Rate law and Rate constant

74. (b) It is an bimolecular and second order reaction.

75. (d) $\frac{dx}{dt} = (HI)^2$, then order of reaction = 2

76. (b) Rate $= K(\text{Sucrose})(H_2O)^o$

77. (b) Because in this reaction one molecule of N_2O_5 is used.

78. (c) Integrated velocity equation for first order reaction is: $k = \frac{2.303}{t} log \frac{(A)_o}{(A)}$

79. **Definition of reaction order:**

- The order of a reaction is determined experimentally and depends on the **rate law** with respect to reactant concentrations.

Effect of surface area:

- Increasing the surface area of a solid reactant **increases the rate of reaction** because more particles are exposed.
- However, the **order of reaction** is a constant value for a given reaction and **does not change** just because the surface area changes.

Conclusion:

- Rate increases with surface area, but **order remains constant**.

Answer: (c) Remain constant

80. (c) $t_{\frac{1}{2}} = \frac{2.303\, log\, 2}{K} = \frac{0.693}{K}$

81. (b) Inversion of sugar is a pseudo-unimolecular reaction.

82. (b) For I[st] order reaction

$$\log(a-x) = \log a - \frac{kt}{2.303}$$

$$y = c + mx$$

83. (c) $t_{\frac{1}{2}} = \frac{0.693}{k} = \frac{0.693}{3.46\times10^{-3}} = 200min$

84. (a) $\frac{1}{Time} \times (conc.) = \frac{molesl^{-1}}{Time} = molesl^{-1}time^{-1}$ for zero order reaction.

85. (a) The order of reaction is $\frac{3}{2}$ and molecularity is 2.

87. (c) Molecularity can never be fractional.

88. (a) As doubling the initial conc. doubles the rate of reaction, order = 1.

89. (c) When *B* is in excess, it becomes a pseudo-unimolecular reaction.

90. (c) $k = \frac{0.693}{t_{\frac{1}{2}}} = \frac{0.693}{69.35} = 9.99 \times 10^{-3} = 0.01s^{-1}$

91. (b) $k = \frac{0.693}{24} hr^{-1} = \frac{2.303}{96} log \frac{10}{a-x}$

or $log \frac{10}{a-x} = 1.2036$ or $1 - \log (a - x) = 1.2036$

or $log(a-x) = -0.2036 = 1.7964$

or $(a-x) = \text{antilog}1.7964 = 0.6258gm$

92. (b) $0.08moll^{-1}$ to $0.01moll^{-1}$ involves 3 half-life. So the t is 30 minutes

93. (c) $t_{\frac{1}{2}}$ of II order reaction is inversely proportional to initial concentration of reactants.

94. (b) As $r = k(H_2O_2)$, it is a reaction of 1st order.

95. The given reaction is:

$RCl + H_2O \longrightarrow ROH + HCl$

Molecularity:

Molecularity is defined as the number of molecules colliding in the *elementary step*.

Here, one molecule of RClRClRCl and one molecule of H2OH_2OH2O are involved.

⇒ **Molecularity = 2**

Order of reaction:

In kinetics, when a reaction is carried out in the presence of a **large excess of water**, the concentration of water remains practically constant.

So, the rate law effectively depends only on [RCl]

Rate=k[RCl]

- ⇒ **Order of reaction = 1**

: **(b) Molecularity is 2, order of reaction is 1**

96. For first order reaction,

$$t_{\frac{1}{2}} = \frac{k}{0.693}$$

$$k = \frac{0.693}{120} = 0.005775\ min^{-1}$$

Time for 90% decomposition:

$$t = \frac{k}{2.303}\ log\frac{[a]}{[a]_0}$$

Here, $[a] = 0.1[a]_0 \Rightarrow \frac{[a]_0}{[a]} = 10$

$t = \{2.303/0.005775\} log 10$

$t = \frac{2.303}{0.005775} \times 1 \approx 399$ minutes$t$