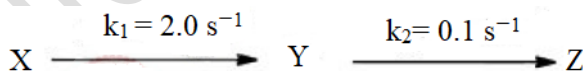


Assignment for B.Sc. Part I (Chem (H))

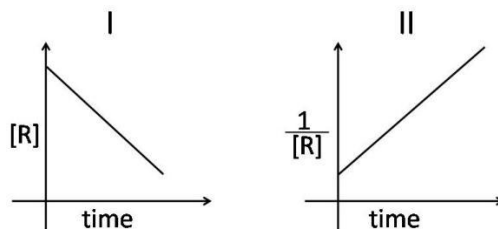
- For the radioactive isotope ^{131}I , the time required for 50% disintegration is 8 days. The time required for the 99.9% disintegration of 5.5 g of ^{131}I is (Up to one decimal place)
 - 70 days
 - 16 days
 - 32 days
 - 80 days
- The rate constant of a first order reaction, $1.6 \times 10^{-3} \text{ s}^{-1}$ at 300 K. Given that the activation energy of the reaction is 28 kJ mol^{-1} and assuming Arrhenius behavior for the temperature dependence, the total time required to obtain 90% of Y at 350 K is (in seconds) - (Up to one decimal place. Use $R = 8.31 \text{ J K}^{-1} \text{ mol}^{-1}$)
 - 350
 - 250
 - 280
 - 310
- The rate constant of a reaction is $1.25 \times 10^{-4} \text{ molL}^{-1} \text{ s}^{-1}$. If the initial concentration of reactant is 0.250 MolL^{-1} , the total time (in second) required for complete conversion is-
 - 2000
 - 1500
 - 200
 - 150

- For the following consecutive first order reactions



the time (in seconds) required for Y to reach its maximum concentration (assuming only X is present at time = 0) is

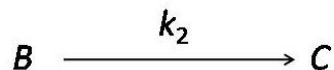
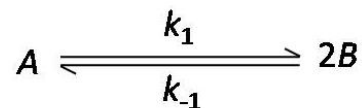
- 1.50
 - 1.60
 - 1.70
 - 1.65
- The concentration of a reactant R varies with time for two different reactions as shown in the following plots



The orders of these two reactions I and II, respectively, are

- a) zero and one b) one and zero c) zero and two d) two and zero

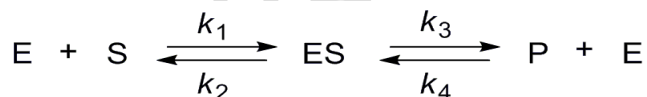
6. For the following reactions



$\frac{d[B]}{dt}$ is given by

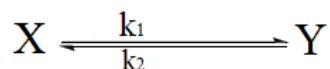
- a) $k_1[A] - k_{-1}[B]^2 - 2k_2[B]$
 b) $2k_1[A] - 2k_{-1}[B]^2 - k_2[B]$
 c) $\frac{1}{2}k_1[A] - \frac{1}{2}k_{-1}[B]^2 - k_2[B]$
 d) $2k_1[A] - 2k_{-1}[B]^{1/2} - k_2[B]$

7. The expression for the equilibrium constant (K_{eq}) for the enzyme catalyzed reaction given below, is



- (a) $\frac{k_1 k_3}{k_2 k_4}$ (b) $\frac{k_1 k_2}{k_3 k_4}$ (c) $\frac{k_2 k_3}{k_1 k_4}$ (d) $\frac{k_1 k_4}{k_2 k_3}$

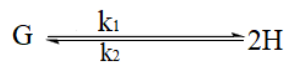
8. For a reaction type



The correct rate expression is ($[X]_0$ and $[X]$ correspond to the concentrations of X at time $t = 0$ and $t = t$, respectively)

- a) $-\frac{d[X]}{dt} = k_1[X]_0 - (k_1 + k_2)[X]$ b) $-\frac{d[X]}{dt} = (k_1 + k_2)[X] - k_2[X]_0$
 c) $-\frac{d[X]}{dt} = (k_1 + k_2)[X]_0 - k_1[X]$ d) $-\frac{d[X]}{dt} = (k_1 - k_2)[X] - k_1[X]_0$

9. For a reaction involving two steps given below



Assume that the first step attains equilibrium rapidly. The rate of formation of P is proportional to

- a) $[G]^{1/2}$ b) $[G]$ c) $[G]^2$ d) $[G]^{3/2}$

10. The specific rate constant of decomposition of a compound is represented by

$$\ln K = 5.0 - \frac{12000}{T}$$

The activation energy of decomposition for this compound at 300K is:

- (a) kcal/mole b) 12 kcal/mole c) 24 cal/mole d) 12 cal/mole

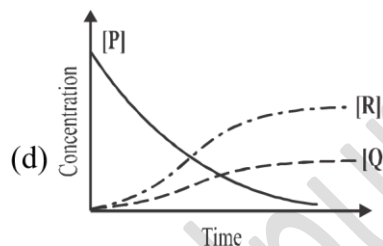
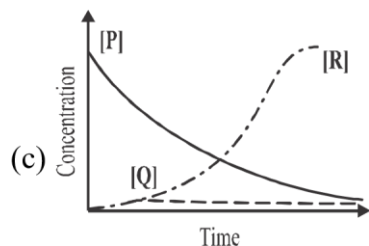
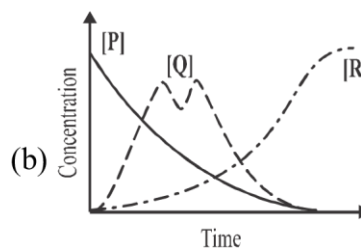
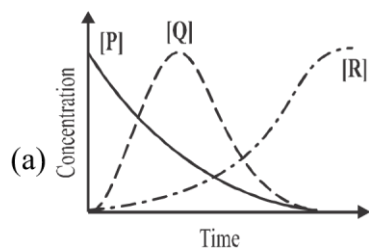
11. The half-life for the hydrolysis of an ester varies with the initial concentration of the reactant $[E_0]$ as follows:

$[E_0]/10^{-2}$ molL^{-1}	5.0	4.0	3.0
Half-life	240	300	400

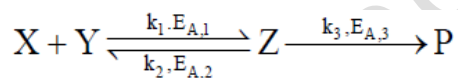
The order of the reaction is

- a) 0 b) 1 c) 2 d) 3

12. For the first order consecutive $P \rightarrow Q \rightarrow R$, under steady state approximation to $[Q]$, the variation of $[P]$, $[Q]$ and $[R]$ with time are best represented by



13. In the reaction mechanism given



where, k 's represent rate constants, E_A 's represent activation energies and $k_2 \gg k_3$

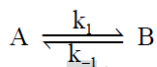
The overall rate constant for the formation of P can be expressed as

- a) $k_1 k_3 / k_2$ b) k_1 c) $k_1 / (k_2 + k_3)$ d) $k_1 / (k_2 - k_3)$

14. The overall activation energy for the formation of P can be expressed as

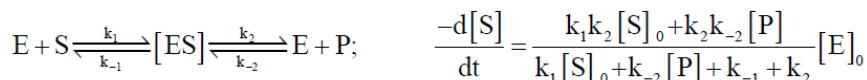
- (a) $\frac{E_{A,1} - E_{A,3}}{E_{A,2}}$ (b) $E_{A,1}$ (c) $E_{A,1} + E_{A,3} - E_{A,2}$ (d) $\frac{E_{A,1}}{E_{A,2} + E_{A,3}}$

15. For the reaction given below, the relaxation time is 10^{-6} s. Given that 10% of A remains at equilibrium, the value of k_1 (s^{-1}) is-



- (a) 9×10^5 (b) 10^{-5} (c) 10^5 (d) 9×10^{-5}

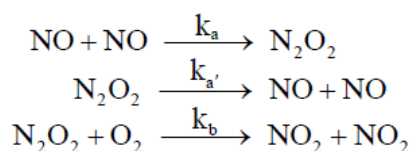
16. The mechanism of enzyme (E) catalyzed reaction of substrate (S) to yield product P is:



If a small amount of S is converted to P, the maximum rate for the reaction will be observed for

- (a) $(k_1 + k_2) \gg k_1 [S]_0$ (b) $(k_{-1} + k_2) \ll k_1 [S]_0$
 (c) $(k_1 + k_2) \gg k_1 (s)_1$ (d) $k_2 \ll k_1$

17. The reaction $2NO(g) + O_2(g) \rightarrow 2NO_2(g)$, Proceed via the following mechanism



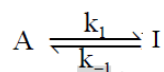
The rate of this reaction is equal to

- (a) $2k_b [NO][O_2]$ (b) $(2k_a k_b [NO]^2 [O_2]) / (k_a + k_b [O_2])$
 (c) $2k_b [NO]^2 [O_2]$ (d) $k_a [NO]^2 [O_2]$

18. The rate constants of two reactions at temperature T are $k_1(T)$ and $k_2(T)$ and the corresponding activation energies are E_1 and E_2 with $E_2 > E_1$. When temperature is raised from T_1 and T_2 , which one of the following relations is correct?

- (a) $\frac{k_1(T_2)}{k_1(T_1)} = \frac{k_2(T_2)}{k_2(T_1)}$ (b) $\frac{k_1(T_2)}{k_1(T_1)} > \frac{k_2(T_2)}{k_2(T_1)}$ (c) $\frac{k_1(T_2)}{k_1(T_1)} \geq \frac{k_2(T_2)}{k_2(T_1)}$ (d) $\frac{k_1(T_2)}{k_1(T_1)} < \frac{k_2(T_2)}{k_2(T_1)}$

19. Consider an exothermic reaction



As the temperature increases

- (a) k_1, k_{-1} , and k_1/k_{-1} increases (b) k_1 increases, k_{-1} decreases, and k_1/k_{-1} increases.
 (c) k_1, k_{-1} increases and k_1/k_{-1} decreases (d) k_1 and k_{-1} decrease, and k_1/k_{-1} increases.

20. The rate constant for a unimolecular reaction was $2.66 \times 10^{-3} s^{-1}$ and $2.2 \times 10^{-1} s^{-1}$ at $T=120$ K and at $T=360$ K respectively. The rate constant (in s^{-1}) at 240 K would be

- a) $2.4 \times 10^{-2} \text{s}^{-1}$ b) $2.4 \times 10^{-1} \text{s}^{-1}$ c) $4.8 \times 10^{-2} \text{s}^{-1}$ d) $1.8 \times 10^{-3} \text{s}^{-1}$

21. The decomposition of gaseous acetaldehyde at T(K) follow the second order kinetics. The half-life of this reaction is 400 s when the initial pressure is 250 Torr. What will be the rate constant (in $\text{Torr}^{-1} \text{s}^{-1}$) and half-life (in s) respectively, if the pressure of the acetaldehyde is 200 Torr at the same temperature?

- a) 10^5 and 500 b) 10^{-5} and 400 c) 10^{-4} and 400 d) 10^{-5} and 500

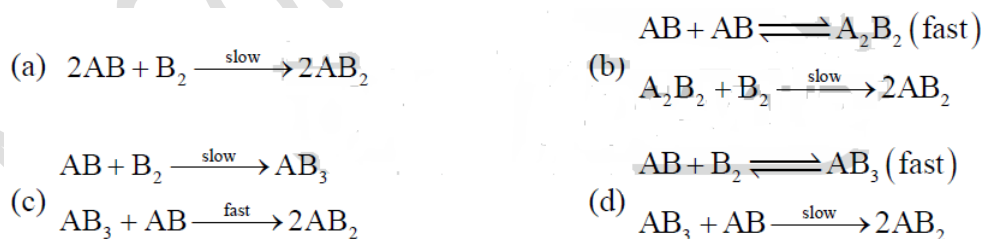
22. For a reaction, the rate constant k at 27°C was found to be $k = 5.4 \times 10^{-11} \text{e}^{-50}$. The activation energy of the reaction is

- a) 50Jmol^{-1} b) 415Jmol^{-1} c) 15000Jmol^{-1} d) $125,000 \text{Jmol}^{-1}$

23. The concentrations of a species A undergoing the reaction $\text{A} \rightarrow \text{P}$ is 1.0, 0.5, 0.33, 0.25 mol dm^{-3} at $t = 0, 1, 2, 3$ seconds respectively. The order of the reaction is:

- a. a) two b) one c) zero d) three

24. The rate equation for the reaction $2\text{AB} + \text{B}_2 \rightarrow 2\text{AB}_2$ is given by rate = $k[\text{AB}][\text{B}_2]$, a possible mechanism consistent with this rate law is



25. According to Arrhenius equation (k = rate constant and T = temperature)

- a) $\ln k$ decreases linearly with $1/T$ b) $\ln k$ decreases linearly with T
c) $\ln k$ increases linearly with $1/T$ d) $\ln k$ increases linearly with T

26. In the mechanism of the reaction, $\text{H}_2 + \text{Br}_2 \rightarrow 2\text{HBr}$, the first step is
- a) dissociation of H_2 into H^\bullet radicals b) dissociation of Br_2 into Br^\bullet radicals
 c) reaction of H^\bullet radical with Br_2 d) reaction of Br^\bullet radical with H_2

27. In the reaction between NO and H_2 the following data are obtained

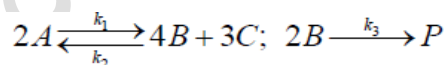
Experiment I: $P_{\text{H}_2} = \text{constant}$

P_{NO} (mm of Hg)	359	300	152
$\frac{-dP_{\text{NO}}}{dt}$	1.50	1.03	0.25

Experiment II: $P_{\text{NO}} = \text{constant}$

P_{H_2} (mm of Hg)	289	205	147
$\frac{-dP_{\text{H}_2}}{dt}$	1.60	1.10	0.79

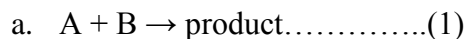
28. The order with respect to H_2 and NO, respectively are
- a) 2 and 1 b) 1 and 2 c) 3 and 1 d) 2 and 2
29. For the following sequence of reactions



The $\frac{d[B]}{dt}$ is given by

- (a) $\frac{1}{4}k_1[A]^2 - \frac{1}{4}k_2[B]^4[C]^3 - \frac{1}{2}k_3[B]^2$ (b) $\frac{1}{2}k_1[A]^2 - \frac{1}{2}k_2[B]^4[C]^3 - k_3[B]^2$
 (c) $2k_1[A]^2 - 2k_2[B]^4[C]^3 - k_3[B]^2$ (d) $4k_1[A]^2 - 4k_2[B]^4[C]^3 - 2k_3[B]^2$

30. Consider the reactions,



Species	M (g/mole)	Diameter (nm)
A	2	1
B	4	2
C	6	3
D	4	4

The ratio of squares of pre-exponential factor of reaction (1) and reaction (2) is-

- a) 1/2 b) 3/4 c) 1/4 d) 2/3

31. A second order reaction is 50 % completed in 5 mins, the time required for 75 % completion of the reaction is

- a) 20 min b) 25 min c) 15 min d) 18 min

32. For a given first order reaction, the reactant reduces to $1/4^{\text{th}}$ its initial value in 10 minutes. The rate constant of the reaction is:

- a) 0.1386 min^{-1} b) 0.0693 min^{-1} c) $0.1386 \text{ molL}^{-1} \text{ min}^{-1}$ d) $0.0693 \text{ molL}^{-1} \text{ min}^{-1}$

33. The temperature dependence of a reaction is given by $k = AT^{5/2} \exp(-E_0/RT)$, the activation energy of the reaction given by

- a) $E_0 + 5 RT/2$ b) $E_0 + 2RT/5$ c) $E_0 + 2RT$ d) $E_0 + 5RT$

34. For a complex reaction $A \rightarrow P$, $E_{a1} = 180 \text{ kJ/mol}$; $E_{a2} = 0 \text{ kJ/mol}$; $E_{a3} = 50 \text{ kJ/mol}$; overall constant k is related to individual rate constant by the equation

$$k = \left(\frac{k_1 \cdot k_2}{k_3} \right)^{2/3}$$

Activation energy (kJ/mol) for the overall reaction is:

- a) 100 b) 43.44 c) 150 d) 140

35. A first order reaction is 50% completed in 20 minutes at 27°C and in 5 minutes at 47°C. The energy of activation of the reaction is:

- a) 43.85kJ/mol b) 55.14kJ/mol c) 11.97kJ/mol d) 6.65kJ/mol

B. N. College Bhagalpur