INDIAN SCHOOL DARSAIT

DEPARTMENT OF CHEMISTRY

Subject: Chemistry Topic : Chemical Kinetics Date of Worksheet: 5. 12.2018

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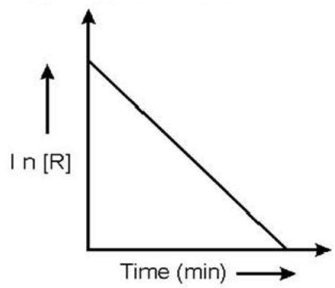
Name of the Student: __________________ Class &Division: XII Roll Number: ___________

1.	Identify the order of the reaction from the following unit for its rate constant: $Lmol^{-1}s^{-1}$	1
2.	For the reaction $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$ If $\Delta[NH_3]/\Delta t = 4x10^{-8}\ molL^{-1}s^{-1}$, what is the value of $-\Delta[H_2]/\Delta t$.? (Ans: $6x10^{-8} molL^{-1}s^{-1}$)	1
3.	Express the relationship between the rate of production of water and the rate of disappearance of oxygen in the following reaction: $2H_2 + O_2 \rightarrow 2H_2O$	1
4.	What is the difference between average rate and instantaneous rate of a chemical reaction?	1
5.	What is a pseudo first order reaction? Give example.	2
6.	Express clearly what you understand by 'rate expression' and 'rate constant' of a reaction.	2
7.	Define: i)Order of a reaction ii)Elementary step in a reaction iii) Activation energy. iv) Elementary reaction in a process v) Rate of a reaction	1
8.	Consider the decomposition of hydrogen peroxide in alkaline medium which is catalysed by iodide ions. $2H_2O_2 \xrightarrow{I^-/OH^-} 2H_2O + O_2$ The reaction takes place in two steps; Step I) $H_2O_2 + I^- \rightarrow H_2O + IO^-$ (slow) Step II) $H_2O_2 + IO^- \rightarrow H_2O + I^- + O_2$ (fast) i)Write the rate law expression and determine the order of reaction w.r.t. H_2O_2 . ii)What is the molecularity of each individual step?	2

9.	A first order reaction is 20% complete in 20 minutes. Calculate the time taken for the reaction to go to 80% completion (Ans: 72.12min)	2
10.	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 x10^{-4}min^{-1})	2
11.	For a chemical reaction variation in concentration, Ln[R] Vs time(min) plot is shown below:  i) What is the order of the reaction? ii) What are the units of rate constant, k for the reaction? iii) Give the relation between k and $t_{1/2}$ iv) What does the slope of the above line indicate? v) Draw the plot of log $[R]_0/[R]$ Vs time(s)	2
12.	Sucrose decomposes in acid solution into glucose and fructose according to the first order rate law with $t_{1/2}$ =3hrs. Calculate the fraction of sucrose which remains after 8hrs. (Ans: 0.158)	2
13.	The decomposition of A into product has value of k as 4.5x 10^3 s^{-1} at 10^0C and activation energy is 60 kJmol^{-1}.Calculate the temperature at which the value of k be 1.5x10^4 s^{-1} (Ans: T = 297K)	2
14.	The rate constant for a zero order reaction is 0.0030 molL^{-1}s^{-1} . How long will it take for the initial concentration of the reactant to fall from 0.10M to 0.075 M ? (Ans: t=8.33 sec)	2
15.	For the reaction $2N_2O_5$ (g) $\longrightarrow$ $4NO_2$ (g) + O_2(g), the rate of formation of NO_2 (g) is 2.8x10^{-3} Ms^{-1}. Calculate the rate of disappearance of N_2O_5(g). (Ans: 1.4x10^{-3}Ms^{-1})	2

16. A reaction is first order in A and second order in B. **3**

i)Write differential rate equation.
ii)How is the rate affected when the concentration of A is tripled?
iii)How is the rate affected when the concentration of both A and B are doubled?

17. A first order reaction has a rate constant value of $0.00510 min^{-1}$. If we begin with 0.10M concentration of the reactant, how much of the reactant will remain after 3.0 hours? **3**

(Ans: 0.0399M)

18. For a decomposition reaction, the values of rate constant k at two different temperatures are given below: **3**

$k_1 = 2.15 \times 10^{-8}\ Lmol^{-1}s^{-1}$ at 650K
$k_2 = 2.39 \times 10^{-7}\ Lmol^{-1}s^{-1}$ at 700K.
Calculate the value of activation energy (E_a) for this reaction. ($R = 8.314\ JK^{-1}mol^{-1}$)
(Ans: $Ea = 182.24\ kJ\ mol^{-1}$.)

19. The following rate data were obtained at 300 K for the reaction $2A + B \rightarrow C + D$. **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}

Calculate the rate of formation of D when [A] = 0.6 mol L^{-1} and [B] = 0.3 mol L^{-1} .

(Ans: $r = 3.78 \times 10^{-1} mol^{-2}L^{2}min^{-1}$)

20. Nitrogen pentoxide decomposes according to the equation **3**

$2N_2O_5(g) \rightarrow 4NO_2(g) + O_2(g)$
This first order reaction was allowed to proceed at 40^0C and the data given below were collected:

$[N_2O_5]$(M)	Time(min)
0.400	0.00
0.289	20.00
0.209	40.00
0.151	60.00
0.109	80.00

i)Calculate the rate constant for the reaction. Include units with your answer.
ii)Calculate the initial rate of a reaction.
iii) What will be the concentration of N_2O_5 after 100 minutes?
iv)After how many minutes will $[N_2O_5]$ be equal to 0.350M?
(Ans: i)$K = 1.6259 \times 10^{-2} min^{-1}$, ii) $6.504 \times 10^{-3}\ molL^{-1}min^{-1}$ iii)0.0787M iv) 8.21 min)

21.	A first order reaction is 50% completed in 40 minutes at 300K and in 20 minutes at 320K. Calculate the activation energy of the reaction. (Ans: Ea = 26.67 KJ/mol)	3
22.	a)Illustrate graphically the effect of catalyst on activation energy. b)Catalysts have no effect on the equilibrium constant. Why?	3
23.	Decomposition of phosphine(PH_3) at 120^0C proceeds according to the equation: $4PH_3$ (g) $\rightarrow$ P_4 (g) + $6H_2$ (g) It is found that this reaction follows the following rate equation: Rate = k[PH_3] The half life of PH_3 is 37.9 s at 120^0C. i)How much time will be required for ¾ of PH_3 to decompose? ii)What fraction of the original amount of PH_3 will remain undecomposed after 1minute . (Ans: i) time=75.76 min ii) 33.37%)	3
24.	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? (Ans: increases by 55.08times)	3
25.	a)For the reaction $C_{12}H_{22}O_{11} + H_2O \xrightarrow{H+} C_6H_{12}O_6 + C_6H_{12}O_6$ Write: i)Rate of reaction expression, ii) Rate law equation, iii)Molecularity iv)Order of reaction b)The following data were obtained during the first order thermal decomposition of SO_2Cl_2 at constant volume. SO_2Cl_2 (g) $\rightarrow$ SO_2 (g) + Cl_2 (g) <table><tr><td>Experiment</td><td>Time (s)</td><td>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 of reaction Ans: (k = 1.386x10^{-2}sec^{-1})	5