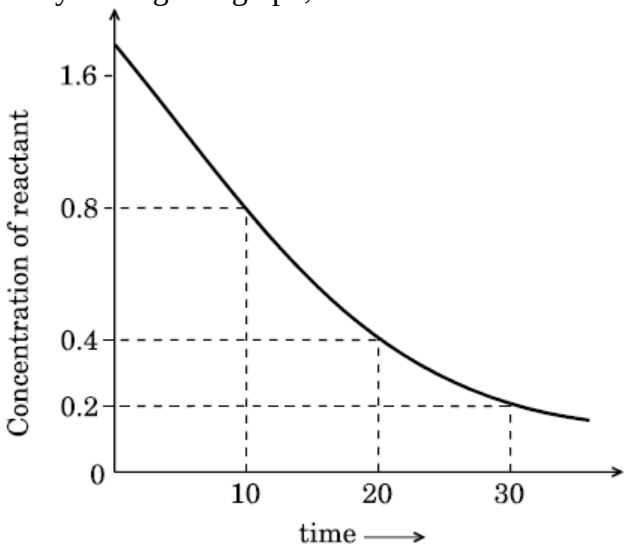
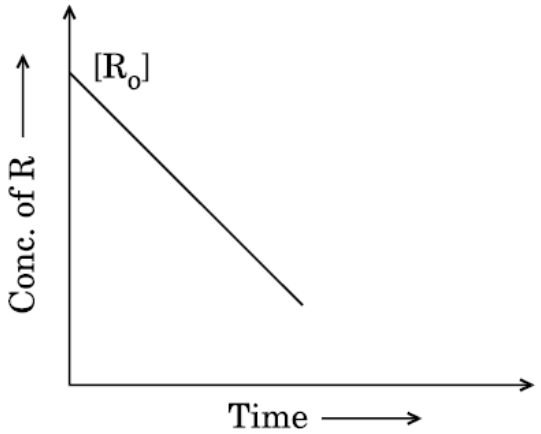
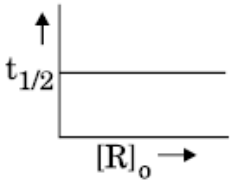
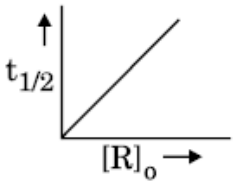
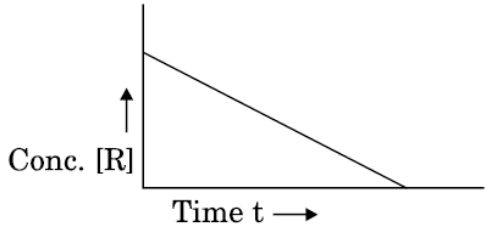
QUESTION BANK
CHEMICAL KINETICS
CLASS-12 (CBSE)

S NO.	QUESTION	YEAR
	Note: The PINK coloured questions are from the **reduced portion** of syllabus as per CBSE guidelines.	
1.	Will the rate constant of the reaction depend upon T if the E_{act} (activation energy) of the reaction is zero ?	2020
2.	Analyse the given graph, drawn between concentration of reactant vs. time.  (a) Predict the order of reaction. (b) Theoretically, can the concentration of the reactant reduce to zero after infinite time? Explain.	2020
3.	How will the rate of the reaction be affected when (a) Surface area of the reactant is reduced, (b) Catalyst is added in a reversible reaction, and (c) Temperature of the reaction is increased?	2020
4.	How will the rate of the reaction be affected when (a) surface area of the reactant is increased, (b) temperature of the reaction is decreased, and (c) Catalyst is added in a reversible reaction?	2020
5.	Calculate the overall order of the reaction whose rate law expression was predicted as : Rate $=k[NO]^{3/2}[O]^{1/2}$.	2020
6.	A reaction is first order w.r.t. reactant A as well as w.r.t. reactant B. Give the rate law. Also give one point of difference between average rate and instantaneous rate	2020
7.	Calculate the overall order of the reaction whose rate law is given by Rate $= k[NH_3]^{5/2}[O_2]^{1/2}$.	2020
8.	Calculate the overall order of the reaction whose rate law is given by Rate $= k[SO_2]^{1/4}[O_2]^{3/4}$.	2020
9.	Write the slope value obtained in the plot of $ln[R]$ vs. time for a first order reaction	2020
10.	A first order reaction is 40% complete in 80 minutes. Calculate the value of rate constant (k). In what time will the reaction be 90% completed? [Given: log 2 = 0·3010, log 3 = 0·4771, log 4 = 0·6021, log 5 = 0·6771, log 6 = 0·7782]	2020

QUESTION BANK
CHEMICAL KINETICS
CLASS-12 (CBSE)

11.	(a) Visha plotted a graph between concentration of R and time for a reaction R ⟶ P.  On the basis of this graph, answer the following questions : (i) Predict the order of reaction. (ii) What does the slope of the line indicate? (iii) What are the units of rate constant? (b) A first order reaction takes 25 minutes for 25% decomposition. Calculate $t_{1/2}$. [Given : log 2 = 0·3010, log 3 = 0·4771, log 4 = 0·6021] **OR** (a) The rate constant for a first order reaction is 60 s^{-1}. How much time will it take to reduce the initial concentration of the reactant to its $1/16^{th}$ value? (b) Write two factors that affect the rate of a chemical reaction. (c) Write two conditions for the collisions to be effective collisions.	2020
12.	In the given reaction $A + 3B \longrightarrow 2C$, the rate of formation of C is $2{\cdot}5 \times 10^{-4}$ mol L^{-1} s^{-1}. Calculate the (i) rate of reaction, and (ii) rate of disappearance of B.	2020
13.	The rate constant for the first order decomposition of N_2O_5 is given by the following equation : $k = (2.5 \times 10^{14}\ s^{-1})\ e^{(-25000K)/T}$ Calculate Ea for this reaction and rate constant if its half-life period be 300 minutes.	2020
14.	Write the slope value obtained in the plot of log [Ro] / [R] Vs. time for a first order reaction.	2020
15.	(a) A first order reaction is 25% complete in 40 minutes. Calculate the value of rate constant. In what time will the reaction be 80% completed? (b) Define order of reaction. Write the condition under which a bimolecular reaction follows first order kinetics. OR (a) A first order reaction is 50% complete in 30 minutes at 300 K and in 10 minutes at 320 K. Calculate activation energy (Ea) for the reaction. (R = 8.314 J K–1 mol^{-1}) (b) Write the two conditions for collisions to be effective collisions. (c) How order of reaction and molecularity differ towards a complex reaction ? [Given : log 2 = 0.3010, log 3 = 0.4771, log 4 = 0.6021, log 5 = 0.6991]	2020

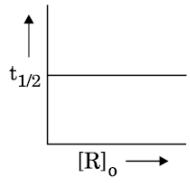
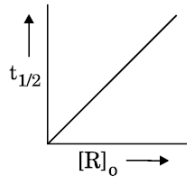
16.	For a reaction $2H_2O_2 \xrightarrow[\text{alkaline medium}]{I^-} 2H_2O + O_2$ the proposed mechanism is as given below : (1) $H_2O_2 + I^- \rightarrow H_2O + IO^-$ (slow) (2) $H_2O_2 + IO^- \rightarrow H_2O + I^- + O_2$ (fast) (i) Write rate law for the reaction. (ii) Write the overall order of reaction. (iii) Out of steps (1) and (2), which one is rate determining step ?	2019
17.	The decomposition of NH_3 on platinum surface is zero order reaction. If rate constant (k) is 4×10^{-3} Ms^{-1}, how long will it take to reduce the initial concentration of NH_3 from 0.1 M to 0.064 M.	2019
18.	Define order of reaction. Predict the order of reaction in the given graphs : (a)  (b)  where $[R]_o$ is the initial concentration of reactant and $t_{1/2}$ is half-life.	2019
19.	The following data were obtained for the reaction : $A + 2B \longrightarrow C$ Experiment | [A]/M | [B]/M | Initial rate of formation of C /M min^{-1} 1 | 0·2 | 0·3 | $4{\cdot}2 \times 10^{-2}$ 2 | 0·1 | 0·1 | $6{\cdot}0 \times 10^{-3}$ 3 | 0·4 | 0·3 | $1{\cdot}68 \times 10^{-1}$ 4 | 0·1 | 0·4 | $2{\cdot}40 \times 10^{-2}$ (a) Find the order of reaction with respect to A and B. (b) Write the rate law and overall order of reaction. (c) Calculate the rate constant (k).	2019
20.	(a) Define order of reaction. How does order of a reaction differ from molecularity for a complex reaction? (b) A first order reaction is 50% complete in 25 minutes. Calculate the time for 80% completion of the reaction.	2019

	OR (a) The decomposition of a hydrocarbon has value of rate constant as $2{\cdot}5 \times 10^4\ s^{-1}$ at 27°C. At what temperature would rate constant be $7{\cdot}5 \times 10^4\ s^{-1}$ if energy of activation is $19{\cdot}147 \times 10^3\ J\ mol^{-1}$? (b) Write a condition under which a bimolecular reaction is kinetically first order. Give an example of such a reaction. (Given : log 2 = 0·3010, log 3 = 0·4771, log 5 = 0·6990)	
21.	(a) Consider the reaction R ⟶ P for which the change in concentration of R with time is shown by the following graph :  (i) Predict the order of reaction. (ii) What does the slope of the curve indicate ? (b) The rate of reaction quadruples when temperature changes from 293 K to 313 K. Calculate Ea assuming that it does not change with time. [$R = 8{\cdot}314\ JK^{-1}\ mol^{-1}$] **OR** (a) Draw the plot of *ln* k vs 1/T for a chemical reaction. What does the intercept represent? What is the relation between slope and Ea? (b) A first order reaction takes 30 minutes for 20% decomposition. Calculate $t_{1/2}$. [log 2 = 0.3010]	2019
22.	Show that for a first order reaction, time required for completion of 99% of reaction is twice the time required for completion of 90% of reaction.	2019
23.	The reaction between A and B is first order with respect to A and zero order with respect to B. For this reaction, fill in the blanks in the following table.	2019

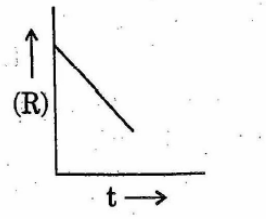
Experiment	[A] mol/L	[B] mol/L	Initial Rate Mol/L/min
I	0·1	0·1	$2{\cdot}0 \times 10^{-2}$
II	–	0·2	$4{\cdot}0 \times 10^{-2}$
III	0·4	0·4	–
IV	–	0·2	$2{\cdot}0 \times 10^{-2}$

24.	For the reaction $2N_2O_5\ (g) \longrightarrow 4NO_2\ (g) + O_2\ (g)$, the rate of formation of NO_2 (g) is $2{\cdot}8 \times 10^{-3}\ M\ s^{-1}$. Calculate the rate of disappearance of N_2O_5 (g).	2018
25.	A first order reaction is 50% completed in 40 minutes at 300 K and in 20 minutes at 320 K. Calculate the activation energy of the reaction. (Given : log 2 = 0·3010, log 4 = 0·6021, R = 8·314 $JK^{-1}\ mol^{-1}$)	2018
26.	What is the effect of adding a catalyst on (a) Activation energy (Ea), and (b) Gibbs energy (ΔG) of a reaction?	2017(OD)

QUESTION BANK
CHEMICAL KINETICS
CLASS-12 (CBSE)

<table>
<tr><td>27.</td><td>A first order reaction takes 20 minutes for 25% decomposition. Calculate the time when 75% of the reaction will be completed.
(Given : log 2 = 0·3010, log 3 = 0·4771, log 4 = 0·6021)</td><td>2017(OD)</td></tr>
<tr><td>28.</td><td>For a reaction R $\longrightarrow$ P, half-life ($t_{1/2}$) is observed to be independent of the initial concentration of reactants. What is the order of reaction?</td><td>2017(D)</td></tr>
<tr><td>29.</td><td>Following data are obtained for the reaction :
$N_2O_5 \longrightarrow 2NO_2 + \frac{1}{2}O_2$
<table>
<tr><td>t/s</td><td>0</td><td>300</td><td>600</td></tr>
<tr><td>$[N_2O_5]$/mol L^{-1}</td><td>1.6×10^{-2}</td><td>0.8×10^{-2}</td><td>0.4×10^{-2}</td></tr>
</table>
(a) Show that it follows first order reaction.
(b) Calculate the half-life.
(Given log 2 = 0.3010 log 4 = 0.6021)</td><td>2017(D)</td></tr>
<tr><td>30.</td><td>(a) A first order reaction is 75% completed in 40 minutes. Calculate its $t_{1/2}$.
(b) Predict the order of the reaction in the given plots :
(i) 
(ii) 
where $[R]_o$ is the initial concentration of reactant. (Given : log 2 = 0·3010, log 4 = 0·6021)</td><td>2017(F)</td></tr>
<tr><td>31.</td><td>The following data were obtained for the reaction :
$2\,NO + O_2 \longrightarrow 2\,NO_2$
<table>
<tr><td>Experiment</td><td>[NO] / M</td><td>$[O_2]$ / M</td><td>Initial rate of formation of NO_2 / M min^{-1}</td></tr>
<tr><td>1</td><td>0.3</td><td>0.2</td><td>7.2×10^{-2}</td></tr>
<tr><td>2</td><td>0.1</td><td>0.1</td><td>6.0×10^{-3}</td></tr>
<tr><td>3</td><td>0.3</td><td>0.4</td><td>2.88×10^{-1}</td></tr>
<tr><td>4</td><td>0.4</td><td>0.1</td><td>2.40×10^{-2}</td></tr>
</table>
(a) Find the order of reaction with respect to NO and O_2.
(b) Write the rate law and overall order of reaction.
(c) Calculate the rate constant (k).</td><td>2017(F)</td></tr>
<tr><td>32.</td><td>For a reaction:
$H_2 + Cl_2 \xrightarrow{h\nu} 2HCl$
Rate = k
(i) Write the order and molecularity of this reaction.
(ii) Write the unit of k.</td><td>2016(OD)</td></tr>
<tr><td>33.</td><td>For the first order thermal decomposition reactions, the following data were obtained
$C_2H_3Cl(g) \longrightarrow C_2H_4(g) + HCl(g)$
<table>
<tr><td>Time/sec</td><td>Total pressure</td></tr>
<tr><td>0</td><td>0.30</td></tr>
<tr><td>300</td><td>0.50</td></tr>
</table>
Calculate the rate constant. (Given: log 2 = 0.301, log 3 = 0.4771, log 4 = 0.6021)</td><td>2016(OD)</td></tr>
<tr><td>34.</td><td>For a reaction:
$2NH_3 \xrightarrow{Fe} N_2 + 3H_2$, Rate = k
(i) Write the order and molecularity of this reaction.
(ii) Write the unit of k.</td><td>2016(D)</td></tr>
</table>

QUESTION BANK
CHEMICAL KINETICS
CLASS-12 (CBSE)

<table>
<tr><td>35.</td><td>The rate constant for the first order decomposition of $H_2O_2$is given by the following equation: $logK = 14.4 - \frac{1\times10^4 K}{T}$, Calculate E_a for this reaction and rate constant k if its half-life period be 200 minutes. (Given: R = 8.314 $\boldsymbol{JK^{-1}mol^{-1}}$).</td><td>2016(D)</td></tr>
<tr><td>36.</td><td>For the hydrolysis of methyl acetate in aqueous solution, the following result are obtained:
<table>
<tr><td>t/s</td><td>0</td><td>10</td><td>20</td></tr>
<tr><td>$[\boldsymbol{CH_3COOCH_3}]/\ \boldsymbol{mol\ L^{-1}}$</td><td>0.10</td><td>0.05</td><td>0.025</td></tr>
</table>
(a) Show that it follows pseudo first order reaction, as the concentration of water remains constant.
(b) Calculate the average rate of reaction between the time interval 10 to 20 seconds.
(Given : Log 2 = 0.3010, Log 4 = 0. 6021)</td><td>2015(OD)
2007(D)</td></tr>
<tr><td>37.</td><td>(a) For a reaction A + B ⟶ P, the rate is given by rate = k[A][B]²
(i) How is the rate of reaction affected in the concentration of B is doubled?
(ii) What is the overall order of reaction if A is present in large excess?
(b) A first order reaction takes 30 minutes for 50% completion. Calculate the time required for 90% completion of the reaction.</td><td>2015(OD)
2015(D)
2007(D)</td></tr>
<tr><td>38.</td><td>For the hydrolysis of methyl acetate in aqueous solution, the following results were obtained:
<table>
<tr><td>t/s</td><td>0</td><td>30</td><td>60</td></tr>
<tr><td>$[\boldsymbol{CH_3COOCH_3}]/\ \boldsymbol{mol\ L^{-1}}$</td><td>0.60</td><td>0.30</td><td>0.15</td></tr>
</table>
(i) Show that is follows pseudo first order reaction, as the concentration of water remains constant.
(ii) Calculate the average rate of reaction between the time interval 30 to 60 seconds.
(Given log 2 = 0.3010, log 4 = 0.6021)</td><td>2015(D)</td></tr>
<tr><td>39.</td><td>For a chemical reaction R⟶P, the variation in the concentration (R) vs. Time(t) plot is given as
 

(i) Predict the order of the reaction.
(ii) What is the slope of the curve?</td><td>2014(OD)</td></tr>
<tr><td>40.</td><td>The following data were obtained during the first order thermal decomposition of $\boldsymbol{SO2Cl2}$ at a constant volume:
$SO_2Cl_2(g) \longrightarrow SO_2(g) + Cl_2(g)$
<table>
<tr><td>$\boldsymbol{Experiment}$</td><td>$\boldsymbol{Times/s^{-1}}$</td><td>$\boldsymbol{Total\ pressure/atm}$</td></tr>
<tr><td>1</td><td>0</td><td>0.4</td></tr>
<tr><td>2</td><td>100</td><td>0.7</td></tr>
</table>
Calculate the rate constant. (Given: Log 4 = 0.6021, Log 2 =0.3010)</td><td>2014(OD)
2014(D)</td></tr>
<tr><td>41.</td><td>Write two differences between ‘order of reaction’ and ‘molecularity of reaction’.</td><td>2014(D)</td></tr>
<tr><td>42.</td><td>(a) For a reaction $\boldsymbol{A + B \longrightarrow P}$, the rate law is given by, $\boldsymbol{r} = [\boldsymbol{A}]^{1/2}[\boldsymbol{B}]^2$ What is the order of this reaction.
(b) A first order reaction is found to have a rate constant $\boldsymbol{k = 5.5\times10^{-14}S^{-1}}$Find the half-life of the reaction.</td><td>2013(OD)</td></tr>
<tr><td>43.</td><td>The rate of a reaction becomes four times when the temperature changes from 293 K to 313 K. Calculate the energy of activation $(\boldsymbol{E_a})$of the reaction assuming that it does not changes with temperature. [$\boldsymbol{R = 8.314\ JK^{-1}mol^{-1}, log4 = 0.6021}$].</td><td>2013(OD)</td></tr>
<tr><td>44.</td><td>(a) A reaction is second order in A and first order in B.
(i). Write the differential rate equation.
(ii). How is the rate affected on increasing the concentrations of both A three times?
(iii). How is the rate affected when the concentrations of both A and B are doubled?
(b). A find order reaction takes 40 minutes for 30% decomposition. Calculate $\boldsymbol{t_{1/2}}$ for this reaction.
(Given log 1.428 = 0.1548)</td><td>2013(D)</td></tr>
</table>

QUESTION BANK
CHEMICAL KINETICS
CLASS-12 (CBSE)

<table>
<tr><td>45.</td><td>(a) For a first order reaction, show that time required for 90% completion is twice the time required for the completion of 90% of reaction.
(b) Rate constant 'k' of a reaction varies with temperature 'T' according to the equation: $logk = \log A - \frac{Ea}{2.303\,R}\left(\frac{1}{T}\right)$ Where $\boldsymbol{Ea}$ is the activation energy? When a graph is plotted for log k Vs $\frac{1}{T}$ straight line with a slope of $-$ 4250 K is obtained. Calculate $\boldsymbol{'Ea'}$ for the reaction.($\mathbf{R = 8.314\ JK{-}1mol{-}1}$)</td><td>2013(D)</td></tr>
<tr><td>46.</td><td>A reaction is of second order with respect to a reactant. How is its rate affected if the concentration of the reactant is (i) doubled (ii) reduced to half?</td><td>2012(OD)</td></tr>
<tr><td>47.</td><td>What do you understand by the order of a reaction? Identify the reaction order from each of the following units of reaction rate constant:
(i) $\boldsymbol{L^{-1}mol\,S^{-1}}$
(ii) $\boldsymbol{Lmol^{-1}S^{-1}}$</td><td>2012(D)
2011(D)</td></tr>
<tr><td>48.</td><td>For the reaction 2NO $(\boldsymbol{g})$ + $Cl_2(\mathbf{g}) \longrightarrow \mathbf{2}\,\boldsymbol{NOCl}\,(\boldsymbol{g})$ the following date were collected. All the measurements were taken at 263K:
<table>
<tr><th>Experiment No.</th><th>Initial [NO] (M)</th><th>Initial [$\boldsymbol{Cl_2}$] (M)</th><th>Initial rate of disappearance of Cl_2 (M/min)</th></tr>
<tr><td>1.</td><td>0.15</td><td>0.15</td><td>0.60</td></tr>
<tr><td>2.</td><td>0.15</td><td>0.13</td><td>1.20</td></tr>
<tr><td>3.</td><td>0.30</td><td>0.15</td><td>2.40</td></tr>
<tr><td>4.</td><td>0.25</td><td>0.25</td><td>?</td></tr>
</table>
(a) Write the expression for rate law.
(b) Calculate the value of rate constant and specify its units.
(c) What is the initial rate of disappearance of $\boldsymbol{Cl_2}$ in exp. 4?</td><td>2012(D)</td></tr>
<tr><td>49.</td><td>The thermal decomposition of HCOOH is a first order reaction with a rate constant of 2.4×10^{-3} at a certain temperature. Calculate how long will it take for three-fourths of initial quantity of HCOOH to decompose. (log 0.25 = -0.6021).</td><td>2012(D)</td></tr>
<tr><td>50.</td><td>Distinguish between 'rate expression' and 'rate constant' of a reaction.</td><td>2011(D)</td></tr>
<tr><td>51.</td><td>Nitrogen pentoxide decomposes according to equation:
$\mathbf{2N_2O_5(g) \longrightarrow 4NO_2(g) + O_2(g)}$.
This first order reaction was allowed to proceed at $\mathbf{40}$ ℃ and the data below were collected:
<table>
<tr><th>$[\boldsymbol{N_2O_5}](\boldsymbol{M})$</th><th>Time (min)</th></tr>
<tr><td>0.400</td><td>0.00</td></tr>
<tr><td>0.289</td><td>20.0</td></tr>
<tr><td>0.209</td><td>40.0</td></tr>
<tr><td>0.151</td><td>60.0</td></tr>
<tr><td>0.109</td><td>80.0</td></tr>
</table>
(a) Calculate the rate constant. Include units with your answer.
(b) What will be the concentration $\boldsymbol{N_2O_5}$ after 100 minutes?
(c) Calculate the initial rate of reaction.</td><td>2011(D)</td></tr>
<tr><td>52.</td><td>(a) Explain the following terms:
(i) Rate of a reaction (ii) Activation energy of a reaction
(b) The decomposition of phosphine, PH_3, proceeds according to the following equation:
$\boldsymbol{4\,PH_3(g) \longrightarrow P_4(g) + 6\,H_2(g)}$
It is found that the reaction follows the following rate equation:
$\boldsymbol{Rate = k[PH_3]}$.
The half-life of $\boldsymbol{PH_3}$ is 37.9 s at $\boldsymbol{120^0C}$.
(i) How much time is required for $\boldsymbol{3/4^{th}}$ of $\boldsymbol{PH_3}$ to decompose?
(ii) What fraction of the original sample of $\boldsymbol{PH_3}$ remains behind after 1 minute?</td><td>2010(OD)</td></tr>
<tr><td>53.</td><td>(a) Explain the following terms:
(i) Order of a reaction (ii) Molecularity of a reaction</td><td>2010(OD)</td></tr>
</table>

QUESTION BANK
CHEMICAL KINETICS
CLASS-12 (CBSE)

	(b) The rate of a reaction increases four times when the temperature changes from 300K to 320 K. Calculate the energy of activation of the reaction, assuming that it doesnot change with temperature. ($\boldsymbol{R = 8.314\ J\ K{-}1\ mol{-}1}$)	
54.	Define 'order of a reaction'.	2010(D) 2008(D)
55.	A reaction is of first order in reactant A and of second order in reactant B. How is the rate of this reaction affected when (i) the concentration of B alone is increased to three times (ii) the concentrations of A as well as B are doubled?	2010(D)
56.	For a first order reaction, time taken for half of the reaction to complete $\boldsymbol{t_1}$ **and** three forth of the reaction to complete is $\boldsymbol{t_2}$. How are $\boldsymbol{t_1}$ **and** $\boldsymbol{t_2}$ related?	2010(D) 2007(D)
57.	A first reaction has rate constant of $\boldsymbol{0.0051\ min^{-1}}$. If we begin with 0.10 M concentration of the reactant. What concentration of the reactant will be left after 3hours?	2009(OD) 2009(D)
58.	A reaction of second order with respect to a reactant. How will the rate of reaction be affected if the concentration of this reactant is (i) Doubled, (ii) Reduced to half?	2009(D)
59.	(a) Define the following: (i) Order of reaction (ii) Activation energy of reaction (b) $\boldsymbol{A + 2B \longrightarrow 3C + 2D}$. The ratio of disappearance of B is $\boldsymbol{1\times10^{-2}mol/L}$/S. What will be (i) Rate of the reaction (ii) Rate of change in concentration of A and C?	2008(OD)
60.	(a) List the factors on which the rate of a chemical reaction depends. (b) The half-life for decay of radioactive $\boldsymbol{14C}$ is 5730 years. An archaeological artifact containing wood has only 80% of the $\boldsymbol{14C}$ activity as found in living trees.Calculate the age of the artifact.	2008(OD)
61.	A first order decomposition reaction takes 40 minutes for 30% decomposition. Calculate its $\boldsymbol{t_{1/2}}$ value.	2008(D) 2007(D)
62.	What is meant by the 'rate constant' k' of a reaction? If the concentration be expressed in mol$\boldsymbol{L^{-1}}$units and time in seconds, what would be the units for k (i) for a zero order reaction and (ii) for a first order reaction?	2008(D)