
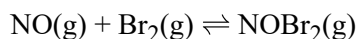
**117** The mechanism of a hypothetical reaction



The overall order of the reaction will be:

1. 2
2. 0
3. 1.5
4. 1

**118** The following mechanism has been proposed for the reaction of NO with  $Br_2$  to form NOBr:



If the second step is the rate determining step, the order of the reaction with respect to NO(g) will be:

1. 1
2. 0
3. 3
4. 2

## ORDER, MOLECULARITY AND MECHANISM - LEVEL II

**119** Select the correct option based on statements below:

<b>Assertion (A):</b>	The order of the reaction can be zero or fractional.
<b>Reason (R):</b>	We cannot determine order from the balanced chemical equation.

1. Both (A) and (R) are true and (R) is the correct explanation of (A).
2. Both (A) and (R) are true but (R) is not the correct explanation of (A).
3. (A) is true but (R) is false.
4. Both (A) and (R) are false.

**120** Select the correct option based on statements below:

<b>Assertion (A):</b>	Base catalyzed hydrolysis of ethyl acetate is a first-order reversible reaction.
<b>Reason (R):</b>	The order of reaction always depends on the stoichiometry of the reaction.

1. Both (A) and (R) are true and (R) is the correct explanation of (A).
2. Both (A) and (R) are true but (R) is not the correct explanation of (A).
3. (A) is true but (R) is false.
4. Both (A) and (R) are false.

**121** Select the correct option based on statements below:

<b>Assertion (A):</b>	The overall order of reaction is the sum of the power of all the reactants in the rate expression.
<b>Reason (R):</b>	There are many higher-order reactions.

1. Both (A) and (R) are true and (R) is the correct explanation of (A).
2. Both (A) and (R) are true but (R) is not the correct explanation of (A).
3. (A) is true but (R) is false.
4. Both (A) and (R) are false.



**122** In a reaction, the rate =  $k[A]^1[B]^{-2/3}$  the order of the reaction is-

1. 1/3
2. 2
3. -1/3
4. Zero

## CATALYST - LEVEL I

**123** The role of a catalyst is to change:

1. Gibbs energy of the reaction
2. Enthalpy of reaction
3. The activation energy of the reaction
4. Equilibrium constant

**124** Match the statements in Column I and Column II :

Column I	Column II
A. Catalyst alters the rate of reaction	1. Proper orientation is not there always
B. $e^{-E_a/RT}$	2. By lowering the activation energy
C. Energetically favorable reactions are sometimes slow	3. Total probability is one
D. Area under the Maxwell-Boltzmann curve is constant	4. Refers to the fraction of molecules with energy equal to or greater than the activation energy

Codes

	A	B	C	D
1.	2	4	1	3
2.	3	1	4	2
3.	1	4	3	2
4.	3	4	1	2

**125** The factor(s) that affect the rate of a chemical reaction is/are:

1. Concentration/Pressure of reactants.
2. Temperature.
3. Presence of a catalyst.
4. All of the above.

**126** An incorrect statement regarding the catalyst is:

- |    |  |
|----|--|
| 1. | It catalyzes the forward and backward reactions to the same extent.                              |
| 2. | It alters gibbs free energy of the reaction.   |
| 3. | It is a substance that does not change the equilibrium constant of a reaction.                   |
| 4. | It provides an alternate mechanism by reducing activation energy between reactants and products. |

**127** Select the correct option based on statements below:

<b>Assertion (A):</b>	The enthalpy of reaction remains constant in the presence of a catalyst.
<b>Reason (R):</b>	A catalyst participating in the reaction forms a different activated complex and lowers down the activation energy but the difference in energy of the reactant and the product remains the same.

- |    |  |
|----|--|
| 1. | Both (A) and (R) are true and (R) is the correct explanation of (A).     |
| 2. | Both (A) and (R) are true but (R) is not the correct explanation of (A). |
| 3. | (A) is true but (R) is false.  |
| 4. | Both (A) and (R) are false.  |

## CATALYST - LEVEL II

**128** In the presence of a catalyst, the heat evolved or absorbed during the reaction:

1. Increases.
2. Decreases.
3. Remains unchanged.
4. May increase or decrease.