

# CHEMICAL KINETICS [TEST PAPER]

1. Half-life of a second order reaction is 50 seconds. 25% of the reaction occurs in  
 (A) 15.6 sec                      (B) 16.6 sec                      (C) 20.6 sec                      (D) 5.6 sec
2. The rate constant of a first order reaction is  $1.54 \times 10^{-3} \text{ sec}^{-1}$ . The half-life time will be:-  
 (A) 100 sec                      (B) 250 sec                      (C) 450 sec                      (D) 400 sec
3. Select the correct statements:-  
 (A) The order of a reaction can be fractional but molecularity can not  
 (B) The molecularity of a reaction can be fractional but order can not  
 (C) Both order and molecularity can be fractional  
 (D) Neither order nor molecularity can be fractional
4. For third order reaction,  $3A \rightarrow \text{Product}$ , with 0.1 M initial concentration,  $t_{1/2}$  is 8 hour and 20 minutes. The rate constant of the reaction is  
 (A)  $5.0 \text{ L}^2 \text{ mol}^{-2} \text{ s}^{-1}$                       (B)  $5.0 \times 10^{-2} \text{ L}^2 \text{ mol}^{-2} \text{ s}^{-1}$   
 (C)  $5.0 \times 10^{-3} \text{ L}^2 \text{ mol}^{-2} \text{ s}^{-1}$                       (D)  $5.0 \times 10^{-4} \text{ L}^2 \text{ mol}^{-2} \text{ s}^{-1}$
5. Chemical relaxation method can be used for studying the kinetics of which of the following reaction:-  
 (A)  $\text{H}_2 + \text{Br}_2 \rightarrow 2\text{HBr}$   
 (B)  $\text{CH}_3\text{I} + \text{H}_2\text{O} \rightarrow \text{CH}_3\text{OH} + \text{HI}$   
 (C) Oxidation of  $\text{Fe}^{+2}$  by  $\text{K}_2\text{Cr}_2\text{O}_7$   
 (D)  $\text{H}^+ + \text{OH}^- \rightleftharpoons \text{H}_2\text{O}$
6. One of the assumptions made in conventional activated complex theory is  
 (A) Equilibrium is maintained between the reactants and the activated complex  
 (B) Equilibrium is maintained between the reactants and the products  
 (C) Equilibrium is maintained between the reactants, activated complex and the products  
 (D) Activated complex decomposes in to product through vibrational degree of freedom
7. For a reaction the rate constant  $k$  at  $27^\circ$  was found to be  $K = 5.4 \times 10^{11} e^{-50}$ . The activation energy of the reaction is about  
 (A)  $50 \text{ J Mol}^{-1}$                       (B)  $415 \text{ J Mol}^{-1}$                       (C)  $15000 \text{ J Mol}^{-1}$                       (D)  $125000 \text{ J Mol}^{-1}$
8. 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)  $0.1386 \text{ min}^{-1}$                       (B)  $0.0693 \text{ min}^{-1}$                       (C)  $0.1386 \text{ mol L}^{-1} \text{ min}^{-1}$                       (D)  $0.0693 \text{ mol L}^{-1} \text{ min}^{-1}$
9. According to conventional activated complex theory, for elementary bimolecular reactions, the molar entropy of activation is  
 (A) Positive                      (B) zero  
 (C) negative                      (D) positive for endothermic and positive for exothermic reactions
10. For a reaction involving two steps given below  

$$\text{A} \rightarrow 2\text{B}$$

$$\text{A} + \text{B} \rightarrow \text{P}$$
 Assume that that the first step attains equilibrium rapidly. The rate of formation of P is proportional to  
 (A)  $[\text{A}]^{1/2}$                       (B)  $[\text{A}]$                       (C)  $[\text{A}]^2$                       (D)  $[\text{A}]^{3/2}$
11. For a first order reaction  $\text{A} \rightarrow \text{P}$ , the temperature (T) dependent rate constant (k) was found to follow the equation  

$$\text{Log } k = - (2000)/T + 6.0$$
 The pre-exponential factor A and the activation energy  $E_a$ , respectively, are  
 (A)  $1.0 \times 10^6 \text{ s}^{-1}$  and  $9.2 \text{ kJmol}^{-1}$                       (B)  $6.0 \text{ s}^{-1}$  and  $16.6 \text{ kJmol}^{-1}$   
 (C)  $1.0 \times 10^6 \text{ s}^{-1}$  and  $16.6 \text{ kJmol}^{-1}$                       (D)  $1.0 \times 10^6 \text{ s}^{-1}$  and  $38.3 \text{ kJmol}^{-1}$
12. For the reaction  $\text{A} + \text{B} \rightarrow \text{products}$ , it is observed that (i) On doubling the concentration of A only, the rate of reaction is also doubled. (ii) On doubling the initial concentration of both A and B, there is change by a factor of 8 in the rate of reaction. The rate of reaction is given by  
 (A)  $\text{Rate} = k [\text{A}] [\text{B}]$                       (B)  $\text{rate} = k [\text{A}]^2 [\text{B}]$                       (C)  $\text{rate} = k [\text{A}] [\text{B}]^2$                       (D)  $\text{rate} = k [\text{A}]^2 [\text{B}]^2$

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13. 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  
 (A)  $4 \times 10^{-4} \text{ mol L}^{-1} \text{ s}^{-1}$  (B)  $6 \times 10^{-4} \text{ mol L}^{-1} \text{ s}^{-1}$   
 (C)  $1 \times 10^{-4} \text{ mol L}^{-1} \text{ s}^{-1}$  (D)  $3 \times 10^{-4} \text{ mol L}^{-1} \text{ s}^{-1}$
14. Half life period of a first order reaction is 1386 seconds. The specific rate constant of the reaction is  
 (A)  $0.5 \times 10^{-2} \text{ s}^{-1}$  (B)  $0.5 \times 10^{-3} \text{ s}^{-1}$   
 (C)  $5.0 \times 10^{-2} \text{ s}^{-1}$  (D)  $5.0 \times 10^{-3} \text{ s}^{-1}$
15. The half life period of a first order chemical reaction is 6.93 minutes. The time required for the completion of 99% of the chemical reaction will be ( $\log 2 = 0.301$ )  
 (A) 230.3 minutes (B) 23.03 minutes  
 (C) 46.06 minutes (D) 460.6 minutes
16. Consider a hypothetical reaction  $2A + B \rightarrow \text{products}$ . Given the following information concerning the initial rate of the reaction with different initial concentrations: What is the rate law that most nearly accounts for these data?

- (A) Rate =  $k[A]^2[B]$  (B) Rate =  $k[A][B]$   
 (C) Rate =  $k[A][B]^2$  (D) Rate =  $k[A]^2[B]^2$

	[A] (mole/L)	[B] (mole/L)	Initial Rate
Exp 1	0.020	0.020	$4.20 \times 10^{-3}$
Exp 2	0.040	0.020	$1.68 \times 10^{-2}$
Exp 3	0.040	0.040	$6.72 \times 10^{-2}$

17. A change in temperature from  $10^\circ\text{C}$  to  $20^\circ\text{C}$  is found to double the rate of a given chemical reaction. How did this change affect the reacting molecules?  
 (A) It doubled their average velocity.  
 (B) It doubled their average energy.  
 (C) It doubled the number of collisions per second  
 (D) It doubled the proportion of molecules possessing at least the min. energy required for the reaction
18. During the kinetic study of the reaction,  $2A + B \rightarrow C + D$ , following results were obtained:

Run	[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	$2.40 \times 10^{-2}$

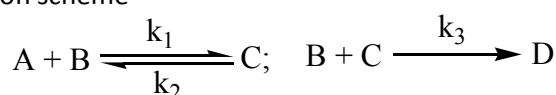
Based on the above data which one of the following is correct?

- (A) Rate =  $k[A]^2[B]^2$  (B) rate =  $k[A][B]^2$  (C) Rate =  $k[A]^2[B]$  (D) rate =  $k[A][B]$
19. If the concept of half life is generalized to quarter life of a first order chemical reaction it will be equal to  
 (A)  $\ln 2/k$  (B)  $\ln 4/k$  (C)  $4/k$  (D)  $1/4k$
20. The half life for the acid-catalyzed hydrolysis of sucrose to form glucose and fructose, which is first order overall, is 3.20 h at  $25^\circ\text{C}$ . What is the rate constant for the reaction at this temperature?  
 (A)  $6.02 \times 10^{-5} \text{ s}^{-1}$  (B)  $8.68 \times 10^{-5} \text{ s}^{-1}$  (C)  $0.217 \text{ s}^{-1}$  (D)  $2.61 \times 10^{-5} \text{ s}^{-1}$
21. A catalyst functions by:  
 (A) lowering the energy of the reactants (B) lowering the energy of the products  
 (C) providing a reaction path with a lower activation energy  
 (D) increasing the equilibrium constant.
22. The gas phase reaction  $X + Y \rightarrow Z$  has a reaction rate which is experimentally observed to follow the relationship of rate =  $k[X]^2[Y]$ . If the concentration of X is tripled and the concentration of Y is doubled, the reaction rate would be increased by a factor of:  
 (A) 6 (B) 9 (C) 12 (D) 18
23. For a reaction the plot of concentration of reactant against time is a straight line with negative slope. The order of the reaction is  
 (A) 2 (B) -1 (C) 1 (D) zero

24. Determine the rate law for the reaction,  $2\text{ICl} + \text{H}_2 \longrightarrow \text{I}_2 + 2\text{HCl}$ , from the following initial rate data:

$[\text{ICl}]_0$	$[\text{H}_2]_0$	Initial Rate ( $\text{Ms}^{-1}$ )	(A) $R = k[\text{ICl}]^2$	(B) $R = k[\text{H}_2]^2$
0.250	0.500	$2.04 \times 10^{-2}$	(C) $R = k[\text{ICl}][\text{H}_2]^2$	(D) $R = k[\text{ICl}][\text{H}_2]$
0.500	0.500	$4.08 \times 10^{-2}$		
0.125	0.125	$2.55 \times 10^{-3}$		
0.125	0.250	$5.09 \times 10^{-3}$		

25. For the reaction scheme



the rate equation for the formation of D is given as

(a)  $\frac{d[\text{D}]}{dt} = \frac{k_1 k_3 C_A C_B}{k_2 + k_3 C_B}$       (b)  $\frac{d[\text{D}]}{dt} = \frac{k_1 k_2 k_3 C_A C_B}{k_2 + k_3 C_B}$       (c)  $\frac{d[\text{D}]}{dt} = \frac{k_1 k_3 C_A C_B^2}{k_2 + k_3 C_B}$       (d)  $\frac{d[\text{D}]}{dt} = \frac{k_1 k_3 C_A C_B}{k_2 k_3 + k_3 C_B}$

26. For the reaction of the type  $\text{X} \xrightleftharpoons[k_2]{k_1} \text{Y}$ , the correct rate expression is ( $[\text{X}]_0$  and  $[\text{X}]$  corresponds to be concentration of X at time  $t = 0$  and  $t = t$ , respectively)

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

27. Consider an exothermic reaction  $\text{A} \xrightleftharpoons[k_{-1}]{k_1} \text{I}$  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

28. In the following sequence of reactions, the energy poor molecule  $\text{A}^*$  in the assuming collision is robbed off enough energy to be deactivated as  $\text{A} + \text{A} \xrightleftharpoons[k_2]{k_1} \text{A} + \text{A}^*$ ;  $\text{A}^* \xrightarrow{k_a} \text{B} + \text{C}$

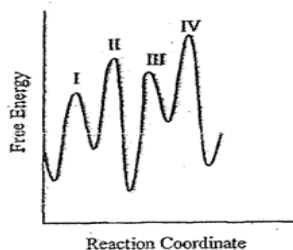
What is the steady state concentration  $[\text{A}^*]$  equal to ?

(a)  $\frac{k_1[\text{A}]}{k_2[\text{A}] + k_3}$       (b)  $\frac{k_1[\text{A}]^2}{k_2[\text{A}] + k_3}$       (c)  $\frac{k_2[\text{A}] + k_3}{k_2[\text{A}]^2}$       (d) None of these

29. The reversible reactions  $\text{S} \rightleftharpoons \text{P}$  is catalyzed by a catalyst. The equilibrium constant  $K_{\text{eq}} = [\text{P}]/[\text{S}]$  is  $2 \times 10^3$ . The forward rate constant was found to be  $5 \times 10^4 \text{ sec}^{-1}$  and  $4 \times 10^{-6} \text{ sec}^{-1}$  in the presence and in the absence of the catalyst respectively. What is the expected rate constant for the reverse reaction in the absence of the catalyst?

- (a)  $5 \times 10^8 \text{ sec}^{-1}$       (b)  $5 \times 10^{-9} \text{ sec}^{-1}$       (c)  $0.8 \times 10^{-10} \text{ sec}^{-1}$       (d)  $5 \times 10^{-9} \text{ sec}^{-1}$

30. Identify the transition state which determines the rate of the reaction from the free energy diagram.



- (a) I      (b) II      (c) III      (d) IV

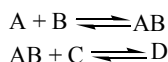
31. A certain reaction proceeds in a sequence of three elementary steps with the rate constants  $k_1$ ,  $k_2$  and  $k_3$ . If the observed rate constant ( $k_{\text{obs}}$ ) of the reaction is expressed as  $k_{\text{obs}} = k_3(k_1/k_2)^{1/2}$ , the observed activation energy ( $E_{\text{obs}}$ ) of the reaction is

(a)  $\frac{1}{2} \left[ \frac{E_1}{E_2} \right] + E_3$       (b)  $\frac{E_3 + E_1}{E_2}$       (c)  $E_3 \left[ \frac{E_1}{E_2} \right]^{1/2}$       (d)  $E_3 + \frac{1}{2}(E_1 - E_2)$

32. In the presence of a catalyst E is lowered by 2 kcal at 27°C. Hence, the rate will be increased by:

(a) 7 times      (b) 14 times      (c) 28 times      (d) 56 times

33. A reaction  $A + B + C \rightleftharpoons D$  follows the mechanism



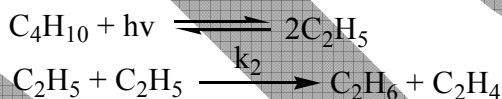
In which first step remains essentially in equilibrium. If  $\Delta H$  is the enthalpy change for the first reaction and  $E_6$  is the activation energy for the second reaction, the activation energy of the overall reaction will be given by:

(a)  $E_0$       (b)  $E_0 - \Delta H$       (c)  $E_0 + \Delta H$       (d)  $E_0 + 2 \Delta H$

34. According to the transition state theory, the plot with slope equal to  $-\frac{\Delta H^\ddagger}{R}$  is

(a)  $\ln k$  vs.  $T$       (b)  $\ln \left( \frac{k}{T} \right)$  vs.  $T$       (c)  $\ln \left( \frac{k}{T} \right)$  vs.  $\frac{1}{T}$       (d)  $\ln k$  vs.  $\frac{1}{T}$

35. In a photochemical reaction, radicals are formed according to the equation



If  $I$  is the intensity of light absorbed, the rate of the overall reaction is proportional to

(A)  $I$       (B)  $I^{1/2}$       (C)  $I[C_4H_{10}]$       (D)  $I^{1/2}[C_4H_{10}]^{1/2}$

36. In the Michaelis-Menten mechanism for enzyme kinetics, the expression obtained is:

$$\frac{v}{[E]_0[S]} = 1.4 \times 10^{12} - \frac{10^4 v}{[E]_0}$$

The values of  $k_3$  ( $k_{\text{exp}}$ ,  $\text{mol L}^{-1} \text{s}^{-1}$ ) and  $K$  (Michaelis constant,  $\text{mol L}^{-1}$ ), respectively are

(a)  $1.4 \times 10^{12}, 10^4$       (b)  $1.4 \times 10^8, 10^4$       (c)  $1.4 \times 10^8, 10^{-4}$       (d)  $1.4 \times 10^{12}, 10^{-4}$

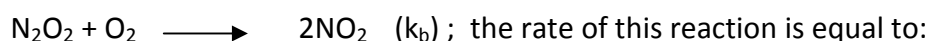
37. In the Lineweaver-Burk plot of  $(\text{initial rate})^{-1}$  vs  $(\text{initial substrate concentration})^{-1}$  for an enzyme catalyzed reaction following Michaelis-Menten mechanism, the y-intercept is  $5000 \text{ M}^{-1} \text{ s}$ . If the initial enzyme concentration is  $1 \times 10^{-9} \text{ M}$ , the turnover number is

(a)  $2.5 \times 10^3$       (b)  $1.0 \times 10^4$       (c)  $2.5 \times 10^4$       (d)  $2.0 \times 10^5$

38. Sucrose is converted to a mixture of glucose and fructose in a pseudo first order process under alkaline condition. The reaction has a life time 28.4 minute. The time required for the reduction of 8.0 mM sample of sucrose to 1.0 mM is

(A) 56.8 min      (B) 170.4 min      (C) 85.2 min      (D) 227.2 min

39. The reaction  $2\text{NO}(\text{g}) + \text{O}_2(\text{g}) \longrightarrow 2\text{NO}_2$  proceeds via the following steps:



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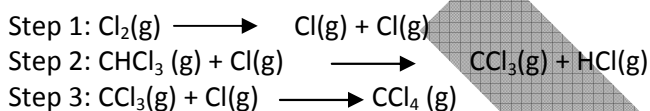
- (A)  $2 k_b[\text{NO}][\text{O}_2]$   
 (B)  $2 k_a k_b[\text{NO}]^2[\text{O}_2] / k_a + k_b [\text{O}_2]$   
 (C)  $2 k_b[\text{NO}]^2[\text{O}_2]$   
 (D)  $k_a[\text{NO}]^2[\text{O}_2]$

40. For the reaction  $\text{P} + \text{Q} + \text{R} \longrightarrow \text{S}$  experimental data for the measured initial rates is given below in the table. The order of the reaction with respect to P, Q and R respectively is

S.No.	[P]M	[Q]M	[R]M	Initial Rates [ $\text{Ms}^{-1}$ ]
1	0.2	0.5	0.4	$8.0 \times 10^{-5}$
2	0.4	0.5	0.4	$3.2 \times 10^{-4}$
3	0.4	2.0	0.4	$1.28 \times 10^{-3}$
4	0.1	0.25	1.6	$4.0 \times 10^{-5}$

- (A) 2,2,1  
 (B) 2,1,2  
 (C) 2,1,1  
 (D) 1,1,2

41. The reaction between chloroform  $\text{CHCl}_3$  (g) and chlorine  $\text{Cl}_2$ (g) to form  $\text{CCl}_4$  (g) is believed to occur by this series of steps:



If this reaction is first order in  $\text{CHCl}_3$  and half order in  $\text{Cl}_2$ , which statement about the relative rates of step 1, 2 and 3 is correct?

- (a) Step 1 is the slowest  
 (b) Step 1 and 2 must both be slow  
 (c) Step 2 must be slower than step 1  
 (d) Step 3 must be the slowest

42. The observed rate of a chemical reaction is substantially lower than the collision frequency. One or more of the following statements is/are true to account for this fact.

- (A) The reactants do not have the required energy  
 (B) The partners do not collide in the proper orientation  
 (C) Collision complex exists for a very short time.  
 (D) Collision frequency over estimates the number of effective collisions

- (a) A, B and C      (b) A, B and C      (c) B, C and D      (d) A, C and D

43. In a reaction,  $\text{A} + \text{B} \rightarrow \text{Product}$ , rate is doubled when the concentration of B is doubled, and rate increases 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

- (A)  $\text{Rate} = k[\text{A}][\text{B}]$       (B)  $\text{Rate} = k[\text{A}]^2[\text{B}]$       (C)  $\text{Rate} = k[\text{A}][\text{B}]^2$       (D)  $\text{Rate} = k[\text{A}]^2[\text{B}]^2$

44. For a first order reaction  $\text{A} \rightarrow \text{products}$  the concentration of A changes from 0.1M to 0.025 M in 40 minutes. The rate of reaction when the concentration of A is 0.01 M is:

- (A)  $1.73 \times 10^{-5} \text{ M/min}$       (B)  $3.47 \times 10^{-4} \text{ M/min}$       (C)  $3.47 \times 10^{-5} \text{ M/min}$       (D)  $1.73 \times 10^{-4} \text{ M/min}$ .

45. The activation energy of a reaction at a given temperature is found to be  $2.303 \text{ RT J mol}^{-1}$ . The ratio of rate constant to the Arrhenius factor is

- (A) 0.1      (B) 0.01      (C) 0.001      (D) 0.02

46. The time taken for 10% completion of a first order reaction is 20 min. Then, for 19% completion, the reaction will take

- (A) 40 mins      (B) 60 mins      (C) 30 mins      (D) 50 mins

47. For a chemical reaction  $A \rightarrow B$ , the rate of the reaction is  $2 \times 10^{-3} \text{ mol dm}^{-3} \text{ s}^{-1}$  when the initial concentration is  $0.05 \text{ mol dm}^{-3}$ . The rate of the same reaction is  $1.6 \times 10^{-2} \text{ mol dm}^{-3} \text{ s}^{-1}$  when the initial concentration is  $0.1 \text{ mol dm}^{-3}$ . The order of the reaction is

- (A) 0 (B) 3 (C) 1 (D) 2

48. Consider the reaction:  $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightarrow 2\text{NH}_3(\text{g})$

The equality relationship between  $\frac{d[\text{NH}_3]}{dt}$  and  $-\frac{d[\text{H}_2]}{dt}$  is

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

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

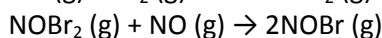
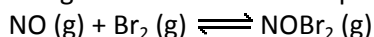
(C)  $+\frac{d[\text{NH}_3]}{dt} = -\frac{d[\text{H}_2]}{dt}$

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

49. Rate of a reaction can be expressed by Arrhenius equation as:  $k = Ae^{-E/RT}$ . In this equation, E represents

- (A) The energy below which colliding molecules will not react  
 (B) The total energy of the reacting molecules at a temperature, T  
 (C) The fraction of molecules with energy greater than the activation energy  
 (D) The energy above which all the colliding molecules will react

50. The following mechanism has been proposed for the reaction of NO and  $\text{Br}_2$  to form NOBr



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

- (A) 0 (B) 3 (C) 2 (D) 1

51. Which of these does not influence the rate of reaction?

- (A) Nature of the reactants (B) Concentration of the reactants  
 (C) Temperature of the reaction (D) Molecularity of the reaction

52. Which of the following statements for order of reaction is not correct?

- (A) Order can be determined experimentally  
 (B) Order of a reaction is equal to the sum of the power of concentration terms in differential rate law  
 (C) It is not affected with the stoichiometric coefficients of the reactants  
 (D) Order cannot be fractional

53. The rate equation for a reaction:  $A \rightarrow B$  is  $r = k[A]^a$ . If the initial concentration of the reactant is  $a \text{ mol dm}^{-3}$ , the half life period of the reaction is

- (A)  $k/a$  (B)  $a/k$  (C)  $2a/k$  (D)  $a/2k$

54. 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

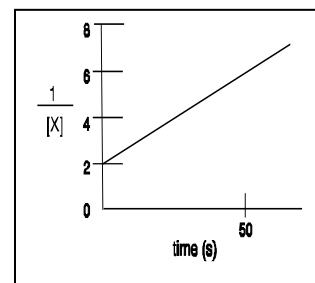
- (A)  $\frac{2000}{2.303} \text{ K}$  (B) 2000 K (C)  $\frac{1000}{2.303} \text{ K}$  (D) 1000 K

55. If 60% of a first order reaction was completed in 60 minutes, 50% of the same reaction would be completed in approximately

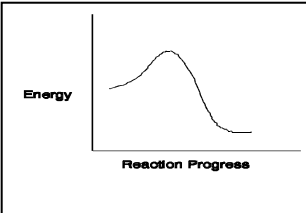
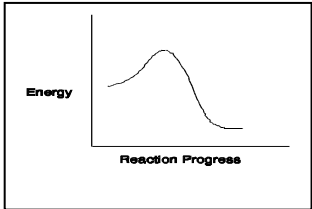
- (A) 45 minutes (B) 60 minutes (C) 40 minutes (D) 50 minutes

56. For the reaction:  $X + Y \rightarrow Z$ , the reaction rate is found to depend only upon the concentration of X. A plot of  $1/X$  versus time gives a straight line. What is the rate law for this reaction?

- (A) rate =  $k[X]$   
 (B) rate =  $k[X]^2$   
 (C) rate =  $k[X][Y]$   
 (D) rate =  $k[X]^2[Y]$



## RAJSI CHEMISTRY POINT, JAIPUR

57. The reaction  $2\text{NO}_2(\text{g}) \rightarrow 2\text{NO}(\text{g}) + \text{O}_2(\text{g})$  is suspected to be second-order in  $\text{NO}_2$ . Which of the following kinetic plots would be the best to do to prove the reaction to be second order?
- (A) a plot of  $[\text{NO}_2]^{-1}$  vs. t (B) a plot of  $\log [\text{NO}_2]$  vs. t  
(C) a plot of  $[\text{NO}_2]$  vs. t (D) a plot of  $[\text{NO}_2]^2$  vs. t
58. Consider the reaction,  $2\text{A} + \text{B} \rightarrow \text{Products}$  When concentration of B alone was doubled, the half-life did not change. When the concentration of A alone was doubled, the rate increased by two times. The unit of rate constant for this reaction is:
- (A) No unit (B)  $\text{mol L}^{-1} \text{s}^{-1}$  (C)  $\text{s}^{-1}$  (D)  $\text{L mol}^{-1} \text{s}^{-1}$
59. For the chemical reaction  $\text{A} \rightarrow \text{C}$ , a plot of  $1/[\text{A}]$  versus time was found to give a straight line with a positive slope. What is the order of reaction?
- (A) zero (B) first (C) second (D) such a plot cannot reveal the order of reaction
60. If  $E_a$  for a certain biological reaction is  $50 \text{ kJ/mol}$ , by what factor (how many times) will the rate of this reaction increase when body temperature increases from  $37^\circ\text{C}$  (normal) to  $40^\circ\text{C}$  (fever)?
- (A) 1.15 times (B) 1.20 times (C)  $2.0 \times 10^5$  times (D) 2.0 times
61. The isomerization of cyclopropane follows first order kinetics. The rate constant at  $700 \text{ K}$  is  $6.20 \times 10^{-4} \text{ min}^{-1}$ , and the half-life at  $760 \text{ K}$  is  $29.0 \text{ min}$ . Calculate the activation energy for this reaction.
- (A)  $5.07 \text{ kJ/mol}$   
(B)  $27.0 \text{ kJ/mol}$   
(C)  $160 \text{ kJ/mol}$   
(D)  $270 \text{ kJ/mol}$
62. For the chemical reaction system described by the diagram below which statement is true?
- (A) The forward reaction is endothermic.  
(B) The activation energy for the forward reaction is greater than the activation energy for the reverse reaction.  
(C) At equilibrium, the activation energy for the forward reaction is equal to the activation energy for the reverse reaction.  
(D) The activation energy for the reverse reaction is greater than the activation energy for the forward reaction.
- 
63. For the chemical reaction system described by the diagram below if the  $E_a$  for the forward reaction is  $25 \text{ kJ/mol}$ , and the enthalpy of reaction is  $-95 \text{ kJ/mol}$ , what is  $E_a$  for the reverse reaction?
- (A)  $120 \text{ kJ/mol}$   
(B)  $70 \text{ kJ/mol}$   
(C)  $95 \text{ kJ/mol}$   
(D)  $-70 \text{ kJ/mol}$
- 
64. According to the collision theory, all collisions do not lead to reaction. Which choice gives both reasons why all collisions between reactant molecules do not lead to reaction?
1. The total energy of two colliding molecules is less than some minimum amount of energy.
  2. Molecules cannot react with each other unless a catalyst is present.
  3. Molecules that are improperly oriented during collision will not react.
  4. Solids cannot react with gases.
- (A) 1 and 2 (B) 1 and 3 (C) 1 and 4 (D) 2 and 3
65. Consider the following statements
1. Energy of activation never negative
  2. The negative energy of activation means rate of reaction increases with temperature
  3. Zero activation energy means that the rate of reaction is independent of temperature
- Which of the statements given above is/ are correct
- (A) 2 only (B) 3 only (C) 2 and 3 (D) 1 and 3

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66. A first order decomposition reaction completes its 50% in 20 minutes. In what time it does complete its 93.75%  
(A) 45 min. (B) 50 min. (C) 60 min. (D) 80 min.
67. If initial concentration is reduced to its  $1/4$  th in a zero order reaction, the time taken for half of the reaction completion  
(A) Remains same (B) becomes 4 times (C) becomes  $1/4$ th (D) becomes double
68. Consider an endothermic reaction,  $X \rightarrow Y$  with activation energies  $E_b$  and  $E_f$  respectively for the backward and forward reactions, respectively. In general,  
(A)  $E_b < E_f$  (B)  $E_b > E_f$   
(C)  $E_b = E_f$  (D) There is no definite relation between  $E_b$  and  $E_f$
69.  $t_{1/4}$  can be taken as the time taken for the concentration of a reactant to drop to  $3/4$  of its initial value. If rate constant for a first order reaction is  $k$ , then  $t_{1/4}$  can be written as  
(A)  $0.01/k$  (B)  $0.29/k$  (C)  $0.69/k$  (D)  $0.75/k$
70. In a first order reaction, the concentration of the reactant decreases from 0.8 M to 0.4 M in 15 minutes. The time taken for the concentration to change from 0.1 M to 0.025 M is  
(A) 7.5 min (B) 15 min (C) 30 min (D) 60 min
71. The rate equation for the reaction:  $2A + B \rightarrow C$  is found to be:  $\text{rate} = k[A][B]$ . The correct statement in relation to this reaction is that the  
(A) Units of  $k$  must be  $s^{-1}$  (B)  $t_{1/2}$  is constant  
(C) Rate of formation of C is twice the rate of disappearance of A  
(D) Value of  $k$  is independent of the initial concentration of A and B.
72. The velocity constant of a reaction at  $290^\circ \text{K}$  was found to be  $3.2 \times 10^{-3} \text{S}^{-1}$ . When the temperature is raised to  $310^\circ \text{K}$ , it will be about  
(A)  $9.6 \times 10^{-3}$  (B)  $1.28 \times 10^{-2}$   
(C)  $6.4 \times 10^{-3}$  (D)  $3.2 \times 10^{-4}$
73. The rate law for a reaction between the substances A and B is given by  $\text{Rate} = k[A]^n[B]^m$ . On doubling the concentration of A and halving the concentration of B, the ratio of the new rate to the earlier rate of reaction will be  
(A)  $m + n$  (B)  $n - m$  (C)  $2^{(n-m)}$  (D)  $\frac{1}{2^{m+n}}$
74. When a bio chemical reaction is carried out in laboratory outside the human body in the absence of enzyme, then the rate of reaction obtained is  $10^{-6}$  times, than activation energy of Reaction in the presence of enzyme is:  
(A)  $6/RT$  (B) P is required  
(C) Different from,  $E_a$  obtained in laboratory  
(D) Can't say any things
75. In an endothermic equilibrium reaction if  $k_1$  and  $k_2$  are the rate constants of forward and backward reaction respectively at temperature  $T^\circ\text{C}$  and  $k_1'$  and  $k_2'$  at  $(T+10^\circ)\text{C}$  then which of the following is correct  
(A)  $k_1'/k_1 = k_2'/k_2$  (B)  $k_1'/k_1 < k_2'/k_2$  (C)  $k_1'/k_1 > k_2'/k_2$  (D) None of the Above
76. In a Zero Order Reaction  $t_{75\%} = xt_{1/2}$ . Then Value of  $x$  will be,  
(A) 2 (B)  $3/2$  (C)  $2/3$  (D) 10
77. For which of the following reaction the pre exponential factor (A) does not depends on temperature,  
(A)  $\text{Atom} + \text{Atom} \Rightarrow \text{Linear TS} \Rightarrow \text{Product}$   
(B)  $\text{Atom} + \text{Linear Molecule} \Rightarrow \text{Linear TS} \Rightarrow \text{Product}$   
(C)  $\text{Atom} + \text{Linear Molecule} \Rightarrow \text{Non-Linear TS} \Rightarrow \text{Product}$   
(D)  $\text{Linear molecule} + \text{Linear Molecule} \Rightarrow \text{Linear TS} \Rightarrow \text{Product}$
78. For the chemical Reaction  $\text{CO}_2 + \text{H}_2 \Rightarrow \text{Non-Linear TS} \Rightarrow \text{CO} + \text{H}_2\text{O}$ , The dependency of Collision Factor on temperature is,  
(A) T (B)  $1/T$  (C)  $1/T^2$  (D)  $1/T^{3/2}$



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79. The rate constant of a chemical reaction depends on temperature according to the relation  $k = A \exp[-E_0/RT]$ . The activation energy of the reaction is equal to,  
 (A)  $E_0 + RT$  (B)  $E_0 + 1/RT$  (C)  $E_0 + 2RT$  (D)  $E_0$
80. Entropy of activation ( $\Delta S^\ddagger$ ) for a bimolecular reaction can be determined by,  
 (A) Slope of "lnk vs T" Plot (B) Slope of  $\ln\left(\frac{k}{T}\right)$  vs. T  
 (C) Intercept of "lnk vs T" Plot (D) intercept of  $\ln\left(\frac{k}{T}\right)$  vs.  $\frac{1}{T}$
81. Two first order reactions have half lives in the ratio 3:2. The value of the ratio of time interval  $t_1 : t_2$  will be (where  $t_1$  is the time period for 25% completion of the first reaction and  $t_2$  for 75% completion of the second reaction)  
 (A) 0.311:1 (B) 0.420:1 (C) 0.273:1 (D) 0.199:1
82. Concentration of reactant molecule in first order reaction reduced to  $1/e^2$  after (Average Life =  $1/k$ )  
 (A) One average Life (B) two average Life  
 (C) Three average Life (D) four average Life
83. For the reaction  $A + 2B \longrightarrow$  Product, (started with the concentration taken in stoichiometric proportion) the experimentally established rate law is,  $-d[A]/dt = k[A]^{1/2}[B]^{1/2}$ . The half life of the reaction would be  
 (A)  $0.693/k$  (B)  $0.693/\sqrt{2}.k$  (C)  $0.693/\sqrt{3}.k$  (D)  $0.693/1/k$
84. The reaction  $A \longrightarrow$  Product, is zero order while  $B \longrightarrow$  product is first order. If the rate constant (k) for these reactions are numerically same, then for what concentration of A (in M) the half life of two reactions will be same,  
 (A) 2 (B)  $\ln 2$  (C)  $2\ln 2$  (D)  $2\log 2$
85. The concentration of R in the reaction  $R \longrightarrow P$ , was measured as function of time and following data are obtained:

[R] in Molar	1.0	0.75	0.40	0.10
Time (minutes)	0.0	0.05	0.12	0.18

The order of the reaction will be,

- (A) 2 (B) 1 (C) 0 (D) 3

\*\*\*\*\*

### Answer Key Format

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