Rate law and Rate constant

119. (a)For first order reactions rate is depend on the concentration of one reactant.

120. (b)Molecularity of a reaction never become zero or fraction.

121. (d) $t = \frac{2.303}{k} log \frac{a}{a-x}$

$t = \frac{2.303}{1.155 \times 10^{-3}} log \frac{100}{100-50} = 600 sec$

122. (b) Rate = $K[A]^{\frac{3}{2}}[B]^{-1}$

$\therefore O.R. = \frac{3}{2} + (-1) = \frac{1}{2}$

123. (d$t_{\frac{1}{2}} \propto (CO)^o$ *i.e.* half life for Ist order is independent of initial concentration.

124. (c)$2NO_{(g)} + Cl_{2(g)} \rightarrow 2NOCl_{(g)}$
Rate = $K[NO]^2[Cl_2]^1, \therefore O.R. = 2 + 1 = 3$

125. (d)$8 \times 10^{-5} = \frac{1}{t}\left[\frac{1}{0.5} - \frac{1}{1}\right]$; $8 \times 10^{-5} = \frac{1}{t}[2-1]$

$t = \frac{1}{8 \times 10^{-5}} = 0.125 \times 10^5 = 1.25 \times 10^4 min.$

126. (b)$r = k$[reactant]$^{-1}$ $\therefore k = \frac{0.693 \times 10^{-2}}{1}$ also $t_{\frac{1}{2}} = \frac{0.693}{k} = \frac{0.693}{0.693 \times 10^{-2}} = 100 min.$

127. (d)$t_{\frac{1}{2}} = \frac{1}{Ka}$ for second order reactions.

128. (d)$k=\frac{2.303}{t}log\left(\frac{a}{a-x}\right)$; $k=\frac{2.303}{30}log\left(\frac{100}{100-75}\right)$

$k=\frac{2.303}{t}log\left(\frac{100}{100-93.75}\right)$ Put the value of K from above equation we get the value of t therefore $\therefore \quad t=60min$.

129. (b)$k=\frac{0.693}{45}min^{-1}=\frac{2.303}{t_{99.9\%}}log\frac{a}{a-0.999a}$ or

$t_{99.9\%}=\frac{2.303\times45}{0.693}log\,10^3=448\,min\approx7.5hrs$

130. (a) Given A(a) = 2.00 *m*, t = 200 *min* and a(a-x) = 0.15 *m* we know

$k=\frac{2.303}{t}log\frac{a}{a-x}=\frac{2.303}{200}log\frac{2.00}{0.15}$

$=\frac{2.303}{200}\times(0.301+0.824)=1.29\times10^{-2}\,min^{-1}$

131. (a,c) The unit for zero order reaction is $mollitre^{-1}time^{-1}$

132. (c) It is a third order reaction because

Rate = $K[\text{NO}]^2[O_2]^1$ $\therefore O.R.=2+1=3$

133. (d) Order of a reaction is decided by relative concentration of reactants.

134. (c) Unit of rate constant for second order reaction is $mol^{-1}litretime^{-1}$

135. (a)$R=K[A]^2[B]$ order of reaction $=2+1=3$

136. (a) Units of 1st rate constant order reaction are $sec^{-1}$and for zero order reaction, these are $mollitre^{-1}sec^{-1}$ i.e. $Msec^{-1}$.

137. (c) This reaction is bimolecular and first order of reaction.

138. (c) $t_{\frac{1}{2}} = \frac{0.693}{k}$ Given $t_{\frac{1}{2}} = 693sec$

$693 = \frac{0.693}{k}$, $k = \frac{693\times10^{-3}}{693}$; $k = 10^{-3} = 0.001\,sec^{-1}$.

139. (d) $2A + B \rightarrow C + B$

Rate = $k[A]^2[B]^1$

$\therefore O.R. = 2 + 1 = 3$ and molecularity is $3[2A + B]$.

140. (c) In photochemical reactions the rate of reaction is independent of the concentration of reacting species.

141. (c) We know that $k = \frac{2.303}{t} log\frac{a}{a-x}$ $10^{-3} = \frac{2.303}{t} log\frac{a}{\left(a-\frac{2a}{3}\right)}, 10^{-3} = \frac{2.303}{t} log\,3$

$10^{-3} = \frac{2.303}{t} \times 0.4771, t = \frac{2.303\times0.4771}{10^{-3}} = 3300sec$

142. (c) $R = K(A)^2, R' = K(2A)^2, \therefore \frac{R'}{R} = 4$

$R = K(A)^2, R' = K(3A)^2, \frac{R'}{R} = 9$

143. **Order of reaction:**

- Can be integer or fractional (e.g., 0.5, 1.5 in complex reactions).

Half-life ($t_{1/2}$):

- Can take any positive value, depends on rate constant and order.

Molecularity:

- Defined as the **number of reacting species in an elementary step**.
- Always a **whole number** (1, 2, 3).

- **Cannot be a fraction.**

Rate constant (k):

- Can have any positive value depending on units and reaction.

Conclusion / Answer: (c) Molecularity