

SOLUTION TEST-B

1. For first order reaction, $t_{3/4} = 2t_{1/2}$, $y = 2x$,

The correct answer is (iv)

2. $r = k [A] [B_2]$... (i) using reaction (a), we can write $k = \frac{[A]^2}{[A_2]}$

$$r = k K^{1/2} [A]^{1/2} [B_2] \quad \text{or } [A] = k^{1/2} [A_2]^{1/2}$$

$$r = k' [A_2]^{1/2} [B_2] \quad \text{put value of } [A] \text{ is equation (i) gives.}$$

$$\text{overall order} = \frac{1}{2} + 1 = 1.5$$

3. For first order reaction $\log \frac{[R]_0}{[R]} = \frac{k t}{2.303}$ or $\log \frac{[R]}{[R]_0} = -k \frac{t}{2.303}$

$$\log \frac{[R]}{[R]_0} \text{ versus } t \text{ is a straight line with slope} = \frac{-k}{2.303}$$

$$\frac{-k}{2.303} = -2.0 \times 10^{-2} \quad k = 2.0 \times 2.303 \times 10^{-2} = 4.606 \times 10^{-2} \text{ s}^{-1}$$

The answer is (ii)

4. **The answer is (iv)**

5. Both assertion and reason are correct.

Catalyst catalyse only those reactions which are actually taking place ($\Delta G < 0$) and catalyst provides an alternative path for the reaction with a lower energy of activation. The reason is not the correct explanation of assertion.

The correct answer is (ii)

6. Examples of pseudo first order reaction are:

- (i) Hydrolysis of an ester.
(ii) Inversion of cane sugar.

7. Zero order

$$8. \quad t = \frac{2.303}{k} \log \frac{[R]_0}{[R]}$$

$$t = \frac{2.303}{1.36 \times 10^{-3}} \log \frac{0.5}{0.3}$$

$$t = \frac{2.303}{1.36 \times 10^{-3}} [0.699 - 0.477]$$

$$t = \frac{2.303 \times 0.222}{1.36 \times 10^{-3}} = 375.93 \text{ s}$$

9. 49 years is equal to nearly four half-lives. The fraction of tritium left in a sample is

$$\frac{[N]_o}{[N]} = \left(\frac{1}{2}\right)^4 = \frac{1}{16} = 0.063$$

$\frac{1}{16}$ th of tritium left at the end of 49 years.

OR

Second solution is

$$\log \frac{N_o}{N} = \frac{kt}{2.303} = \frac{0.693}{12.3} \times \frac{49}{2.303}$$

$$\log \frac{N_o}{N} = 1.199$$

$$\frac{N_o}{N} = 15.8$$

Fraction of tritium left at the end of 49 years is $\frac{N_o}{N} = \frac{1}{15.8} = 0.0633$

10. $R \rightarrow P$

$$-\frac{d[R]}{dt} = k[R]$$

$$\int_{[R]_o}^{[R]} \frac{1}{[R]} d[R] = -k \int_{t=0}^{t=t} dt$$

$$\ln[R] - \ln[R]_o = -kt$$

$$\ln \frac{[R]}{[R]_o} = -kt$$

taking antilog gives $\frac{[R]}{[R]_o} = e^{-kt}$

$$[R] = [R]_o e^{-kt}$$

The concentration of the reactant decreases exponentially with time.

11. $\log k(s^{-1}) = 14.301 - \frac{14000}{T} K$

comparing it with $\log k = \log A - \frac{E_a}{2.303} \cdot \frac{1}{T}$

gives $\log A = 14.301$

$A = \text{antilog}(14.301) = 2.0 \times 10^{14} s^{-1}$ and $\frac{E_a}{2.303R} \cdot \frac{1}{T} = \frac{14000}{T} K$

$E_a = 14000 K \times 2.303 \times 8.314 J mol^{-1} K^{-1}$

$E_a = 268060 J/mol$

12. (i) order of the reaction = $\frac{3}{2}$

(ii) rate = bar. s⁻¹

rate constant = (bar)^{1-(3/2)}s⁻¹

rate constant = bar^{-1/2}s⁻¹

13. Let $r = k[R]^x$... (i)

$1.02 \times 10^{-3} = k(0.02)^x$... (ii)

$8.16 \times 10^{-3} = k(0.04)^x$... (iii)

equation (iii) ÷ eqn.(ii) gives $8 = 2^x = 2^3$

∴ $x = 3$

(i) order of the reaction = 3

(ii) $k = (\text{conc})^{1-n} \text{time}^{-1}$

$k = (\text{mol L}^{-1})^{1-3} \text{s}^{-1}$

$k = \text{mol}^{-2} \text{L}^2 \text{s}^{-1}$

(iii) No change

14. (i) **Energy of activation** is defined as the minimum energy required by the reactant molecules over and above the energy possessed by the reactant molecules to cross the energy of activation barrier. It is the energy difference between the activated complex and the reactant molecules.

(ii) **Orientation barrier:** It refers to the orientation of molecules which collide and facilitate the breaking of bonds between the reacting species and formation of new bonds to form products.

(iii) **Effect of catalyst:** The presence of catalyst lower the energy of activation barrier by providing an alternate path for the reaction. Catalyst increases the rate of chemical reaction.

15. (a) $[R]_0 = 0.68 \text{ M}$

$[R] = 0.35 \text{ M}$

for zero order reaction $t = \frac{[R]_0 - [R]}{k}$

$t = \frac{0.68 - 0.35}{7.5 \times 10^{-2}}$ $t = 4.4 \text{ s}$

Half-life $t_{1/2} = \frac{[R]_0}{2k}$

$t_{1/2} = \frac{0.68}{2 \times 7.5 \times 10^{-2}}$ $t_{1/2} = 4.53 \text{ s}$

(b) **Elementary step:**

The reactions taking place in one step are called elementary reactions and the step is called elementary step.

Rate determining step: The slowest step in the reaction which control the overall rate of reaction is called rate determining step.

