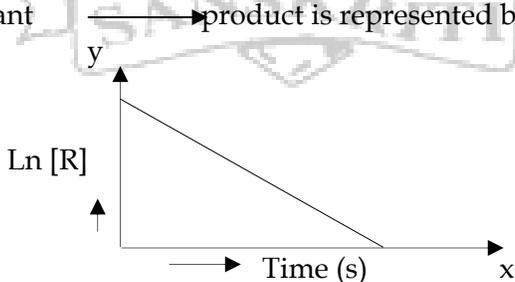


Assignment

Chapter 4: Chemical Kinetics

1.	For the reaction : $\text{Cl}_2 (\text{g}) + 2 \text{NO} (\text{g}) \longrightarrow 2\text{NOCl} (\text{g})$ The rate law is expressed as $\text{rate} = k [\text{Cl}_2][\text{NO}]^2$ What is the overall order of the reaction?
2.	Define the order and molecularity of the reaction. What is the molecularity of the reaction? $\text{Cl} \longrightarrow \frac{1}{2} \text{Cl}_2 (\text{g})$
3.	A first order reaction takes 69.3 minutes for 50% completion. Set up an equation for the determining the time needed for 80% completion of this reaction. (Calculation of result is not required).
4.	Explain the following terms: (i) Rate constant (k) (ii) Half life period of a reaction($t_{1/2}$)
5.	What do you understand by the 'order of reaction' ? Identify the reaction order from each of following units of reaction rate constant : (i) $\text{L}^{-1} \text{mol s}^{-1}$ (ii) $\text{L mol}^{-1} \text{s}^{-1}$
6.	The rate of a particular reaction triples when temperature changes from 50°C to 100°C . Calculate the activation energy of the reaction. [$\log 3 = 0.4771$, $R = 8.314 \text{ JK}^{-1} \text{ mol}^{-1}$] (22.01 KJ/mol)
7.	Give an example of pseudo first order reaction.
8.	A reaction, reactant \longrightarrow product is represented by the graph below. predict  (i) The order of the reaction in this case. (ii) What does the slope of the graph represent? (iii) What are the units of rate constant k? (iv) Give the relationship between k and $t_{1/2}$ (half life period). (v) Draw the plot of $\log [R]_0/[R]$ vs. time (s)

9.	<p>For the reaction</p> $2\text{NO}_{(g)} + \text{Cl}_{2(g)} \longrightarrow 2\text{NOCl}_{(g)}$ <p>The following data were collected . All the measurements were taken at 263 K:</p> <table border="1" data-bbox="313 411 1468 667"> <thead> <tr> <th>Experiment No.</th> <th>Initial(NO) (M)</th> <th>Initial(Cl₂) (M)</th> <th>Initial rate of disappearance of Cl₂ (M/min)</th> </tr> </thead> <tbody> <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>0.30</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> </tbody> </table> <p>Write the expression for the rate law.</p> <p>(a) Calculate the value of rate constant and specify in units. (b) What is initial rate of disappearance of Cl₂ in exp.4 ?</p> <p style="text-align: center;">[(a) $k = 177,7 \text{ M}^{-2} \text{ min}^{-1}$; (b) Rate = 2.8 M min^{-1}]</p>	Experiment No.	Initial(NO) (M)	Initial(Cl ₂) (M)	Initial rate of disappearance of Cl ₂ (M/min)	1	0.15	0.15	0.60	2	0.15	0.30	1.20	3	0.30	0.15	2.40	4	0.25	0.25	?
Experiment No.	Initial(NO) (M)	Initial(Cl ₂) (M)	Initial rate of disappearance of Cl ₂ (M/min)																		
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4	0.25	0.25	?																		
10.	<p>The decomposition of NH₃ on platinum surface, $2\text{NH}_3(g) \xrightarrow{\text{Pt}} \text{N}_2(g) + 3\text{H}_2(g)$ is a zero order reaction with $k = 2.5 \times 10^{-4} \text{ MS}^{-1}$. What are the rates of production of N₂ and H₂ ?</p> <p style="text-align: center;">($2.5 \times 10^{-4} \text{ Ms}^{-1}$, $7.5 \times 10^{-4} \text{ Ms}^{-1}$)</p>																				
11.	<p>For a certain chemical reaction:</p> $2\text{A} + 2\text{B} \longrightarrow 2\text{C} + \text{D}$ <p>The experimentally obtained information is tabulated below.</p> <table border="1" data-bbox="313 1213 1427 1398"> <thead> <tr> <th>Experiment</th> <th>[A]_o</th> <th>[B]_o</th> <th>Initial rate of reaction</th> </tr> </thead> <tbody> <tr> <td>1.</td> <td>0.30</td> <td>0.30</td> <td>0.096</td> </tr> <tr> <td>2.</td> <td>0.60</td> <td>0.30</td> <td>0.384</td> </tr> <tr> <td>3.</td> <td>0.30</td> <td>0.60</td> <td>0.192</td> </tr> <tr> <td>4.</td> <td>0.60</td> <td>0.60</td> <td>0.768</td> </tr> </tbody> </table> <p>For this reaction</p> <p>(i) derive the order of reaction w.r.t both the reactants A and B. (ii) write the rate law. (iii) calculate the value of rate constant k. ($k = 3.5 \text{ l}^2\text{mol}^{-2} \text{ s}^{-1}$) (iv) write the expression for the rate of reaction in terms of A and C.</p>	Experiment	[A] _o	[B] _o	Initial rate of reaction	1.	0.30	0.30	0.096	2.	0.60	0.30	0.384	3.	0.30	0.60	0.192	4.	0.60	0.60	0.768
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12.	<p>For an elementary reaction</p> $2\text{A} + \text{B} \longrightarrow 3\text{C}$ <p>the rate of appearance of C at time 't' is $1.3 \times 10^{-4} \text{ mol l}^{-1}\text{s}^{-1}$ Calculate at this time</p> <p>i) rate of the reaction. ii) Rate of disappearance of A.</p> <p style="text-align: center;">{ (i) $4.33 \times 10^{-5} \text{ mo/l/s}$, (ii) $8.66 \times 10^{-5} \text{ mol/l/s}$ }</p>																				

13.	<p>The following data were obtained during the first order thermal decomposition of SO_2Cl_2 at a constant volume:</p> $\text{SO}_2\text{Cl}_2(\text{g}) \longrightarrow \text{SO}_2(\text{g}) + \text{Cl}_2(\text{g})$ <table border="1" data-bbox="440 348 1370 464"> <thead> <tr> <th>Experiment</th> <th>Time/s^{-1}</th> <th>Total pressure/atm</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>0</td> <td>0.4</td> </tr> <tr> <td>2</td> <td>100</td> <td>0.7</td> </tr> </tbody> </table> <p>Calculate the rate constant. (Given $\log 4 = 0.6021$, $\log 2 = 0.3010$)</p>	Experiment	Time/ s^{-1}	Total pressure/atm	1	0	0.4	2	100	0.7
Experiment	Time/ s^{-1}	Total pressure/atm								
1	0	0.4								
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14.	Derive the general form of the expression for the half-life of a first order reaction.									
15.	<p>A reaction is of first order in reactant A and second order in reactant B. How is the rate of this reaction affected when</p> <ol style="list-style-type: none"> the concentration of B alone is increased to three times the concentration of A as well as B is doubled. 									
16.	<p>The rate constant for a reaction of zero order in A is $0.0030 \text{ mol L}^{-1} \text{ s}^{-1}$. How long will it take for the initial concentration of A to fall from 0.10 M to 0.075 M.</p> <p style="text-align: right;">($t = 8.33 \text{ sec}$)</p>									
17.	<p>The half life for decay of radioactive ^{14}C is 5730 years. An archaeological artefact containing wood has only 80% of the ^{14}C activity as found in living trees. Calculate the age of the artefact.</p>									
18.	<p>Gurupreet Kaur was born and brought up in Mumbai. She got married in last week of November 2012 and shifted over to Amritsar. She was an expert curd maker. However she find that setting of curd in Amritsar is not as good as it was in Mumbai. Ramandeep Kaur , her sister-in-law , is a student of science. One day , while observing Gurpreet Kaur in the kitchen she advised a slightly modified procedure to prepare curd. She advised Gurupreet Kaur to add some curd to warm milk and keep the same in well insulated container for overnight for the curd to set.</p> <p>Read the above passage and answer the following questions.</p> <ol style="list-style-type: none"> Do you think Ramandeep Kaur advise will help Gupreet Kaur. What is the main cause of curd setting late ? What is the scientific reason behind Ramandeep Kaur's advise ? What values are associated with Ramandeep Kaur advise. 									