CHEMISTRY

NCERT - NCERT CHEMISTRY(GUJRATI)

CHEMICAL KINETICS-II

Examples

1. In the thermal decomposition of N_2O at $764^\circ C$, the time required to decompose half the reactant was 263 seconds,

when the initial pressure was 290 mm of Hg and 212 seconds at an initial pressure of 360 mm of Hg. What is the order of this reaction ?

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2. In a first-order reaction, it takes the reactant 40.5 minutes to be 25% decomposed. Find the rate constant of the reaction.

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3. A certain amount of methyl acetate was hydrolysed in the presence of excess of $0.05\,\mathrm{M\,HCl}$ at $25^\circ C$. 20 mL of reaction mixture were removed and titrated with $NaOH$ solution, the volume V of alkali required for neutralisation after time 't' were as follows :

$\mathrm{t(min)}$	0	20	40	60	∞
$\mathrm{v(mL)}$	20.2	25.6	29.5	32.8	50.5

Show that the reaction is the first order reaction.

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4. The following values for the first order rate constant were obtained for a certain reaction :

$\text{Temp} \quad (^\circ C)$	$k \times 10^{-5} \quad \text{sec}^{-1}$
25	3.46
35	13.50

Calculate the Arrhenius frequency factor and activation energy $'E_a'$.

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Self Evaluation A Choose The Correct Answer

1. Hydrolysis of an ester by dilute HCl is an example for

A. second order reaction

B. zero order reaction

C. pseudo first order reaction

D. first order reaction

Answer: pseudo first order reaction

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2. The unit of zero order rate constant is

A. $\text{litre mol}^{-1}\text{sec}^{-1}$

B. $\text{mol litre}^{-1}\text{sec}^{-1}$

C. sec^{-1}

D. $\text{litre}^{2}\text{sec}^{-1}$

Answer: $\text{litre mol}^{-1}\text{sec}^{-1}$

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3. The excess energy which a molecule must posses to become active is known as

A. kinetic energy

B. threshold energy

C. potential energy

D. activation energy

Answer:

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4. Arrhenius equation is

A. $k = Ae^{-1/RT}$

B. $k = Ae^{-RT/Ea}$

C. $Ae^{-Ea/RT} = k$

D. $k = Ae^{Ea/RT}$

Answer:

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5. Arrhenius equation is

A. Probability factor

B. Activation of energy

C. Collision factor

D. Frequency factor

Answer:

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6. The sum of the powers of the concentration terms that occur in the rate equation is called

A. molecularity

B. order

C. rate

D. rate constant

Answer: order

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7. Reactions in which the reacting molecules react in more than one way yielding different set of products are called

A. consecutive reactions

B. parallel reactions

C. opposing reactions

D. chain reactions

Answer: parallel reactions

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8. The half life period of a first order reaction is 10 minutes. Then its rate constant is

A. $6.93 \times 10^{2} \mathrm{min}^{-1}$

B. $0.693 \times 10^{-2} \mathrm{min}^{-1}$

C. $6.932 \times 10^{-2} \mathrm{min}^{-1}$

D. $69.3 \times 10^{-1} \mathrm{min}^{-1}$

Answer:

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9. For a reaction : $aA \rightarrow bB$, the rate of reaction is doubled when the concentration of

A is increased by four times. The rate of reaction is equal to

A. $k[A]^a$

B. $k[A]^{\frac{1}{2}}$

C. $k[A]^{\frac{1}{a}}$

D. $k[A]$

Answer:

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10.

$2N_2O_5 \rightarrow 4NO_2 + O_2$, $\frac{d[N_2O_5]}{dt} = k_1[N_2O_5]$

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$\frac{d[NO_2]}{dt} = k_2[N_2O_5]$ and $\frac{d[O_2]}{dt} = k_3[N_2O_5]$

, the relation between k_1, k_2 and k_3 is

A. $2k_1 = 4k_2 = k_3$

B. $k_1 = k_2 = k_3$

C. $2k_1 = k_2 = 4k_3$

D. $2k_1 = k_2 = k_3$

Answer:

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11. For a reaction, $E_a = 0$ and $k = 4.2 \times 10^5 \sec^{-1}$ at $300K$, the value of k at 310 K will be

A. $4.2 \times 10^5 \sec^{-1}$

B. $8.4 \times 10^5 \sec^{-1}$

C. $8.4 \times 10^6 \sec^{-1}$

D. unpredictable

Answer:

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Self Evaluation B Answer In One Or Two Sentences

1. Define order of a reaction.

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2. Derive the relationship between half-life period and rate constant for a first order

reaction.

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Self Evaluation D Solve The Problems

1. The specific reaction rates of a chemical reaction are $2.45 \times 10^{-5} \sec^{-1}$ at $273K$ and $16.2 \times 10^{-4} \sec^{-1}$ at 303 K. Calculate the activation energy.

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2. Rate constant of a first order reaction is $0.45\,\mathrm{sec}^{-1}$, calculate its half life.

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3. A first order reaction completes $25\,\%$ of the reaction in 100 mins. What are the rate constant and half life values of the reaction?

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4. If 30% of a first order reaction is completed in 12 mins, what percentage will be completed in 65.33 mins?

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5. Show that for a first order reaction the time required for 99.9% completion is about 10 times its half life period.

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6. The half life period of a first order reaction is 10 mins, what percentage of the reactant will remain after one hour?

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7. The initial rate of a first order reaction is $5.2 \times 10^{-6}\ \text{mol.lit}^{-1}.\ s^{-1}$ at 298 K. When the initial concentration of reactant is $2.6 \times 10^{-3}\ \text{mol.lit}^{-1}$, calculate the first order rate constant of the reaction at the same temperature.

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