



# CHEMISTRY

## BOOKS - DISHA CHEMISTRY (HINGLISH)

### CHEMICAL KINETICS

#### Chemistry

1. The decomposition of a substance follows first order kinetics. Its concentration is reduced to  $\frac{1}{8}$ th of its initial value in 24 minutes. The rate constant of the decomposition process is

A.  $\frac{1}{4} \text{min}^{-1}$

B.  $\frac{0.692}{24} \text{mol}^{-1}$

C.  $\frac{2.303}{24} \log\left(\frac{1}{8}\right) \text{min}^{-1}$

D.  $\frac{2.303}{24} \log\left(\frac{8}{1}\right) \text{min}^{-1}$

**Answer: D**



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2. Consider the reaction,  $A + B \rightarrow$  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.  $s^{-1}$

B.  $L \cdot Mol^{-1} \cdot s^{-1}$

C. no units

D.  $mol \cdot L^{-1} \cdot s^{-1}$

**Answer: B**



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3. A reaction involving two different reactants can never be

- A. bimolecular reaction
- B. second order reaction
- C. first order reaction
- D. unimolecular reaction

**Answer: D**



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4. Select the rate law that corresponding to the shown for the following reaction :  $A + B \rightarrow C$



A.  $Rate = k[B]^3$

B.  $Rate = k[B]^4$

C.  $Rate = k[A][B]^3$

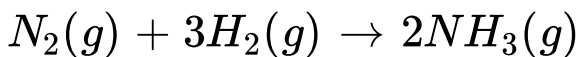
D.  $Rate = k[A]^2[B]^2$

**Answer: A**



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5. Consider the reaction,



The equility relationship between

$\frac{d[NH_3]}{dt}$  and  $-\frac{d[H_2]}{dt}$  is

A.  $+\frac{d[NH_3]}{dt} = -\frac{2}{3}\frac{d[H_2]}{dt}$

B.  $+\frac{d[NH_3]}{dt} = -\frac{3}{2}\frac{d[H_2]}{dt}$

C.  $\frac{d[NH_3]}{dt} = \frac{d[H_2]}{dt}$

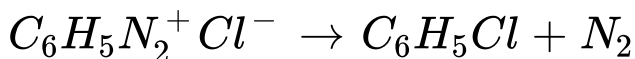
D.  $+\frac{d[NH_3]}{dt} = -\frac{1}{3}\frac{d[H_2]}{dt}$

**Answer: A**



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6. Diazonium salt decomposes as



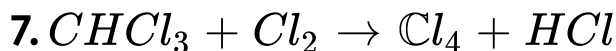
At  $0^\circ\text{C}$ , the evolution of  $N_2$  becomes two faster when the initial concentration of the salt is doubled. Therefore, it is

- A. a first order reaction
- B. a second order reaction
- C. independent of the initial concentration of the salt
- D. a zero order reaction

**Answer: A**



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Rate law for above reaction will be

$$\text{Rate} = K[\text{CHCl}_3] \frac{[\text{Cl}_2]^1}{2}$$

On the basis of information provided which of the following option will be correct?

- A. Rate law for any chemical reaction can be predicted accurately by looking at balanced chemical equation.



B. Rate law for a chemical reaction has to determine experimentally.

C. Either determine experimentally or obtained from balanced reaction rate will be same.

D. None of the above is correct

**Answer: B**



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**8. Which of the following statements is incorrect?**

- A. Activation energy for the forward reaction equals to activation energy for the reverse reaction.
- B. For a reversible reaction, an increase in temperature increase the reaction rate for both the forward and the backward reaction.
- C. The larger the initial reactant concentration for a second order reaction, the shorter is its half-life.
- D. When  $\Delta t$  is infinitesimally small, the average rate equals the instantaneous rate.

**Answer: A**



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9. In a reaction  $A \rightarrow$  products, when start is made from  $8.0 \times 10^{-2} \text{M}$  of A, half-life is found to be 120minute. For the initial concentration  $4.0 \times 10^{-2} \text{M}$ , the half-life of the reaction becomes 240 minutes. The order of the reaction is :

A. zero

B. one

C. two

D. 0.5

**Answer: C**



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**10.** During decomposition of an activated complex.

(i).energy is always releasing

(ii).energy is always absorbed

(iii).energy does not change

(iv).reactants may be formed

A. (i), (ii) and (iii)

B. (i) and (iv)

C. (ii) and (iii)

D. (ii), (iii) and (iv)

**Answer: B**



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**11.** Which of the following statements is incorrect?

A. Energy is always released when activated complex decomposes to form products.

B. Peak of the energy distribution curve corresponds to the most probable potential

energy.

C. Peak of the energy distribution curve corresponds to the most probable kinetic energy.

D. When the temperature is raised maximum of energy curve moves to higher energy value and broadens out.

**Answer: B**



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12. A catalyst increase rate of reaction by

- A. decrease enthalpy.
- B. decreasing internal energy .
- C. decreasing activation energy.
- D. increasing activation energy.

**Answer: C**



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13. Consider a reaction  $aG + bH \rightarrow$  products.

When concentration of both the reactants G and H is doubled, the rate increase by eight times.

However, when concentration of G is doubled keeping the concentration of H fixed, the rate is doubled. The overall order of the reaction is

A. 0

B. 1

C. 2

D. 3

**Answer: D**





14. For a first order reaction  $(A) \rightarrow$  products the concentration of A changes from 0.1M to 0.025M in 40 minutes.

The rate of reaction of when the concentration of A is 0.01M is:

A.  $1.73 \times 10^{-5} M \cdot \text{min}^{-1}$

B.  $3.47 \times 10^{-4} M \cdot \text{min}^{-1}$

C.  $3.47 \times 10^{-5} M \cdot \text{min}^{-1}$

D.  $1.73 \times 10^{-4} M \cdot \text{min}^{-1}$

**Answer: B**



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**15.** The given reaction



example of

A. first order concentration

B. second order reaction

C. third order reaction

D. None of these

Answer: C



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16. In a first order reaction,  $A + B \rightarrow$  , If  $K$  is rate constant and initial concentration of the reactant  $A$  is  $0.5M$ , then the half-life is

A.  $(\log 2)/(k)$

B.  $(\log 2)/(k\sqrt{0.5})$

C.  $\frac{\ln 2}{k}$

D.  $\frac{0.693}{0.5k}$

**Answer: C**



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17. The integrated rate equations can be determined for

- A. zero order reactions
- B. first order reactions
- C. second order reactions
- D. Both (a) and (b)

**Answer: D**



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**18.** The rate constant, the activation energy and the arrhenius parameter of a chemical reaction at  $25^\circ$  are

$3.0 \times 10^{-4} s^{-1}$ ,  $104.4 kJ \cdot mol^{-1}$  and  $6.0 \times 10^{14} s^{-1}$

respectively. The value of the rate constant as  $T \rightarrow \infty$  is

A.  $2.0 \times 10^{18} s^{-1}$

B.  $6.0 \times 10^{14} s^{-1}$

C. Infinity

D.  $3.6 \times 10^{30} s^{-1}$

**Answer: B**



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**19.** According to the adsorption theory of catalysis, the speed of the reaction increase because

- A. in the process of adsorption, the activation energy of the molecules becomes large
- B. adsorption produces heat which increase the speed of the reaction.

C. adsorption lowers the activation energy of the reaction

D. the concentration of product molecules at the active centres of the catalyst becomes high due to adsorption.

**Answer: C**



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**20.** Consider a general chemical change

$2A + 3B \rightarrow$  products. The rate with respect to A is

$r_1$  and that with respect to B is  $r_2$ . The rates

$r_1$  and  $r_2$  are related as

A.  $3r_1 = 2r_2$

B.  $r_1 = r_2$

C.  $2r_1 = 3r_2$

D.  $r_1^2 = 2r_2^2$

**Answer: A**



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21. In a first order reaction, the concentration of the reactant, decrease from 0.8M to 0.4M in 15minutes. The time taken for the concentration to changes from 0.1M to 0.025M is

A. 7.5 minutes

B. 15 minutes

C. 30 minutes

D. 60 minutes

**Answer: C**



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22. Activation energy ( $E_a$ ) and rate constant ( $k_1$  and  $k_2$ ) of chemical reaction at two different temperatures ( $T_1$  and  $T_2$ ) are related by :

A.  $\ln \frac{k_2}{k_1} = \frac{E_a}{R} \left[ \frac{1}{T_1} - \frac{1}{T_2} \right]$

B.  $\ln \frac{k_2}{k_1} = \frac{E_a}{R} \left[ \frac{1}{T_2} - \frac{1}{T_1} \right]$

C.  $\ln \frac{k_2}{k_1} = \frac{E_a}{R} \left[ \frac{1}{T_2} + \frac{1}{T_1} \right]$

D.  $\ln \frac{k_2}{k_1} = \frac{E_a}{R} \left[ \frac{1}{T_1} + \frac{1}{T_2} \right]$

**Answer: A**



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23.  $\frac{t_1}{4}$  can be taken as the time taken for the concentration of a reactant to drop to  $\frac{3}{4}$  of its initial value. If the rate constant for a first order reaction is  $k$ , the  $\frac{t_1}{4}$  can be written as

A.  $\frac{0.75}{k}$

B.  $\frac{0.69}{k}$

C.  $\frac{0.29}{k}$

D.  $\frac{0.10}{k}$

**Answer: C**



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24. the decomposition of ammonia on tungsten surface at 500K follows zero order kinetics. The Half-life period of this reaction is 45 minutes when the initial pressure is 4 bar. The half-life period (minutes) of the reaction when the initial pressure is 16 bar at the same temperature is

A. 120

B. 60

C. 240

D. 180

**Answer: D**



25. In a 1st order reaction, reactant concentration  $C$  varies with times  $t$  as:

A.  $\frac{1}{C}$  increase linearly with  $t$

B.  $\log C$  decrease linearly with  $t$

C.  $C$  decrease with  $\frac{1}{t}$

D.  $\log C$  decrease with  $\frac{1}{t}$

**Answer: B**



26. For a reactions  $A \rightarrow$  Products, a plot of  $\log t_{\frac{1}{2}}$  versus  $\log a_0$  is shown in the figure. If the initial concentration A is represented by  $a_0$ , the order of the reaction is



- A. one
- B. zero
- C. two
- D. three

**Answer: B**



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27. The rate of a chemical reaction doubles for every  $10^{\circ}C$  rise of temperature. If the temperature is raised by  $50^{\circ}C$ , the rate of the reaction is about,

A. 10 times

B. 24 times

C. 32 times

D. 64 times

**Answer: C**



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28. For a first order reaction  $t_{0.75}$  is 1368 seconds, therefore, the specific rate constant in  $\text{sec}^{-1}$  is

A.  $10^{-3}$

B.  $10^{-2}$

C.  $10^{-9}$

D.  $10^{-5}$

**Answer: A**



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29. The integrated rate equations is

$$R = \log C_0 - \log C_r$$

The straight line graph is obtained by plotting

A. time Vs  $\log C_t$

B.  $\frac{1}{\text{time}}$  Vs  $C_t$

C. time Vs  $C_t$

D.  $\frac{1}{\text{time}}$  Vs  $\frac{1}{C_t}$

**Answer: A**



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30. The energies of activation for forward and reverse reactions for  $A_2 + B_2 \leftrightarrow 2AB$  are  $180\text{kJmol}^{-1}$  and  $200\text{kJmol}^{-1}$  respectively. The presence of catalyst lowers the activation energy of both (forward and reverse) reactions by  $100\text{kJmol}^{-1}$ . The enthalpy change of the reaction ( $A_2 + B_2 \rightarrow 2AB$ ) in the presence of a catalyst will be (in  $\text{kJmol}^{-1}$ )

A. 20

B. 300

C. 120

D. 280

**Answer: A**



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**31.** The half-life period of a order reaction is 15 minutes. The amount of substance left after one hour will be:

- A.  $\frac{1}{4}$  of the original amount
- B.  $\frac{1}{8}$  of the original amount
- C.  $\frac{1}{16}$  of the original amount
- D.  $\frac{1}{32}$  of the original amount

**Answer: C**



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**32.** Reaction rate between two substance A and B is expressed as following,

$$\text{rate} = k[A]^n[B]^m$$

If the concentration of A is doubled and concentration of B is made half of initial concentration, the ratio of the new rate to the earlier rate will be,

A.  $m + n$

B.  $n - m$

C.  $\frac{1}{2^{n+m}}$

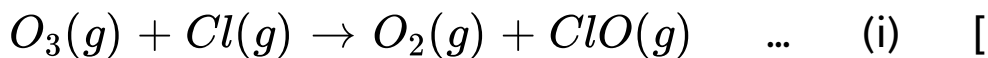
D.  $2^{n-m}$

**Answer: D**

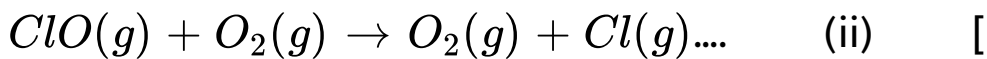


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**33.** The reaction of ozone with oxygen atoms in the presence of chlorine atoms can occur by two step process shown below,

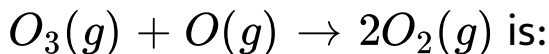


$$K_i = 5.2 \times 10^9 L \cdot mol^{-1} \cdot s^{-1}$$



$$K_{ii} = 2.6 \times 10^{10} \text{ l} \cdot \text{mol}^{-1} \cdot \text{s}^{-1}]$$

The closet rate constant for the overall reaction



A.  $1.4 \times 10^{20} \text{ l} \cdot \text{mol}^{-1} \cdot \text{s}^{-1}$

B.  $3.1 \times 10^{10} \text{ l} \cdot \text{mol}^{-1} \cdot \text{s}^{-1}$

C.  $5.2 \times 10^9 \text{ l} \cdot \text{mol}^{-1} \cdot \text{s}^{-1}$

D.  $2.6 \times 10^{10} \text{ l} \cdot \text{mol}^{-1} \cdot \text{s}^{-1}$

**Answer: A**



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34. The temperature dependence of rate constant( $k$ ) of a chemical reaction is written in terms of Arrhenius equation,  $k = A \cdot e^{-E_a}$   
Activation energy ( $E_a$ ) of the reaction can be calculated by plotting

A.  $k \text{ Vs } \frac{1}{\log T}$

B.  $\log k \text{ Vs } \frac{1}{T}$

C.  $\log k \text{ Vs } \frac{1}{\log T}$

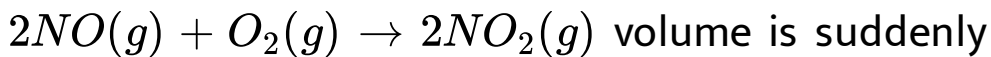
D.  $k \text{ Vs } T$

**Answer: B**



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**35.** For the reaction system,



volume is suddenly reduced to half its value by increasing the pressure on it. If the reaction is of first order with respect to  $O_2$  and second order with respect to  $NO$ , the rate of reaction will

- A. diminish to one-eighth of its initial value
- B. increase to eighth times of its initial value
- C. increase to fourth times of its initial value
- D. diminish to one-fourth of its initial value



**Answer: B**



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**36.** In the reaction of formation of sulphur trioxide by contact process  $2SO_2 + O_2 \leftrightarrow 2SO_3$  the rate of reaction was  $\frac{d[O_2]}{dt} = 2.5 \times 10^{-4} \text{ mol} \cdot L^{-1} \cdot s^{-1}$ . The rate of reaction in terms of  $[SO_2]$  in  $\text{mol} \cdot L^{-1} \cdot s^{-1}$  will be

A.  $-1.25 \times 10^{-4}$

B.  $-2.50 \times 10^{-4}$

C.  $-3.75 \times 10^{-4}$

D.  $-5.00 \times 10^{-4}$

**Answer: D**



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**37.** A reactant (A) forms two products,



If  $E_{a_1} = 2E_{a_2}$ , then  $k_1$  and  $k_2$  are related as:

A.  $k_2 = k_1 e^{\frac{E_{a_1}}{RT}}$

$$\text{B. } k_2 = k_1 e^{\frac{E_{a2}}{RT}}$$

$$\text{C. } k_1 = A k_2 e^{\frac{E_{a1}}{RT}}$$

$$\text{D. } k_1 = 2k_2 e^{\frac{E_{a1}}{RT}}$$

**Answer: C**



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**38.** Consider an endothermic reaction  $X \rightarrow Y$  with the activation energies  $E_b$  and  $E_i$ , for the backward and forward reactions, respectively. In general

A. there is no definite relation between

$$E_b \text{ and } E_f$$

B.  $E_b = E_f$

C.  $E_b > E_f$

D.  $E_b < E_f$

**Answer: D**



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**39.** Which of the following influences the rate of a chemical reactions performed in solution?

A. Temperature

B. Activation energy

C. Presence of a catalyst

D. All of the above influence the rate

**Answer: D**



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**40.** The rate of a reaction quadruples when the temperature changes from 300 to 310k. The activation energy of this reaction is : (Assume activation energy and pre-exponential factor are

independent of temperature ,  $\ln 2 = 0.693$ ,

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

A.  $107.2 \text{ kJ} \cdot \text{mol}^{-1}$

B.  $53.6 \text{ kJ} \cdot \text{mol}^{-1}$

C.  $26.8 \text{ kJ} \cdot \text{mol}^{-1}$

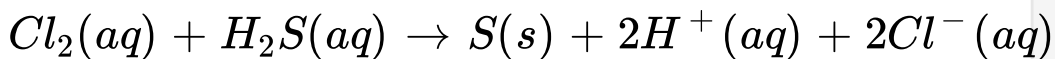
D.  $214.4 \text{ kJ} \cdot \text{mol}^{-1}$

**Answer: A**



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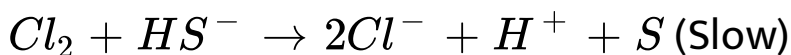
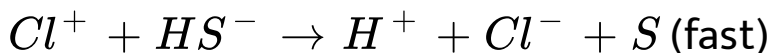
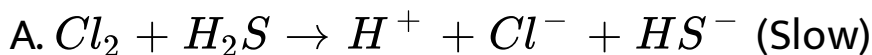
41. Consider the reaction :



the rate equation for this reaction is rate=

$$k[\text{Cl}_2][\text{H}_2\text{S}]$$

Which of these mechanism is/ are consistent with this rate equation?



A. B only

B. Both A and B

C. neither A nor B

D. A only

**Answer: D**



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**42.** The slope in Arrhenius plot, is equal to,

A.  $-\frac{E_a}{2.303R}$

B.  $\frac{E_a}{R}$

C.  $\frac{R}{2.303E_2}$

D. None of these



**Answer: A**



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43. A schematic plot of  $\ln K_{eq}$  versus inverse of temperature for a reaction is shown below



The reaction must be

- A. highly spontaneous at ordinary temperature
- B. one with negligible enthalpy change
- C. endothermic
- D. exothermic

Answer: D



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44. Plots showing the variation of the rate constant ( $k$ ) with temperature ( $T$ ) are given below. The plot that follows Arrhenius equations is

A. 

B. 

C. 

D. 

**Answer: A**



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45. The reaction  $2NO_2(g) \rightarrow 4NO_2(g) + O_2(g)$  follows first order kinetics. The pressure of a vessel containing only  $N_2O_5$  was found to increase from 50mm Hg to 87.5mm Hg in 30min. The pressure exerted by the gases after 60min will be (assume temperature remains constant):

A.  $106.2mm$  Hg

B.  $150mm$  Hg

C.  $125\text{mm Hg}$

D.  $116.5\text{mm Hg}$

**Answer: A**



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