

PHYSICAL CHEMISTRY

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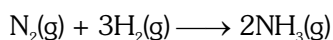
EXERCISE

Chemical Kinetics

ENGLISH MEDIUM

EXERCISE-I (Conceptual Questions)
Build Up Your Understanding
RATE OF REACTION

1. Consider the chemical reaction :



The rate of this reaction can be expressed in terms of concentration of $\text{N}_2(\text{g})$, $\text{H}_2(\text{g})$ or $\text{NH}_3(\text{g})$. Identify the correct relationship amongst the rate expressions.

$$(1) \text{Rate} = -\frac{d[\text{N}_2]}{dt} = -\frac{1}{3} \frac{d[\text{H}_2]}{dt} = \frac{1}{2} \frac{d[\text{NH}_3]}{dt}$$

$$(2) \text{Rate} = -\frac{d[\text{N}_2]}{dt} = -\frac{3d[\text{H}_2]}{dt} = \frac{2d[\text{NH}_3]}{dt}$$

$$(3) \text{Rate} = \frac{d[\text{N}_2]}{dt} = \frac{1}{3} \frac{d[\text{H}_2]}{dt} = \frac{1}{2} \frac{d[\text{NH}_3]}{dt}$$

$$(4) \text{Rate} = -\frac{d[\text{N}_2]}{dt} = -\frac{d[\text{H}_2]}{dt} = \frac{d[\text{NH}_3]}{dt}$$

CK0001

2. In the formation of sulphur trioxide by the contact process $2\text{SO}_2(\text{g}) + \text{O}_2(\text{g}) \rightarrow 2\text{SO}_3(\text{g})$; the rate of reaction is expressed as

$$-\frac{d[\text{O}_2]}{dt} = 2.5 \times 10^{-4} \text{ mol L}^{-1} \text{ s}^{-1}$$

The rate of disappearance of (SO_2) will be

- (1) $5 \times 10^{-4} \text{ mol L}^{-1} \text{ s}^{-1}$
 (2) $-2.25 \times 10^{-4} \text{ mol L}^{-1} \text{ s}^{-1}$
 (3) $3.75 \times 10^{-4} \text{ mol L}^{-1} \text{ s}^{-1}$
 (4) $50.0 \times 10^{-4} \text{ mol L}^{-1} \text{ s}^{-1}$

CK0002

3. In a catalytic reaction involving the formation of ammonia by Haber's process $\text{N}_2 + 3\text{H}_2 \rightarrow 2\text{NH}_3$ the rate of appearance of NH_3 was measured as $2.5 \times 10^{-4} \text{ mole L}^{-1} \text{ s}^{-1}$. 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) $5 \times 10^{-4} \text{ mol L}^{-1} \text{ s}^{-1}$

CK0003

4. Which of the following statement is correct for a reaction $\text{X} + 2\text{Y} \rightarrow \text{Product (p)}$

- (1) The rate of disappearance of X = twice the rate of disappearance of Y.
 (2) The rate of disappearance of X = $\frac{1}{2}$ rate of appearance of product (p)
 (3) The rate of appearance of product (p) = $\frac{1}{2}$ the rate of disappearance of Y
 (4) The rate of appearance of product (p) = $\frac{1}{2}$ the rate of disappearance of X

CK0004

5. For the reaction, $\text{N}_2\text{O}_5 \longrightarrow 2\text{NO}_2 + \frac{1}{2}\text{O}_2$

$$\text{Given } -\frac{d[\text{N}_2\text{O}_5]}{dt} = K_1[\text{N}_2\text{O}_5], \quad \frac{d[\text{NO}_2]}{dt} = K_2[\text{N}_2\text{O}_5]$$

$$\frac{d[\text{O}_2]}{dt} = K_3[\text{N}_2\text{O}_5]$$

The relation between K_1 , K_2 and K_3 is –

- (1) $2K_1 = K_2 = 4K_3$ (2) $K_1 = K_2 = K_3$
 (3) $2K_1 = 4K_2 = K_3$ (4) None

CK0005

6. Rate of formation of SO_3 according to the reaction $2\text{SO}_2 + \text{O}_2 \rightarrow 2\text{SO}_3$ is $1.6 \times 10^{-3} \text{ kg L}^{-1} \text{ min}^{-1}$. Hence rate of decomposition of SO_2 is :-

- (1) $1.6 \times 10^{-3} \text{ kg L}^{-1} \text{ min}^{-1}$
 (2) $8.0 \times 10^{-4} \text{ kg L}^{-1} \text{ min}^{-1}$
 (3) $3.2 \times 10^{-3} \text{ kg L}^{-1} \text{ min}^{-1}$
 (4) $1.28 \times 10^{-3} \text{ kg L}^{-1} \text{ min}^{-1}$

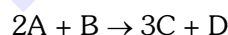
CK0006

7. For a general chemical change $2\text{A} + 3\text{B} \rightarrow$ products, the rate of disappearance of A is r_1 and of B is r_2 . The rates r_1 and r_2 are related as :-

- (1) $3r_1 = 2r_2$ (2) $r_1 = r_2$
 (3) $2r_1 = 3r_2$ (4) $r_1^2 = 2r_2^2$

CK0007

8. For the reaction

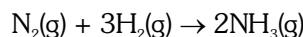


Which of the following does not express the reaction rate ?

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

CK0117

9. Consider the reaction



The correct equality relationship between

$$\frac{d[\text{NH}_3]}{dt} \text{ and } -\frac{d[\text{H}_2]}{dt} \text{ is :}$$

- (1) $\frac{d[\text{NH}_3]}{dt} = -\frac{1}{3} \frac{d[\text{H}_2]}{dt}$
 (2) $+\frac{d[\text{NH}_3]}{dt} = -\frac{2}{3} \frac{d[\text{H}_2]}{dt}$
 (3) $+\frac{d[\text{NH}_3]}{dt} = -\frac{3}{2} \frac{d[\text{H}_2]}{dt}$
 (4) $\frac{d[\text{NH}_3]}{dt} = -\frac{d[\text{H}_2]}{dt}$

CK0118

RATE LAW / ORDER / MOLECULARITY

10. For gaseous reaction, $\text{rate} = k [\text{A}] [\text{B}]$. If volume of container is reduced to $\frac{1}{4}$ of initial, then the rate of the reaction will be..... times of initial:-

(1) $\frac{1}{8}$ (2) 8 (3) $\frac{1}{16}$ (4) 16

CK0010

11. $2\text{A}(\text{g}) + \text{B}(\text{g}) \longrightarrow \text{Product}$ is an elementary reaction,

If pressure of both A and B is increased three times of the initial pressure, the rate of forward reaction will be ----- of the previous rate :-

(1) 9 times (2) 27 times
(3) $\frac{1}{9}$ times (4) $\frac{1}{27}$ times

CK0011

12. The rate of certain hypothetical reaction

$\text{A} + \text{B} + \text{C} \rightarrow \text{products}$ is given by

$r = \frac{-d[\text{A}]}{dt} = K [\text{A}]^{\frac{1}{2}} [\text{B}]^{\frac{1}{3}} [\text{C}]^{\frac{1}{4}}$ The order of the reaction -

(1) 1 (2) $\frac{1}{2}$ (3) 2 (4) $\frac{13}{12}$

CK0012

13. Which of the following rate law has an overall order of 0.5 for reaction involving substances x, y and z ?

(1) $\text{Rate} = K (\text{C}_x) (\text{C}_y) (\text{C}_z)$
(2) $\text{Rate} = K (\text{C}_x)^{0.5} (\text{C}_y)^{0.5} (\text{C}_z)^{0.5}$
(3) $\text{Rate} = K (\text{C}_x)^{1.5} (\text{C}_y)^{-1} (\text{C}_z)^0$
(4) $\text{Rate} = K (\text{C}_x) (\text{C}_z)^0 / (\text{C}_y)^2$

CK0013

14. A chemical reaction involves two reacting species. The rate of reaction is directly proportional to square of the concentration of one of them and inversely proportional to the concentration of the other. The order of reaction is -

(1) 1 (2) 2
(3) Zero (4) Unpredictable

CK0014

15. For the reaction $\text{H}_2(\text{g}) + \text{Br}_2(\text{g}) \rightarrow 2\text{HBr}(\text{g})$, the experimental data suggests, $\text{Rate} = K [\text{H}_2] [\text{Br}_2]^{\frac{1}{2}}$. The order for this reaction is -

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

CK0015

16. Select the rate law that corresponds to the data shown for the following reaction $\text{A} + \text{B} \rightarrow \text{C}$

Exp.	[A]	[B]	Initial rate
1.	0.012	0.035	0.10
2.	0.024	0.070	1.6
3.	0.024	0.035	0.20
4.	0.012	0.070	0.80

(1) $\text{Rate} = K [\text{B}]^3$ (2) $\text{Rate} = K [\text{B}]^4$
(3) $\text{Rate} = K [\text{A}] [\text{B}]^3$ (4) $\text{Rate} = K [\text{A}]^2 [\text{B}]^2$

CK0016

17. Select the rate law that corresponds to data shown for the following reaction $2\text{A} + \text{B} \rightarrow \text{C} + \text{D}$:-

Exp.	[A]	[B]	Initial rate ($\text{mol L}^{-1} \text{min}^{-1}$)
1.	0.1	0.1	7.5×10^{-3}
2.	0.3	0.2	9.0×10^{-2}
3.	0.3	0.4	3.6×10^{-1}
4.	0.4	0.1	3.0×10^{-2}

(1) $\text{Rate} = K [\text{A}]^2 [\text{B}]$ (2) $\text{Rate} = K [\text{A}] [\text{B}]^2$
(3) $\text{Rate} = K [\text{A}] [\text{B}]^3$ (4) $\text{Rate} = K [\text{A}] [\text{B}]$

CK0018

18. For a hypothetical reaction ; $\text{A} + \text{B} \rightarrow \text{C}$ the following data were obtained in three different experiments :-

[A] (mol L^{-1})	[B] (mol L^{-1})	Rate of reaction ($\text{mol L}^{-1} \text{min}^{-1}$)
0.01	0.01	1.0×10^{-4}
0.01	0.03	9.0×10^{-4}
0.03	0.03	2.70×10^{-3}

The rate law will be :-

(1) $r = K [\text{A}]^2 [\text{B}]$ (2) $r = K [\text{A}] [\text{B}]^2$
(3) $r = K [\text{A}] [\text{B}]$ (4) None of these

CK0019

19. Calculate the order of the reaction w.r.t. A and B:

[A] (mol L^{-1})	[B] (mol L^{-1})	Rate ($\text{mol L}^{-1} \text{S}^{-1}$)
0.05	0.05	1.2×10^{-3}
0.10	0.05	2.4×10^{-3}
0.05	0.10	1.2×10^{-3}

(1) 1 and 0 (2) 1 and 1
(3) 0 and 1 (4) None

CK0020

20. For a chemical reaction $A + B \rightarrow \text{product}$, the order is one with respect to each A and B. Value of x and y from the given data is :-

Rate (mol L ⁻¹ s ⁻¹)	[A]	[B]
0.10	0.20 M	0.05 M
0.40	x	0.05 M
0.80	0.40 M	y

- (1) 0.20, 0.80 (2) 0.80, 0.40
(3) 0.80, 0.20 (4) 0.40, 0.20

CK0021

21. The rate law for the single step reaction $2A + B \rightarrow 2C$, is given by -

- (1) Rate = $K[A][B]$ (2) Rate = $K[A]^2[B]$
(3) Rate = $K[2A][B]$ (4) Rate = $K[A]^2[B]^0$

CK0023

22. For a reaction of the type $A + B \rightarrow \text{products}$, it is observed that doubling the concentration of A causes the reaction rate to increase four times but doubling the amount of B does not effect the rate. The rate equation is -

- (1) Rate = $K[A][B]$ (2) Rate = $K[A]^2$
(3) Rate = $K[A]^2[B]$ (4) Rate = $K[A]^2[B]^2$

CK0024

23. Point out incorrect statement.

- (1) Rate law is an experimental value
(2) Law of mass action is a theoretical proposal
(3) Rate law is more informative than law of mass action for developing mechanism
(4) Rate law is always different from the expression of law of mass action.

CK0025

24. For an elementary process $2X + Y \rightarrow Z + W$, the molecularity is -

- (1) 2 (2) 1
(3) 3 (4) Unpredictable

CK0026

25. For a reaction $A + B \rightarrow \text{products}$, the rate of the reaction was doubled when the concentration of A was doubled, the rate was again doubled when the concentration of both A & B were doubled the order of the reaction with respect to A & B are:-

- (1) 1, 1 (2) 2, 0 (3) 1, 0 (4) 0, 1

CK0027

26. For the reaction $A + B \rightarrow \text{products}$, it is found that the order w.r.t. A is 1 and the order w.r.t. B is $\frac{1}{2}$. When the concentration of both A and B are increased four times, the rate will increase by a factor of :-

- (1) 16 (2) 8 (3) 6 (4) 4

CK0028

27. The rate law for a reaction $A + B \rightarrow \text{product}$ is rate = $K[A]^1[B]^2$. Then which one of the following statement is false :-

- (1) If [B] is kept constant while [A] is doubled, the reaction will proceed twice as fast
(2) If [A] is kept constant while [B] is reduced to one quarter, the rate will be halved
(3) If [A] and [B] are both doubled, the reaction will proceed 8 times as fast
(4) This is a third order reaction

CK0029

28. For a chemical reaction $A \rightarrow B$, the rate of reaction doubles when the concentration of A is increased 8 times. The order of reaction w.r.t. A is :-

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

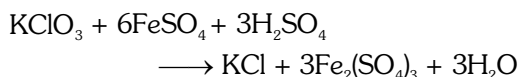
CK0030

29. The rate constant of a first order reaction depends on the :-

- (1) Concentration of the reactant
(2) Concentration of the product
(3) Time
(4) Temperature

CK0031

30. Consider the following reaction,



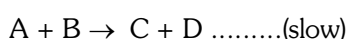
Which of the statements regarding this reaction is incorrect?

- (1) It is a complex reaction
(2) It is a tenth order reaction
(3) It is completed in several steps
(4) Order of this reaction can be determined experimentally

CK0215

PSEUDO FIRST ORDER REACTION / MECHANISM OF REACTION

31. Following mechanism has been proposed for a reaction $2A + B \rightarrow D + E$

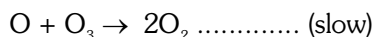
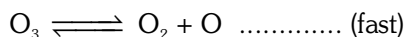


The rate law expression for the reaction is -

- (1) $r = K[A]^2[B]$ (2) $r = K[A][B]$
(3) $r = K[A]^2$ (4) $r = K[A][C]$

CK0032

32. The chemical reaction $2\text{O}_3 \rightarrow 3\text{O}_2$ proceeds as follows

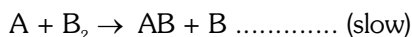


The rate law expression should be –

- (1) $r = K[\text{O}_3]^2$ (2) $r = K[\text{O}_3]^2[\text{O}_2]^{-1}$
 (3) $r = K[\text{O}_3][\text{O}_2]$ (4) Unpredictable

CK0033

33. The hypothetical reaction $\text{A}_2 + \text{B}_2 \rightarrow 2\text{AB}$ follows the mechanism as given below –



The order of the over all reaction is –

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

CK0034

34. The rate for the reaction

$\text{RCl} + \text{NaOH (aq)} \rightarrow \text{ROH} + \text{NaCl}$ is given by rate = $k_1[\text{RCl}]$. The rate of the reaction is –

- (1) Doubled on doubling the concentration of NaOH
 (2) Halved on reducing the concentration of RCl to half
 (3) Decreased on increasing the temperature of reaction
 (4) Unaffected by increasing the temperature of the reaction

CK0035

35. For reaction $\text{NO}_2 + \text{CO} \rightarrow \text{CO}_2 + \text{NO}$, the rate expression is, Rate = $k[\text{NO}_2]^2$

The number of molecules of CO involved in the slowest step will be –

- (1) 0 (2) 1 (3) 2 (4) 3

CK0036

36. The rate law of the reaction $\text{A} + 2\text{B} \rightarrow \text{product}$ is

given by $\frac{d[\text{P}]}{dt} = K[\text{A}]^2[\text{B}]$. If A is taken in large excess, the order of the reaction will be –

- (1) Zero (2) 1 (3) 2 (4) 3

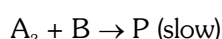
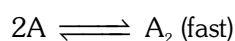
CK0037

37. The acidic hydrolysis of ester is –

- (1) Pseudo 1st order reaction
 (2) 2nd order reaction
 (3) Trimolecular reaction
 (4) All of the above

CK0038

38. The reaction $2\text{A} + \text{B} \rightarrow \text{P}$, follows the mechanism

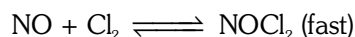


The order of the reaction is :-

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

CK0041

39. For the reaction $2\text{NO} + \text{Cl}_2 \rightarrow 2\text{NOCl}$ the following mechanism has been proposed



$\text{NOCl}_2 + \text{NO} \rightarrow 2\text{NOCl}$ (slow) the rate law for the reaction is :-

- (1) Rate = $K[\text{NO}]^2[\text{Cl}_2]$ (2) Rate = $K[\text{NO}][\text{Cl}_2]^2$
 (3) Rate = $K[\text{NOCl}_2]$ (4) Rate = $K[\text{NOCl}]^2$

CK0042

ZERO / FIRST / nth ORDER REACTIONS

40. The rate constant is numerically the same for three reactions of first, second and third order respectively. Which one is true at a moment for rate of all three reactions if concentration of reactants is same and greater than 1 M.

- (1) $r_1 = r_2 = r_3$ (2) $r_1 > r_2 > r_3$
 (3) $r_1 < r_2 < r_3$ (4) All

CK0043

41. K for a zero order reaction is

$2 \times 10^{-2} \text{ mol L}^{-1} \text{ s}^{-1}$. If the concentration of the reactant after 25s is 0.5M, the initial concentration must have been.

- (1) 0.5 M (2) 1.25 M
 (3) 12.5 M (4) 1.0 M

CK0044

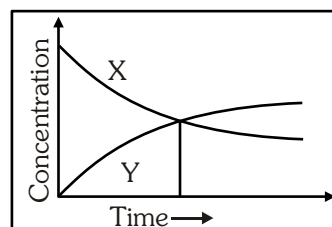
42. The decomposition of N_2O_5 occurs as,

$2\text{N}_2\text{O}_5 \rightarrow 4\text{NO}_2 + \text{O}_2$, and follows first order kinetics; hence

- (1) The reaction is bimolecular
 (2) The reaction is unimolecular
 (3) $t_{1/2} \propto a^0$
 (4) $t_{1/2} \propto a^2$

CK0045

43. The accompanying figure depicts the change in concentration of species X and Y for the reaction $\text{X} \rightarrow \text{Y}$ as a function of time. The point of intersection of the two curves represents.



- (1) $t_{1/2}$
 (2) $t_{3/4}$
 (3) $t_{2/3}$
 (4) Data is insufficient to predict

CK0046

- 44.** If the first order reaction involves gaseous reactants and gaseous products the unit of its rate is –
 (1) atm (2) atm s
 (3) atm s⁻¹ (4) atm² s²
CK0047
- 45.** Plot of log(a – x) vs time t is straight line. This indicates that the reaction is of –
 (1) Second order (2) First order
 (3) Zero order (4) third order
CK0048
- 46.** The rate constant of a first order reaction is $4 \times 10^{-3} \text{ s}^{-1}$. At a reactant concentration of 0.02 M, the rate of reaction would be –
 (1) $8 \times 10^{-5} \text{ M s}^{-1}$ (2) $4 \times 10^{-3} \text{ M s}^{-1}$
 (3) $2 \times 10^{-1} \text{ M s}^{-1}$ (4) $4 \times 10^{-1} \text{ M s}^{-1}$
CK0049
- 47.** In a first order reaction, the concentration of the reactant is decreased from 1.0 M to 0.25 M in 20 min. The rate constant of the reaction would be –
 (1) 10 min^{-1} (2) 6.931 min^{-1}
 (3) 0.6931 min^{-1} (4) 0.06931 min^{-1}
CK0050
- 48.** In a first order reaction, the value of $a/(a - x)$ was found to be 8 after 10 minute. The rate constant is
 (1) $\frac{(2.303 \times 3 \log 2)}{10}$
 (2) $\frac{(2.303 \times 2 \log 3)}{10}$
 (3) $10 \times 2.303 \times 2 \log 3$
 (4) $10 \times 2.303 \times 3 \log 2$
CK0051
- 49.** 75 % of a first order reaction was found to complete in 32 min. When will 50 % of the same reaction complete –
 (1) 24 min (2) 16 min
 (3) 8 min (4) 4 min
CK0052
- 50.** A first order reaction has a half life period of 69.3 s. At 0.10 mol L⁻¹ reactant concentration, the rate will be –
 (1) 10^{-4} M s^{-1} (2) 10^{-3} M s^{-1}
 (3) 10^{-1} M s^{-1} (4) $6.93 \times 10^{-1} \text{ M s}^{-1}$
CK0053
- 51.** For a first order reaction $A \rightarrow \text{products}$, the rate of reaction at $[A] = 0.2 \text{ M}$ is $1 \times 10^{-2} \text{ mol L}^{-1} \text{ min}^{-1}$. The half life period for the reaction is –
 (1) 832 min. (2) 440 s
 (3) 416 min. (4) 14 min.
CK0054
- 52.** 99 % of a first order reaction was completed in 32 min. when will 99.9 % of the reaction complete ?
 (1) 50 min. (2) 46 min.
 (3) 49 min. (4) 48 min.
CK0055
- 53.** What is the half life of a radioactive substance if 87.5% of any given amount of the substance disintegrate in 40 minutes ?
 (1) 160 min (2) 10 min
 (3) 20 min (4) 13 min 20 sec.
CK0057
- 54.** For a given reaction of first order, it takes 20 min for the concentration to drop from 1 M to 0.6 M. The time required for the concentration to drop from 0.6 M to 0.36 M will be :
 (1) More than 20 min
 (2) Less than 20 min
 (3) Equal to 20 min
 (4) Infinity
CK0058
- 55.** A first order reaction is carried out with an initial concentration of 10 mol per litre and 80% of the reactant changes into the product. Now if the same reaction is carried out with an initial concentration of 5 mol per litre for the same period, the percentage of the reactant changing to the product is.
 (1) 40
 (2) 80
 (3) 160
 (4) Cannot be calculated
CK0059
- 56.** The reaction $L \rightarrow M$ is started with 10 g/L. After 30 minute and 90 minute, 5 g/L and 1.25 g/L are left respectively. The order of reaction is
 (1) 0 (2) 2
 (3) 1 (4) 3
CK0061
- 57.** Doubling the initial concentration of a reactant doubles $t_{1/2}$ of the reaction, then order of the reaction is –
 (1) 3 (2) 2
 (3) 1 (4) 0
CK0062

58. The half life period for catalytic decomposition of AB_3 at 50 mm is found to be 4 hrs and at 100 mm it is 2 hrs. The order of reaction is –
 (1) 3 (2) 1 (3) 2 (4) 0

CK0063

59. The rate constant for a reaction is $10.8 \times 10^{-5} \text{ mol L}^{-1} \text{ s}^{-1}$. The reaction obeys –
 (1) First order (2) Zero order
 (3) Second order (4) All are wrong

CK0064

60. A substance 'A' decomposes in solution following the first order kinetics flask I contains 1 L of 1M. solution of A and flask II contains. 100 ml of 0.6 M solution. After 8 hr. the concentration of A in flask I become 0.25 M, what will be the time for concentration of A in flask II to become 0.3 M.
 (1) 0.4 hr.
 (2) 2.4 hr.
 (3) 4.0 hr.
 (4) Unpredictable as rate constant is not given

CK0065

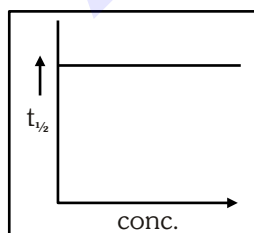
61. The rate constant (K) for the reaction $2A + B \rightarrow$ product, was found to be $2.57 \times 10^{-5} \text{ L mol}^{-1} \text{ s}^{-1}$ after 15 s, $2.60 \times 10^{-5} \text{ L mol}^{-1} \text{ s}^{-1}$ after 30 s and $2.55 \times 10^{-5} \text{ L mol}^{-1} \text{ s}^{-1}$ after 50 s. The order of reaction is
 (1) 2 (2) 3 (3) Zero (4) 1

CK0066

62. The rate constant for a second order reaction is $8 \times 10^{-5} \text{ M}^{-1} \text{ min}^{-1}$. How long will it take a 1M solution to be reduced to 0.5 M.
 (1) $8.665 \times 10^3 \text{ min}$ (2) $8 \times 10^{-3} \text{ min}$
 (3) $1.25 \times 10^4 \text{ min}$ (4) $4 \times 10^{-5} \text{ min}$

CK0067

63. A graph between $t_{1/2}$ and concentration for n^{th} order reaction is a straight line. Reaction of this nature is completed 50% in 10 minutes when concentration is 2 mol L^{-1} . This is decomposed 50% in t minutes at 4 mol L^{-1} , n and t are respectively



- (1) 0, 20 min. (2) 1, 10 min.
 (3) 1, 20 min. (4) 0, 5 min.

CK0068

64. In the case of first order reaction, the ratio of time required for 99.9 % completion to 50 % completion is :-

(1) 2 (2) 5 (3) 10 (4) None

CK0070

65. From different sets of data of $t_{1/2}$ at different initial concentrations say 'a' for a given reaction, the $[t_{1/2} \times a]$ is found to be constant. The order of reaction is :-

(1) 0 (2) 1 (3) 2 (4) 3

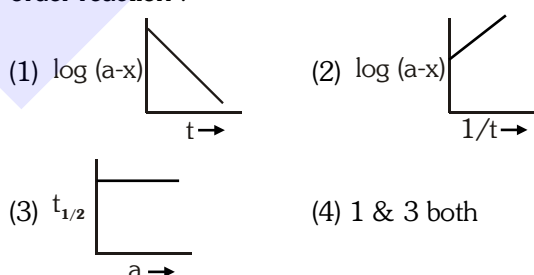
CK0071

66. Which of the following statement is not correct for the reaction whose rate is $r = k$ (rate constant)

- (1) rate of reaction is independent of concentration of reactant
 (2) $t_{1/2}$ of reaction does not depend upon concentration of reactant
 (3) rate constant is independent of concentration of reactant
 (4) this is zero order reaction

CK0073

67. Which of the following curves represents a 1st order reaction :-



CK0074

68. The following data were obtained at a certain temperature for the decomposition of ammonia

p (mm)	50	100	200
$t_{1/2}$	3.64	1.82	0.91

The order of the reaction is :-

- (1) 0 (2) 1
 (3) 2 (4) 3

CK0075

69. A reaction is found to have the rate constant $x \text{ s}^{-1}$, by what factor the rate is increased if initial concentration of reactant is tripled

- (1) 3
 (2) 9
 (3) x
 (4) Remains same

CK0076

70. Which is incorrect :-

- (1) Half life of a first order reaction is independent of initial concentration
- (2) Rate of reaction is constant for first order reaction
- (3) Unit of K for second order reaction is $\text{mol}^{-1} \text{L s}^{-1}$
- (4) Half life of zero order is proportional to initial concentration

CK0077

71. Hydrolysis of ester in alkaline medium is :-

- (1) First order reaction
- (2) Second order reaction
- (3) Zero order reaction
- (4) Third order reaction

CK0078

72. The expression which gives $\frac{1}{4}$ th life of 1st order reaction is :-

- (1) $\frac{K}{2.303} \log \frac{4}{3}$
- (2) $\frac{2.303}{K} \log 3$
- (3) $\frac{2.303}{K} \log \frac{3}{4}$
- (4) $\frac{2.303}{K} \log \frac{4}{3}$

CK0079

73. The rate constant of a zero order reaction is $0.2 \text{ mol dm}^{-3} \text{h}^{-1}$. If the concentration of the reactant after 30 minutes is 0.05 mol dm^{-3} . Then its initial concentration would be :-

- (1) 6.05 mol dm^{-3}
- (2) 0.15 mol dm^{-3}
- (3) 0.25 mol dm^{-3}
- (4) 4.00 mol dm^{-3}

CK0080

74. A reaction is of first order. After 100 minutes, 75 gm of the reactant A are decomposed when 100 gm are taken initially, calculate the time required when 150 gm of the reactant A are decomposed, the initial weight taken is 200 gm :-

- (1) 100 minutes
- (2) 200 minutes
- (3) 150 minutes
- (4) 175 minutes

CK0081

75. For which of the following, the unit of rate and rate constant of the reaction are identical :-

- (1) First order reaction
- (2) Zero order reaction
- (3) Second order reaction
- (4) Fractional order of reaction

CK0082

76. $A \rightarrow \text{Product}$, follows the first order kinetics. If the half life period of the reaction at $[A]_{\text{initial}} = 0.2 \text{ mol L}^{-1}$ is 20 min. then the value of rate constant would be:-

- (1) 4 s^{-1}
- (2) 20 s^{-1}
- (3) $4 \text{ lit. mol}^{-1} \text{min}^{-1}$
- (4) 0.034 min^{-1}

CK0083

77. Correct statement about first order reaction is:-

- (1) $t_{\text{completion}} = \text{finite}$
- (2) $t_{1/2} \propto \frac{1}{a}$
- (3) Unit of K is $\text{mole lit}^{-1} \text{s}^{-1}$
- (4) $t_{1/2} \times K = \text{constant}$ (at given temperature)

CK0084

COLLISION THEORY AND FACTORS AFFECTING RATE OF REACTION

78. Activation energy of a reaction is -

- (1) The energy released during the reaction
- (2) The energy evolved when activated complex is formed
- (3) Minimum extra amount of energy needed to overcome the potential barrier of reaction
- (4) The energy needed to form one mole of the product

CK0086

79. The minimum energy for molecules to enter into chemical reaction is called.

- (1) Kinetic energy
- (2) Potential energy
- (3) Threshold energy
- (4) Activation energy

CK0087

80. The rate constant k_1 of a reaction is found to be double that of rate constant k_2 of another reaction. The relationship between corresponding activation energies of the two reactions at same temperature (E_1 & E_2) can be represented as

- (1) $E_1 > E_2$
- (2) $E_1 < E_2$
- (3) $E_1 = E_2$
- (4) $E_1 = 4E_2$

CK0088

81. At room temperature, the reaction between NO and O_2 to give NO_2 is fast while that between CO and O_2 is slow it is due to -

- (1) CO is smaller in size than that of NO
- (2) CO is poisonous
- (3) The activation energy for the reaction $2\text{NO} + \text{O}_2 \rightarrow 2\text{NO}_2$ is less than $2\text{CO} + \text{O}_2 \rightarrow 2\text{CO}_2$
- (4) NO_2 is poisonous

CK0089

82. Chemical reaction occurs as a result of collisions between reacting molecules. Therefore the reaction rate is given by

- (1) Total number of collisions occurring in a unit volume per second
- (2) Fraction of molecules which possess energy less than the threshold energy.
- (3) Total number of effective collisions
- (4) Temperature

CK0090

83. An endothermic reaction $A \rightarrow B$ has an activation energy 15 kcal/mol and the heat of the reaction is 5 kcal/mol. The activation energy of the reaction $B \rightarrow A$ is –

(1) 20 kcal/mol (2) 15 kcal/mol
(3) 10 kcal/mol (4) Zero

CK0091

84. A large increase in the rate of a reaction for a rise in temperature is due to –

(1) Increase in the number of collisions
(2) Increase in the number of activated molecules
(3) Lowering of activation energy
(4) Shortening of the mean free path

CK0092

85. Rate of which reactions increases with temperature

(1) Of all reactions
(2) Of exothermic reactions
(3) Of endothermic reactions
(4) Can't be predicted

CK0093

86. The rate of a chemical reaction doubles for every 10°C rise in temperature. If the temperature is increased by 60°C the rate of reaction increases by :

(1) 20 times (2) 32 times
(3) 64 times (4) 128 times

CK0094

87. According to the arrhenius equation, a straight line is to be obtained by plotting the logarithm of the rate constant of chemical reaction ($\log k$) against.

(1) T (2) $\log T$
(3) $1/T$ (4) $\log 1/T$

CK0095

88. Which plot will give the value of activation energy.

(1) k v/s T (2) $1/k$ v/s T
(3) $\ln k$ v/s T (4) $\ln k$ v/s $1/T$

CK0096

89. Given that k is the rate constant of any reaction at temp T then the value of $\lim_{T \rightarrow \infty} \log k$ _____.

(1) $A/2.303$ (2) A
(3) $2.303 A$ (4) $\log A$

CK0097

90. The rate constant, the activation energy and the frequency factor of a chemical reaction at 25°C are $3 \times 10^{-4} \text{ s}^{-1}$; $104.4 \text{ kJ mol}^{-1}$ and $6.0 \times 10^{14} \text{ s}^{-1}$ respectively, the value of the rate constant as $T \rightarrow \infty$ is.

(1) $2 \times 10^8 \text{ s}^{-1}$ (2) $6 \times 10^{14} \text{ s}^{-1}$
(3) Infinity (4) $3.6 \times 10^{30} \text{ s}^{-1}$

CK0099

91. For an endothermic reaction where ΔH represents the enthalpy of the reaction in kJ/mol ; the minimum value for the energy of activation will be

(1) Less than ΔH (2) Zero
(3) More than ΔH (4) Equal to ΔH

CK0100

92. The rate of reaction increases 2.3 times when the temperature is raised from 300 K to 310 K. If K is the rate constant at 300 K then the rate constant at 310 K will be equal to –

(1) $2k$ (2) k (3) $2.3k$ (4) $3k^2$

CK0101

93. If the concentration units are reduced by n times then the value of rate constant of first order will

(1) Increases by n times
(2) Decreases by factor of n
(3) Remain constant
(4) Decrease $1/n$ times

CK0103

94. Which is used in the determination of reaction rates.

(1) Reaction Temperature
(2) Reaction Concentration
(3) Specific rate constant
(4) All of these

CK0104

95. The rate constant of a first order reaction depends on the :-

(1) Concentration of the reactant
(2) Concentration of the product
(3) Volume of the reaction container
(4) Temperature

CK0105

96. For the decomposition of $\text{N}_2\text{O}_5(\text{g})$ it is given that $2\text{N}_2\text{O}_5(\text{g}) \rightarrow 4\text{NO}_2(\text{g}) + \text{O}_2(\text{g})$ activation energy = E_a , $\text{N}_2\text{O}_5(\text{g}) \rightarrow 2\text{NO}_2(\text{g}) + \frac{1}{2}\text{O}_2(\text{g})$ activation energy = E'_a then

(1) $E_a = 2E'_a$ (2) $E_a > E'_a$
(3) $E_a < E'_a$ (4) $E_a = E'_a$

CK0106

97. For a reaction in which case the activation energies of forward and reverse reactions are equal :-

- (1) $\Delta H = 0$ (2) $\Delta S = 0$
(3) The order is zero (4) There is no catalyst

CK0107

98. The energy of activation of a forward reaction is 50 kcal. The energy of activation of its backward reaction is:-

- (1) Equal to 50 kcal.
(2) Greater than 50 kcal.
(3) Less than 50 kcal.
(4) Either greater or less than 50 kcal.

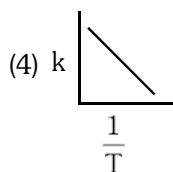
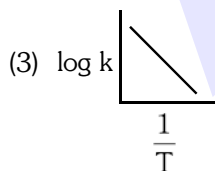
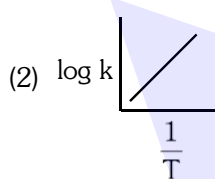
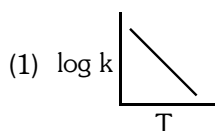
CK0108

99. An exothermic reaction $X \rightarrow Y$ has an activation energy 30 kJ mol⁻¹. If energy change (ΔH) during the reaction is - 20 kJ, then the activation energy for the reverse reaction is :-

- (1) 10 kJ (2) 20 kJ
(3) 50 kJ (4) - 30 kJ

CK0109

100. Which of the following plot is in accordance with the arrhenius equation :-



CK0110

101. The rate of reaction increases with increase in temperature because :-

- (1) Collision is increased
(2) Energy of products decreases
(3) Fraction of molecules possessing energy $\geq E_T$ (Threshold energy) increases
(4) Mechanism of a reaction is changed

CK0111

102. For a certain gaseous reaction, rise of temperature from 25° C to 35° C doubles the rate of reaction. What is the value of activation energy :-

- (1) $\frac{10}{2.303R \times 298 \times 308}$
(2) $\frac{2.303 \times 10}{298 \times 308R}$
(3) $\frac{0.693R \times 10}{290 \times 308}$
(4) $\frac{0.693R \times 298 \times 308}{10}$

CK0112

103. For producing the effective collisions, the colliding molecules must possess :-

- (1) A certain minimum amount of energy
(2) Energy equal to or greater than threshold energy
(3) Proper orientation
(4) Threshold energy as well as proper orientation of collision

CK0114

104. The half life for a reaction of temperature :-

- (1) Independent
(2) Increases with increase
(3) Decreases with increase
(4) Increases or decreases with increase

CK0115

- 105.** The activation energy for a chemical reaction depends upon :-
- (1) Temperature
 - (2) Nature of reacting species
 - (3) Concentration of the reacting species
 - (4) Collision frequency

CK0116

- 106.** During decomposition of an activated complex

- (1) Some energy is absorbed
- (2) Some energy is released
- (3) No energy change
- (4) Both (1) & (2)

CK0216

EXERCISE-I (Conceptual Questions)

ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	1	1	3	3	1	4	1	1	2	4	2	4	3	1	2
Que.	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Ans.	3	2	2	1	3	2	2	4	3	3	2	2	3	4	2
Que.	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
Ans.	2	2	3	2	1	2	1	2	1	3	4	3	1	3	2
Que.	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Ans.	1	4	1	2	2	4	4	4	3	2	3	4	3	2	3
Que.	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
Ans.	1	3	2	3	3	2	4	3	1	2	2	4	2	1	2
Que.	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
Ans.	4	4	3	3	2	3	3	3	2	1	3	3	4	4	2
Que.	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105
Ans.	3	3	3	4	4	4	1	4	3	3	3	4	4	3	2
Que.	106														
Ans.	2														

EXERCISE-II (Previous Year Questions)
AIPMT 2009

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

CK0121

2. For the reaction $A + B \rightarrow \text{products}$, it is observed that :-
- (a) on doubling the initial concentration of A only, the rate of reaction is also doubled and
 (b) on doubling the initial concentrations of both A and B, there is a change by a factor of 8 in the rate of the reaction.
- The rate of this reaction is given by :-
- (1) rate = $k[A][B]$ (2) rate = $k[A]^2[B]$
 (3) rate = $k[A][B]^2$ (4) rate = $k[A]^2[B]^2$

CK0122

3. In the reaction $BrO_3^-(aq) + 5Br^-(aq) + 6H^+ \rightarrow 3Br_2(l) + 3H_2O(l)$
- The rate of appearance of bromine (Br_2) is related to rate of disappearance of bromide ions as following :-
- (1) $\frac{d[Br_2]}{dt} = \frac{3}{5} \frac{d[Br^-]}{dt}$
 (2) $\frac{d[Br_2]}{dt} = -\frac{3}{5} \frac{d[Br^-]}{dt}$
 (3) $\frac{d[Br_2]}{dt} = -\frac{5}{3} \frac{d[Br^-]}{dt}$
 (4) $\frac{d[Br_2]}{dt} = \frac{5}{3} \frac{d[Br^-]}{dt}$

CK0123

4. Half life period of a first-order reaction is 1386 s. The specific rate constant of the reaction is :-
- (1) $5.0 \times 10^{-2} \text{ s}^{-1}$ (2) $5.0 \times 10^{-3} \text{ s}^{-1}$
 (3) $0.5 \times 10^{-2} \text{ s}^{-1}$ (4) $0.5 \times 10^{-3} \text{ s}^{-1}$

CK0124
AIPMT/NEET
AIPMT 2010

5. The rate of the reaction $2NO + Cl_2 \rightarrow 2NOCl$ is given by the rate equation
- $$\text{rate} = k[NO]^2[Cl_2]$$
- the value of rate constant can be increased by :
- (1) Increasing the concentration of NO
 (2) Increasing the concentration of the Cl_2
 (3) Increasing the temperature
 (4) all of these

CK0125

6. For the reaction $N_2O_5(g) \rightarrow 2NO_2(g) + \frac{1}{2}O_2(g)$ the value of 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) $1.25 \times 10^{-2} \text{ mol L}^{-1}\text{s}^{-1}$ and $6.25 \times 10^{-3} \text{ mol L}^{-1}\text{s}^{-1}$
 (2) $6.25 \times 10^{-3} \text{ mol L}^{-1}\text{s}^{-1}$ and $6.25 \times 10^{-3} \text{ mol L}^{-1}\text{s}^{-1}$
 (3) $1.25 \times 10^{-2} \text{ mol L}^{-1}\text{s}^{-1}$ and $3.125 \times 10^{-3} \text{ mol L}^{-1}\text{s}^{-1}$
 (4) $6.25 \times 10^{-3} \text{ mol L}^{-1}\text{s}^{-1}$ and $3.125 \times 10^{-3} \text{ mol L}^{-1}\text{s}^{-1}$

CK0126

7. During the kinetic study of the reaction, $2A + B \rightarrow C + D$, following results were obtained:-
- | Ex. No. | [A](mol L ⁻¹) | [B](mol L ⁻¹) | Initial rate of formation of D(mol L ⁻¹ min ⁻¹) |
|---------|---------------------------|---------------------------|--|
| I | 0.1 | 0.1 | 6.0×10^{-3} |
| II | 0.3 | 0.2 | 7.2×10^{-2} |
| III | 0.3 | 0.4 | 2.88×10^{-1} |
| IV | 0.4 | 0.1 | 2.40×10^{-2} |
- Based on the above data which one of the following is correct ?
- (1) rate = $k[A][B]^2$ (2) rate = $k[A]^2[B]$
 (3) rate = $k[A][B]$ (4) rate = $k[A]^2[B]^2$

CK0127

8. For an endothermic reaction, energy of activation is E_a and enthalpy of reaction is ΔH (both of these in kJ/mol). Minimum value of E_a will be :-
- (1) Equal to zero (2) Less than ΔH
 (3) Equal to ΔH (4) More than ΔH

CK0128

AIPMT Pre. 2011

9. Which one of the following statements for the order of a reaction is incorrect ?
- (1) Order can be determined only experimentally
 - (2) Order is not influenced by stoichiometric coefficient of the reactants
 - (3) Order of reaction is sum of power to the concentration terms of reactants to express the rate of reaction
 - (4) Order of reaction is always whole number

CK0130

AIPMT Mains 2011

10. The unit of rate constant for a zero order reaction is :-
- (1) s^{-1}
 - (2) $\text{mol L}^{-1} s^{-1}$
 - (3) $\text{L mol}^{-1} s^{-1}$
 - (4) $\text{L}^2 \text{mol}^{-2} s^{-1}$
11. The half life of a substance in a certain enzyme-catalysed first order reaction is 138 s. The time required for the concentration of the substance to fall from 1.28 mg L^{-1} to 0.04 mg L^{-1} :-
- (1) 276 s
 - (2) 414 s
 - (3) 552 s
 - (4) 690 s

CK0131

CK0132

12. The rate of the reaction $2\text{N}_2\text{O}_5 \rightarrow 4\text{NO}_2 + \text{O}_2$ can be written in three ways

$$\frac{-d[\text{N}_2\text{O}_5]}{dt} = k[\text{N}_2\text{O}_5]$$

$$\frac{d[\text{NO}_2]}{dt} = k' [\text{N}_2\text{O}_5]$$

$$\frac{d[\text{O}_2]}{dt} = k'' [\text{N}_2\text{O}_5]$$

The relationship between k and k' and between k and k'' are :-

- (1) $k' = k$; $k'' = k$
- (2) $k' = 2k$; $k'' = k$
- (3) $k' = 2k$; $k'' = k/2$
- (4) $k' = 2k$; $k'' = 2k$

CK0133

AIPMT Pre. 2012

13. In a zero-order reaction for every 10° rise of temperature, the rate is doubled. If the temperature is increased from 10°C to 100°C , the rate of the reaction will become:
- (1) 64 times
 - (2) 128 times
 - (3) 256 times
 - (4) 512 times

CK0135

14. In a reaction $\text{A} + \text{B} \rightarrow \text{Product}$, rate is doubled when the concentration of B is doubled and rate increased by a factor of 8 when the concentrations of both the reactants (A and B) are doubled, rate law for the reaction can be written as:

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

CK0136

AIPMT Mains 2012

15. Activation energy (E_a) and rate constants (k_1 and k_2) of a chemical reaction at two different temperatures (T_1 and T_2) are related by :

$$(1) \ln \frac{k_2}{k_1} = -\frac{E_a}{R} \left(\frac{1}{T_2} + \frac{1}{T_1} \right)$$

$$(2) \ln \frac{k_2}{k_1} = \frac{E_a}{R} \left(\frac{1}{T_1} - \frac{1}{T_2} \right)$$

$$(3) \ln \frac{k_2}{k_1} = -\frac{E_a}{R} \left(\frac{1}{T_1} - \frac{1}{T_2} \right)$$

$$(4) \ln \frac{k_2}{k_1} = -\frac{E_a}{R} \left(\frac{1}{T_2} - \frac{1}{T_1} \right)$$

CK0137

NEET-UG 2013

16. A reaction having equal energies of activation for forward and reverse reactions has :-
- (1) $\Delta H = \Delta G = \Delta S = 0$
 - (2) $\Delta S = 0$
 - (3) $\Delta G = 0$
 - (4) $\Delta H = 0$

CK0140

17. What is the activation energy of a reaction if its rate doubles when the temperature is raised from 20°C to 35°C ? ($R = 8.314 \text{ J mol}^{-1} \text{ K}^{-1}$)
- (1) 15.1 kJ mol^{-1}
 - (2) 342 kJ mol^{-1}
 - (3) 269 kJ mol^{-1}
 - (4) 34.7 kJ mol^{-1}

CK0141

AIPMT 2015

18. The activation energy of a reaction can be determined from the slope of which of the following graphs ?
- (1) $\frac{\ln k}{T}$ v/s. T
 - (2) $\ln k$ v/s. $\frac{1}{T}$
 - (3) $\frac{T}{\ln k}$ v/s. $\frac{1}{T}$
 - (4) $\ln k$ v/s. T

CK0145

19. When initial concentration of a reactant is doubled in a reaction, its half-life period is not affected. The order of the reaction is :-
- (1) First
 - (2) Second
 - (3) More than zero but less than first
 - (4) Zero

CK0146

Re-AIPMT 2015

20. The rate constant of the reaction $A \rightarrow B$ is $0.6 \times 10^{-3} \text{ M sec}^{-1}$. If the concentration of A is 5 M, then concentration of B after 20 min is :-
- (1) 0.36 M (2) 0.72 M
(3) 1.08 M (4) 3.60 M

CK0147
NEET-I 2016

21. The rate of a first-order reaction is $0.04 \text{ mol L}^{-1} \text{ s}^{-1}$ at 10 s and $0.03 \text{ mol L}^{-1} \text{ s}^{-1}$ at 20 s after initiation of the reaction. The half-life period of the reaction is :
- (1) 24.1 s (2) 34.1 s
(3) 44.1 s (4) 54.1 s

CK0151

22. The addition of a catalyst during a chemical reaction alters which of the following quantities ?
- (1) Entropy (2) Internal energy
(3) Enthalpy (4) Activation energy

CK0152
NEET-II 2016

23. The decomposition of phosphine (PH_3) on tungsten at low pressure is a first-order reaction. It is because the
- (1) rate is independent of the surface coverage
(2) rate of decomposition is very slow
(3) rate is proportional to the surface coverage
(4) rate is inversely proportional to the surface coverage

CK0153
NEET(UG) 2017

24. Mechanism of a hypothetical reaction $X_2 + Y_2 \rightarrow 2XY$ is given below :
- (i) $X_2 \rightleftharpoons X + X$ (fast)
(ii) $X + Y_2 \rightarrow XY + Y$ (slow)
(iii) $X + Y \rightarrow XY$ (fast)
- The overall order of the reaction will be :
- (1) 2 (2) 0 (3) 1.5 (4) 1
25. A first order reaction has a specific reaction rate of 10^{-2} s^{-1} . How much time will it take for 20 g of the reactant to reduce to 5 g ?
- (1) 138.6 s (2) 346.5 s
(3) 693.0 s (4) 238.6 s

CK0160
NEET(UG) 2018

26. The correct difference between first- and second-order reaction is that
- (1) the rate of a first-order reaction does not depend on reactant concentration; the rate of a second-order reaction does depend on reactant concentrations.
(2) the half-life of a first-order reaction does not depend on $[A]_0$; the half-life of a second-order reaction does depend on $[A]_0$
(3) a first-order reaction can be catalyzed; a second-order reaction cannot be catalyzed.
(4) the rate of a first-order reaction does depend on reactant concentrations; the rate of a second-order reaction does not depend on reactant concentrations

CK0165

27. When initial concentration of the reactant is doubled, the half-life period of a zero order reaction
- (1) is halved
(2) is doubled
(3) is tripled
(4) remains unchanged

CK0166
NEET(UG) 2019

28. If the rate constant for a first order reaction is k, then the time (t) required for the completion of 99% of the reaction is given by :-
- (1) $t = 0.693/k$
(2) $t = 6.909/k$
(3) $t = 4.606/k$
(4) $t = 2.303/k$

CK0217

29. For the chemical reaction $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightarrow 2\text{NH}_3(\text{g})$ the **correct** option is :

- (1) $-\frac{1}{3} \frac{d[\text{H}_2]}{dt} = -\frac{1}{2} \frac{d[\text{NH}_3]}{dt}$
(2) $-\frac{d[\text{N}_2]}{dt} = 2 \frac{d[\text{NH}_3]}{dt}$
(3) $-\frac{d[\text{N}_2]}{dt} = \frac{1}{2} \frac{d[\text{NH}_3]}{dt}$
(4) $3 \frac{d[\text{H}_2]}{dt} = 2 \frac{d[\text{NH}_3]}{dt}$

CK0218

NEET(UG) 2019 (Odisha)

30. A first order reaction has a rate constant of $2.303 \times 10^{-3} \text{ s}^{-1}$. The time required for 40g of this reactant to reduce to 10 g will be-

[Given that $\log_{10} 2 = 0.3010$]

- (1) 230.3 s (2) 301 s
(3) 2000 s (4) 602 s

CK0219

31. For a reaction, activation energy $E_a = 0$ and the rate constant at 200K is $1.6 \times 10^6 \text{ s}^{-1}$. The rate constant at 400K will be-

[Given : gas constant $R = 8.314 \text{ J K}^{-1} \text{ mol}^{-1}$]

- (1) $3.2 \times 10^4 \text{ s}^{-1}$ (2) $1.6 \times 10^6 \text{ s}^{-1}$
(3) $1.6 \times 10^3 \text{ s}^{-1}$ (4) $3.2 \times 10^6 \text{ s}^{-1}$

CK0220

NEET (UG) 2020

32. 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 is :

- (1) 1000 s (2) 100 s
(3) 200 s (4) 500 s

CK0227

33. An increase in the concentration of the reactants of a reaction leads to change in :

- (1) collision frequency
(2) activation energy
(3) heat of reaction
(4) threshold energy

CK0228

NEET (UG) 2020 (COVID-19)

34. The half-life for a zero order reaction having 0.02 M initial concentration of reactant is 100 s. The rate constant (in $\text{mol L}^{-1} \text{ s}^{-1}$) for the reaction is

- (1) 1.0×10^{-4}
(2) 2.0×10^{-4}
(3) 2.0×10^{-3}
(4) 1.0×10^{-2}

CK0229

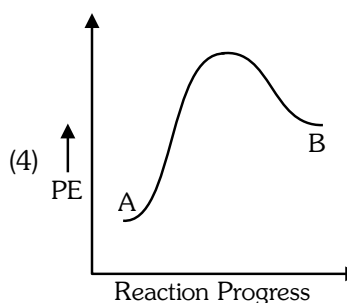
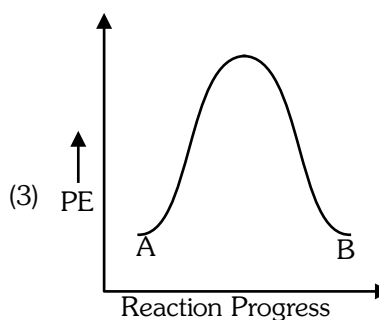
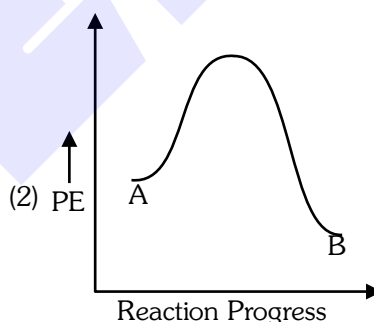
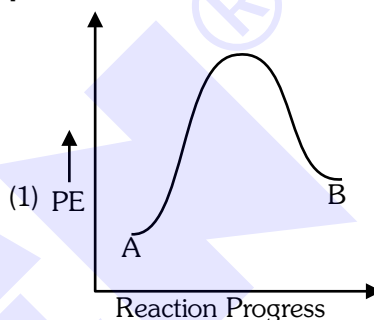
35. In collision theory of chemical reaction, Z_{AB} represents

- (1) the fraction of molecules with energies greater than E_a
(2) the collision frequency of reactants, A and B
(3) steric factor
(4) the fraction of molecules with energies equal to E_a

CK0230

NEET (UG) 2021

36. For a reaction $A \rightarrow B$, enthalpy of reaction is -4.2 kJ mol^{-1} and enthalpy of activation is 9.6 kJ mol^{-1} . The correct potential energy profile for the reaction is shown in option.



CK0231

37. The slope of Arrhenius Plot $\left(\ln k \text{ v/s } \frac{1}{T}\right)$ of

first order reaction is $-5 \times 10^3 \text{ K}$. The value of E_a of the reaction is. Choose the correct option for your answer.

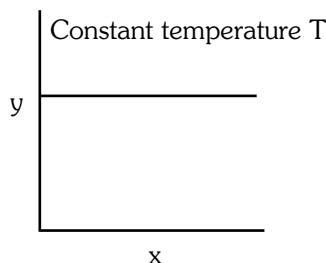
[Given $R = 8.314 \text{ J K}^{-1} \text{ mol}^{-1}$]

- (1) 41.5 kJ mol^{-1} (2) 83.0 kJ mol^{-1}
(3) 166 kJ mol^{-1} (4) -83 kJ mol^{-1}

CK0232

NEET (UG) 2022

38. The given graph is a representation of kinetics of a reaction.



The y and x axes for zero and first order reactions, respectively are

- (1) zero order ($y = \text{concentration}$ and $x = \text{time}$),
first order ($y = \text{rate constant}$ and $x = \text{concentration}$)
(2) zero order ($y = \text{rate}$ and $x = \text{concentration}$),
first order ($y = t_{1/2}$ and $x = \text{concentration}$)
(3) zero order ($y = \text{rate}$ and $x = \text{concentration}$),
first order ($y = \text{rate}$ and $x = t_{1/2}$)
(4) zero order ($y = \text{concentration}$ and $x = \text{time}$),
first order ($y = t_{1/2}$ and $x = \text{concentration}$)

CK0233

39. For a first order reaction $A \rightarrow \text{Products}$, initial concentration of A is 0.1 M, which becomes 0.001 M after 5 minutes. Rate constant for the reaction in min^{-1} is

- (1) 0.9212
(2) 0.4606
(3) 0.2303
(4) 1.3818

CK0234

NEET (UG) 2022 (OVERSEAS)

40. For the reaction, $2A \rightarrow B$. rate $= k[A]^2$.

If concentration of reactant is doubled, then the

- (a) rate of reaction will be doubled.
(b) rate constant will remain unchanged, however rate of reaction is directly proportional to the rate constant.
(c) rate constant will change since rate of reaction and rate constant are directly proportional to each other.
(d) rate of reaction will increase by four times.

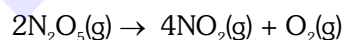
Identify the set of correct statements :

Choose the **correct answer** from the options given below :

- (1) (a), (b) only
(2) (b), (d) only
(3) (c), (d) only
(4) (a), (c) only

CK0235

41. The plot of $\ln k$ vs $\frac{1}{T}$ for the following reaction



gives a straight line with the slope of line equal to $-1.0 \times 10^4 \text{ K}$. Activation energy for the reaction in J mol^{-1} is (Given $R = 8.3 \text{ J K}^{-1} \text{ mol}^{-1}$)

- (1) 4.0×10^{-2}
(2) 8.3×10^{-4}
(3) 8.3×10^4
(4) 4.0×10^2

CK0236

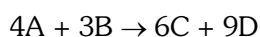
Re-NEET (UG) 2022

42. The half life of a first order reaction is 2000 years. If the concentration after 8000 years is 0.02 M, then the initial concentration was :

- (1) 0.16 M
(2) 0.32 M
(3) 0.08 M
(4) 0.04 M

CK0237

43. For a chemical reaction



rate of formation of C is $6 \times 10^{-2} \text{ mol L}^{-1} \text{ s}^{-1}$ and

rate of disappearance of A is $4 \times 10^{-2} \text{ mol L}^{-1} \text{ s}^{-1}$.

The rate of reaction and amount of B consumed in interval of 10 seconds, respectively will be :

- (1) $1 \times 10^{-2} \text{ mol L}^{-1} \text{ s}^{-1}$ and $30 \times 10^{-2} \text{ mol L}^{-1}$
- (2) $10 \times 10^{-2} \text{ mol L}^{-1} \text{ s}^{-1}$ and $10 \times 10^{-2} \text{ mol L}^{-1}$
- (3) $1 \times 10^{-2} \text{ mol L}^{-1} \text{ s}^{-1}$ and $10 \times 10^{-2} \text{ mol L}^{-1}$
- (4) $10 \times 10^{-2} \text{ mol L}^{-1} \text{ s}^{-1}$ and $30 \times 10^{-2} \text{ mol L}^{-1}$

CK0238

EXERCISE-II (Previous Year Questions)

ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	2	3	2	4	3	3	1	4	4	2	4	3	4	2	2,4
Que.	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Ans.	4	4	2	1	2	1	4	3	3	1	2	2	3	3	4
Que.	31	32	33	34	35	36	37	38	39	40	41	42	43		
Ans.	2	4	1	1	2	2	1	2	1	2	3	2	1		

EXERCISE-III (Analytical Questions)

Master Your Understanding

1. For the elementary reaction
 $A + 2B \rightarrow \text{Product}$,
 the differential rate equation is :-

(1) $-\frac{1}{2} \frac{d[A]}{dt} = \frac{-d[B]}{dt} = k[A][B]^2$
 (2) $-\frac{1}{2} \frac{d[A]}{dt} = \frac{d[B]}{dt} = k[A][B]^2$
 (3) $\frac{-d[A]}{dt} = -\frac{1}{2} \frac{d[B]}{dt} = k[A][B]^2$
 (4) $\frac{dA}{dt} = \frac{1}{2} \frac{d[B]}{dt} = k[A][B]^2$

CK0175

2. For the reaction $A \rightarrow B$ rate increases 5.19 times if the concentration of reactant A is tripled. The order of the reaction.

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

CK0176

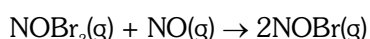
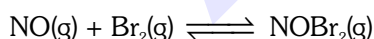
3. For the non-stoichiometric reaction
 $2A + B \rightarrow C + D$, the following kinetic data were obtained in three different experiments, measured at 298 K.

Initial Conc. (A)	Initial Conc. (B)	Initial rate formation of C (Ms^{-1})
0.1M	0.1M	1.2×10^{-3}
0.1M	0.2M	1.2×10^{-3}
0.2M	0.1M	2.4×10^{-3}

- (1) $\text{rate} = k[A][B]^2$ (2) $\text{rate} = k[A]$
 (3) $\text{rate} = k[A][B]$ (4) $\text{rate} = k[A]^2[B]$

CK0177

4. The following mechanism has been proposed for the reaction of NO with Br_2 to form NOBr :

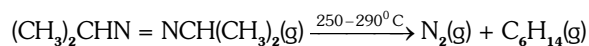


If the second step is the rate determining step, the order of the reaction with respect to NO(g) is :

- (1) 2 (2) 1
 (3) 0 (4) 3

CK0178

5. Azo isopropane decomposes according to the equation :-



It is found to be a first order reaction. If initial pressure is P_o and pressure of the mixture at time t is P_t then rate constant k would be :-

(1) $k = \frac{2.303}{t} \log \frac{P_o}{2P_o - P_t}$
 (2) $k = \frac{2.303}{t} \log \frac{P_o - P_t}{P_o}$
 (3) $k = \frac{2.303}{t} \log \frac{P_o}{P_o - P_t}$
 (4) $k = \frac{2.303}{t} \log \frac{2P_o}{2P_o - P_t}$

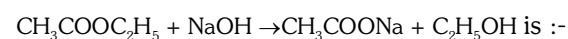
CK0181

6. Which of the following statement is false :-

- (1) A fast reaction has a large rate constant and short half life
 (2) For a first order reaction, successive half lives are equal
 (3) For a first order reaction, the half life is independent of concentration
 (4) The half life of a reaction is half the time required for the reaction to go for completion

CK0183

7. The reaction



- (1) Bimolecular reaction (2) II order reaction
 (3) Both (1) & (2) (4) None

CK0184

8. Correct expression for the first order reaction is:-

(1) $C_t = C_o e^{k_1 t}$ (2) $C_t e^{k_1 t} = C_o$
 (3) $\ln \frac{C_o}{C_t} = -k_1 t$ (4) $\ln \frac{C_t}{C_o} = k_1 t$

CK0185

9. The rate of first order reaction is $1.5 \times 10^{-2} \text{ mol L}^{-1} \text{ min}^{-1}$ at 0.5 M concentration of the reactant. The half life of the reaction is

- (1) 7.53 min (2) 0.383 min
 (3) 23.1 min (4) 8.73 min

CK0186

10. In a first order reaction, the concentration of the reactant, decreases from 0.8 M to 0.4 M in 15 min. The time taken for the concentration to change from 0.1 M to 0.025 M is
 (1) 7.5 min (2) 15 min
 (3) 30 min (4) 60 min

CK0187

11. The rate equation for the reaction $2A + B \rightarrow C$ is found to be : rate = $k[A][B]$. The correct statement for this reaction is that the
 (1) rate of formation of C is twice the rate of disappearance of A.
 (2) Half life is a constant
 (3) unit of k must be s^{-1}
 (4) value of k is independent of the concentrations of A and B

CK0188

12. The half-life of a radio isotope is four hours. If the initial mass of the isotope was 200 g, the mass remaining after 24hr undecayed is :
 (1) 3.125 g (2) 2.084 g
 (3) 1.042 g (4) 4.167 g

CK0189

13. For a first order reaction $A \rightarrow B$ the reaction rate at reactant concentration of 0.01 M is found to be $2.0 \times 10^{-5} \text{ mol L}^{-1}\text{s}^{-1}$. The half life period of the reaction is :
 (1) 220 s (2) 30 s (3) 300 s (4) 347 s

CK0190

14. For reaction $aA \rightarrow xP$. When [A] is 2.2 mM, the rate was found to be 2.4 mM s^{-1} . On reducing concentration of A to half, the rate changes to 0.6 mM s^{-1} . The order of reaction with respect to A is :
 (1) 1.5 (2) 2.0
 (3) 2.5 (4) 3.0

CK0191

15. The $t_{1/2}$ of a reaction is halved as the initial concentration of the reactant is doubled. What is the order of reaction ?
 (1) 1 (2) 0
 (3) 2 (4) 3

CK0192

16. The rate of a chemical reaction doubles for every 10°C rise of temperature. If the temperature is raised by 50°C , the rate of the reaction increases by about :-

- (1) 32 times (2) 64 times
 (3) 10 times (4) 24 times

CK0193

17. For a first order reaction, $(A) \rightarrow \text{products}$, the concentration of A changes from 0.1 M to 0.025M in 40 min. The rate of reaction when the concentration of A is 0.01 M is :-
 (1) $1.73 \times 10^{-4} \text{ M/min}$ (2) $1.73 \times 10^{-5} \text{ M/min}$
 (3) $3.47 \times 10^{-4} \text{ M/min}$ (4) $3.47 \times 10^{-5} \text{ M/min}$

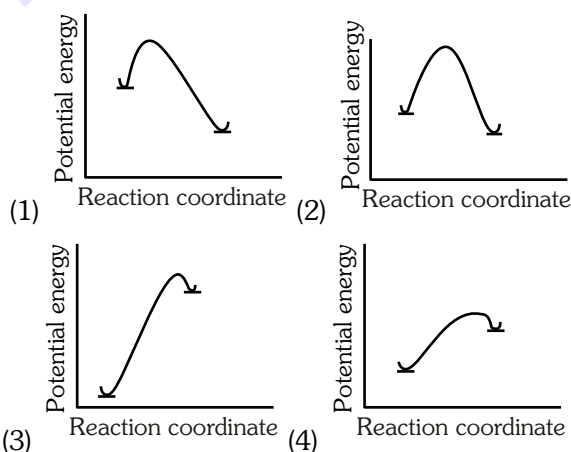
CK0194

18. Arrhenius equation may be written as :-

- (1) $\frac{d}{dT} (\ln k) = -\frac{E_a}{RT}$ (2) $\frac{d}{dT} (\ln k) = -\frac{E_a}{RT^2}$
 (3) $\frac{d}{dT} (\ln k) = +\frac{E_a}{RT^2}$ (4) $\frac{d}{dT} (\ln k) = \frac{E_a}{RT}$

CK0195

19. An endothermic reaction with high activation energy for the forward reaction is given by the diagram :



CK0196

20. The rate of a reaction doubles when its temperature changes from 300 K to 310 K. Activation energy of such a reaction will be ($R = 8.314 \text{ JK}^{-1} \text{ mol}^{-1}$ and $\log 2 = 0.301$)
 (1) 53.6 kJ mol^{-1} (2) 48.6 kJ mol^{-1}
 (3) 58.5 kJ mol^{-1} (4) 60.5 kJ mol^{-1}

CK0198

21. The rate constants k_1 and k_2 for two different reactions are $10^{16}e^{-2000/T}$ and $10^{15}e^{-1000/T}$, respectively.

The temperature at which $k_1 = k_2$ is

- (1) $\frac{2000}{2.303}$ K (2) 2000 K
(3) $\frac{1000}{2.303}$ K (4) 1000 K

CK0119

22. The bromination of acetone that occurs in acid solution is represented by this equation



The kinetic data were obtained for given reaction at different concentrations.

$[\text{CH}_3\text{COCH}_3]$	$[\text{Br}_2]$	$[\text{H}^+]$	ROD of Br_2 , Ms^{-1}
0.30	0.05	0.05	6×10^{-5}
0.30	0.10	0.05	6×10^{-5}
0.30	0.10	0.10	1.2×10^{-4}
0.40	0.05	0.20	3×10^{-4}

Based on these data, the rate equation is :

- (1) Rate = $k[\text{CH}_3\text{COCH}_3][\text{Br}_2]$
(2) Rate = $k[\text{CH}_3\text{COCH}_3][\text{Br}_2][\text{H}^+]^2$
(3) Rate = $k[\text{CH}_3\text{COCH}_3][\text{Br}_2][\text{H}^+]$
(4) Rate = $k[\text{CH}_3\text{COCH}_3][\text{H}^+]$

CK0120

23. Rate of a reaction can be expressed as $r = PZ_{AB}e^{-E_a/RT}$. In the above expression which term is called steric factor and collision frequency of reaction A & B.

- (1) Z_{AB} and $e^{-E_a/RT}$
(2) P and Z_{AB}
(3) Z_{AB} and $e^{-E_a/RT}$
(4) P and $e^{-E_a/RT}$

CK0221

24. For $\text{A}(\text{g}) \rightarrow \text{B}(\text{g}) + \text{C}(\text{g})$ reaction the differential rate law expression is given as $r = \frac{-d[\text{A}]}{dt} = k[\text{A}]$

. Initially the pressure is 100 mm of Hg & after 10 minutes, total pressure is 120 mm of Hg. Hence rate constant (min^{-1}) is

- (1) $k = \frac{2.303}{10} \log \frac{120}{100}$ (2) $k = \frac{2.303}{10} \log \frac{100}{20}$
(3) $k = \frac{2.303}{10} \log \frac{100}{80}$ (4) $k = \frac{2.303}{10} \log \frac{100}{120}$

CK0222

25. The rate constant for 1st order reaction is 69.3 s^{-1} . How much time will it take to reduce the initial concentration of the reactant to its $\frac{1}{16}$ th value?

- (1) 0.04 sec (2) 0.02 sec
(3) 0.06 sec (4) 0.05 sec

CK0223

26. For any chemical reaction, chemists try to find out

- (1) the feasibility of a chemical reaction which can be predicted by thermodynamics
(2) speed of a reaction
(3) extent to which a reaction will proceed can be determined
(4) All of the above

CK0224

27. $t_{1/2}$ for a zero order reaction is(I).... proportional to the initial concentration of the reactants and(II).... proportional to the rate constant. Choose the correct words to fill up the blanks (I) and (II) respectively from the options given below.

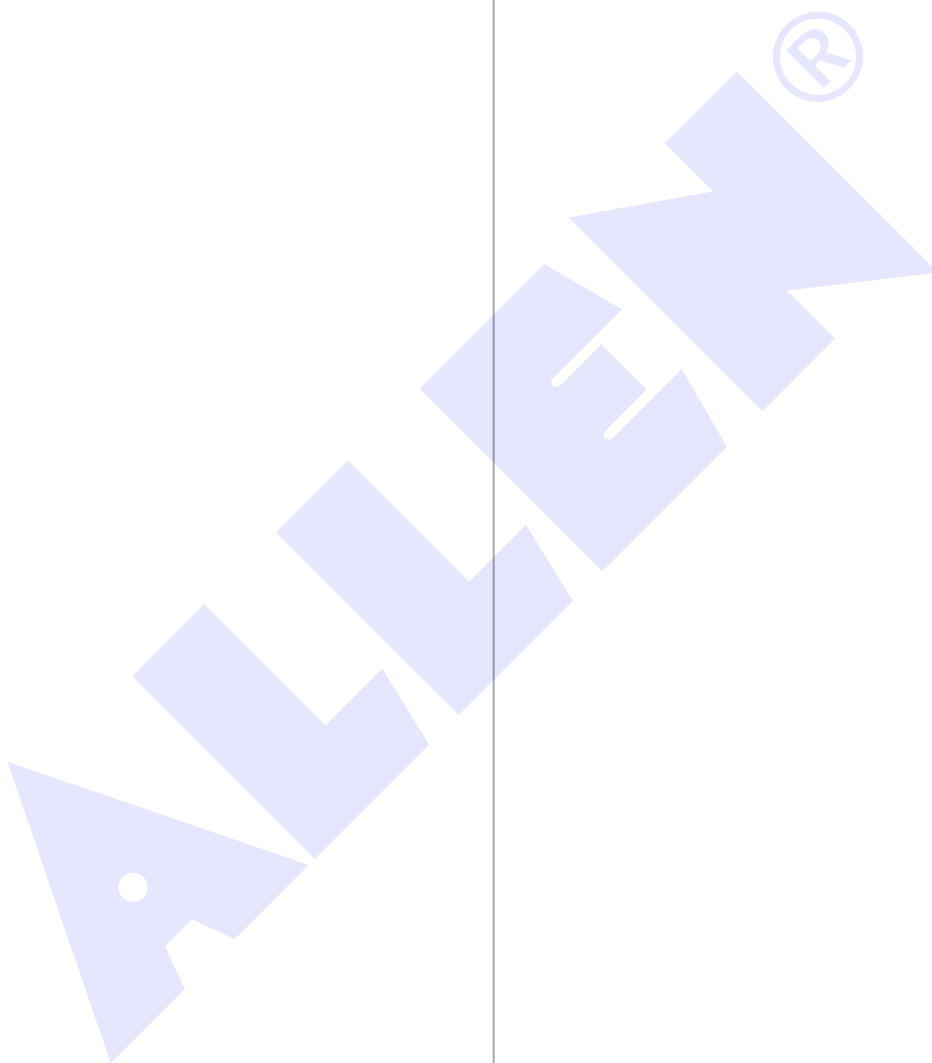
- (1) (I) inversely, (II) directly
(2) (I) directly, (II) directly
(3) (I) inversely, (II) inversely
(4) (I) directly, (II) inversely

CK0225

28. What is true about pseudo first order reaction?

- (1) One of the two reactants is in excess in the reaction
- (2) There is only one reactant in the reaction
- (3) It is actually a zero order reaction
- (4) None of the above

CK0226



EXERCISE-III (Analytical Questions)

ANSWER KEY

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