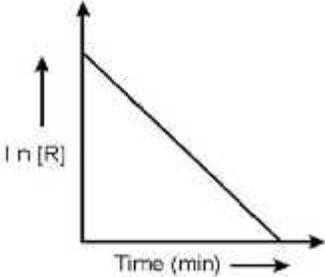




INDIAN SCHOOL DARSAIT
DEPARTMENT OF CHEMISTRY



Subject: Chemistry Topic : Chemical Kinetics Date of Worksheet: 20.11.2017		
Resource Person: SREEKALA M Date of Submission: _____		
Name of the Student: _____ Class & Division: XII Roll Number: _____		
1	Identify the order of the reaction from the following unit for its rate constant: $\text{Lmol}^{-1}\text{s}^{-1}$	1
2	For the reaction $\text{N}_2(\text{g}) + 3 \text{H}_2(\text{g}) \rightarrow 2 \text{NH}_3(\text{g})$ If $[\text{NH}_3]/t = 4 \times 10^{-8} \text{ molL}^{-1}\text{s}^{-1}$, what is the value of $-\text{[H}_2]/t$? (Ans: $6 \times 10^{-8} \text{ molL}^{-1}\text{s}^{-1}$)	1
3	Express the relationship between the rate of production of water and the rate of disappearance of oxygen in the following reaction: $2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$	1
4	What is the difference between average rate and instantaneous rate of a chemical reaction?	1
5	In a hydrolysis reaction, 5g ethyl acetate is hydrolysed in presence of dilute HCl in 300 min. If the reaction is of first order and the initial concentration of ethyl acetate is 22g/L, calculate the rate constant of the reaction. (Ans: $8.36 \times 10^{-4} \text{ min}^{-1}$)	2
6	Consider the decomposition of hydrogen peroxide in alkaline medium which is catalysed by iodide ions. I^-/OH^- $2\text{H}_2\text{O}_2 \rightarrow 2\text{H}_2\text{O} + \text{O}_2$ The reaction takes place in two steps; Step I) $\text{H}_2\text{O}_2 + \text{I}^- \rightarrow \text{H}_2\text{O} + \text{IO}^-$ (slow) Step II) $\text{H}_2\text{O}_2 + \text{IO}^- \rightarrow \text{H}_2\text{O} + \text{I}^- + \text{O}_2$ (fast) a) Write the rate law expression and determine the order of reaction with respect to H_2O_2 . b) What is the molecularity of each individual step?	2

7	<p>For a chemical reaction variation in concentration, $\ln[R]$ Vs time(min) plot is shown below:</p>  <p>i) What is the order of the reaction? ii) What are the units of rate constant, k for the reaction? iii) If initial concentration of the reactant is half of the original concentration, how will $t_{1/2}$ change? iv) Draw the plot of $\log [R]_0/[R]$ Vs time(s)</p>	2
8	<p>Sucrose decomposes in acid solution into glucose and fructose according to the first order rate law with $t_{1/2} = 3$ hrs. Calculate the fraction of sucrose which remains after 8 hrs.</p> <p style="text-align: right;">(Ans: 0.158)</p>	2
9	<p>A first order reaction has a rate constant value of 0.00510 min^{-1}. If we begin with 0.10 M concentration of the reactant, how much of the reactant will remain after 3.0 hours? (Ans: $1.148 \times 10^{-25} \text{ M}$)</p>	2
10	<p>The rate constant for a zero order reaction is $0.0030 \text{ molL}^{-1}\text{s}^{-1}$. How long will it take for the initial concentration of the reactant to fall from 0.10 M to 0.075 M ? (Ans: $t = 8.33 \text{ sec}$)</p>	2
11.	<p>Explain pseudo first order reaction with an example.</p>	2
12	<p>Define:</p> <p>i) Elementary reaction ii) Rate of a reaction iii) Order of a reaction iv) Elementary step in a reaction v) Activation energy vii) Activated complex. viii) Molecularity of a reaction. ix) Threshold energy.</p>	1 mark each.
13	<p>A first order reaction is 20% complete in 20 minutes. Calculate the time taken for the reaction to go to 80% completion (Ans: 72.12 min)</p>	3
14.	<p>A first order reaction takes 20 minutes for 15% completion. Calculate the time required for 60% completion of this reaction. (Ans: 112.7 min)</p>	3

15	<p>The following rate data were obtained at 300 K for the reaction $2A + B \rightarrow C + D$.</p> <table border="1" data-bbox="277 262 1393 485"> <thead> <tr> <th>Experiment No.</th> <th>[A] mol/L</th> <th>[B] mol/L</th> <th>Rate of formation of D mol L⁻¹ min⁻¹</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>0.1</td> <td>0.1</td> <td>7.0×10^{-3}</td> </tr> <tr> <td>2</td> <td>0.3</td> <td>0.2</td> <td>8.4×10^{-2}</td> </tr> <tr> <td>3</td> <td>0.3</td> <td>0.4</td> <td>3.36×10^{-1}</td> </tr> <tr> <td>4</td> <td>0.4</td> <td>0.1</td> <td>2.8×10^{-2}</td> </tr> </tbody> </table> <p>Calculate the rate of formation of D when [A] = 0.6 mol L⁻¹ and [B] = 0.3 mol L⁻¹.</p>	Experiment No.	[A] mol/L	[B] mol/L	Rate of formation of D mol L ⁻¹ min ⁻¹	1	0.1	0.1	7.0×10^{-3}	2	0.3	0.2	8.4×10^{-2}	3	0.3	0.4	3.36×10^{-1}	4	0.4	0.1	2.8×10^{-2}	3
Experiment No.	[A] mol/L	[B] mol/L	Rate of formation of D mol L ⁻¹ min ⁻¹																			
1	0.1	0.1	7.0×10^{-3}																			
2	0.3	0.2	8.4×10^{-2}																			
3	0.3	0.4	3.36×10^{-1}																			
4	0.4	0.1	2.8×10^{-2}																			
16	<p>For a decomposition reaction, the values of rate constant k at two different temperatures are given below: $k_1 = 2.15 \times 10^{-8} \text{ L mol}^{-1} \text{ s}^{-1}$ at 650K $k_2 = 2.39 \times 10^{-7} \text{ L mol}^{-1} \text{ s}^{-1}$ at 700K. Calculate the value of activation energy (E_a) for this reaction. ($R = 8.314 \text{ JK}^{-1} \text{ mol}^{-1}$) (Ans: $E_a = 182.24 \text{ kJ mol}^{-1}$)</p>	3																				
17.	<p>The reaction between A and B is first order with respect to A and zero order with respect to B. Fill in the blanks in the following table:</p> <table border="1" data-bbox="284 892 1382 1203"> <thead> <tr> <th>Experiment</th> <th>[A]/ mol L⁻¹</th> <th>[B]/ mol L⁻¹</th> <th>Initial rate/ mol L⁻¹ min⁻¹</th> </tr> </thead> <tbody> <tr> <td>I</td> <td>0.1</td> <td>0.1</td> <td>2.0×10^{-2}</td> </tr> <tr> <td>II</td> <td>-</td> <td>0.2</td> <td>4.0×10^{-2}</td> </tr> <tr> <td>III</td> <td>0.4</td> <td>0.4</td> <td>-</td> </tr> <tr> <td>IV</td> <td>-</td> <td>0.2</td> <td>2.0×10^{-2}</td> </tr> </tbody> </table>	Experiment	[A]/ mol L ⁻¹	[B]/ mol L ⁻¹	Initial rate/ mol L ⁻¹ min ⁻¹	I	0.1	0.1	2.0×10^{-2}	II	-	0.2	4.0×10^{-2}	III	0.4	0.4	-	IV	-	0.2	2.0×10^{-2}	3
Experiment	[A]/ mol L ⁻¹	[B]/ mol L ⁻¹	Initial rate/ mol L ⁻¹ min ⁻¹																			
I	0.1	0.1	2.0×10^{-2}																			
II	-	0.2	4.0×10^{-2}																			
III	0.4	0.4	-																			
IV	-	0.2	2.0×10^{-2}																			
18	<p>a Express clearly what you understand by 'rate expression' and 'rate constant' of a reaction.</p>	5																				
	<p>b Nitrogen pentoxide decomposes according to the equation $2\text{N}_2\text{O}_5(\text{g}) \rightarrow 4\text{NO}_2(\text{g}) + \text{O}_2(\text{g})$ This first order reaction was allowed to proceed at 40°C and the data given below were collected:</p> <table border="1" data-bbox="451 1480 1203 1707"> <thead> <tr> <th>[N₂O₅](M)</th> <th>Time(min)</th> </tr> </thead> <tbody> <tr> <td>0.400</td> <td>0.00</td> </tr> <tr> <td>0.289</td> <td>20.00</td> </tr> <tr> <td>0.209</td> <td>40.00</td> </tr> <tr> <td>0.151</td> <td>60.00</td> </tr> <tr> <td>0.109</td> <td>80.00</td> </tr> </tbody> </table> <p>Calculate the rate constant for the reaction. Include units with your answer. Calculate the initial rate of a reaction. After how many minutes will [N₂O₅] be equal to 0.350M? (Ans: i) $K = 1.6259 \times 10^{-2} \text{ min}^{-1}$, ii) $6.50 \times 10^{-3} \text{ mol L}^{-1} \text{ min}^{-1}$ iii) 8.37 min</p>	[N ₂ O ₅](M)	Time(min)	0.400	0.00	0.289	20.00	0.209	40.00	0.151	60.00	0.109	80.00									
[N ₂ O ₅](M)	Time(min)																					
0.400	0.00																					
0.289	20.00																					
0.209	40.00																					
0.151	60.00																					
0.109	80.00																					

19	<p>Decomposition of phosphine(PH₃) at 120⁰C proceeds according to the equation: $4\text{PH}_3 (\text{g}) \rightarrow \text{P}_4 (\text{g}) + 6\text{H}_2 (\text{g})$ It is found that this reaction follows the following rate equation: Rate = k[PH₃] The half life of PH₃ is 37.9 s at 120⁰C. How much time will be required for ¾ of PH₃ to decompose? What fraction of the original amount of PH₃ will remain undecomposed after 1 minute . (Ans: i) time=75.76 min ii) 33.37%)</p>	5
20	<p>The activation energy of first order reaction at 300K is 60kJmol⁻¹. In the presence of a catalyst, the activation energy gets lowered to 50kJ mol⁻¹ at 300K. How many times the reaction rate changes in the presence of a catalyst at the same temperature? Use $\log K_2/K_1 = E_a - E_a(\text{catalyst}) / 2.303RT$ (Ans: increases by 55.08times)</p>	5
21	<p>a)Illustrate graphically the effect of catalyst on activation energy. b)Catalysts have no effect on the equilibrium constant. Why? c)The decomposition of A into product has value of k as 4.5x 10³ s⁻¹ at 10⁰C and activation energy is 60 kJmol⁻¹.Calculate the temperature at which the value of k be 1.5x10⁴ s⁻¹ (Ans: T = 297K)</p>	5
22	<p>a)For the reaction $\text{C}_{12}\text{H}_{22}\text{O}_{11} + \text{H}_2\text{O} \xrightarrow{\text{H}^+} \text{C}_6\text{H}_{12}\text{O}_6 + \text{C}_6\text{H}_{12}\text{O}_6$ Write: i)Rate of reaction expression ii)Rate law equation, iii)Molecularity and iv) Order of reaction b)The rate of the chemical reaction doubles for an increase of 10K in absolute temperature from 298K. Calculate E_a: (Ans:52.89kJ)</p>	5