TEST-B

SOLVED

Time: 1 hr. **Max. Marks: 30**

SECTION-A

Tick the correct option:

1. A first order reaction is half complete is x minutes and three-fourth complete in y minutes. The x and y are related by **[1]**

   (i) x= y (ii) x = 2y (iii) $x = y^2$ (iv) y = 2x

2. For the reaction $A_2 + B_2 \rightarrow 2AB$, the following mechanism is given: **[1]**

   (a) $A_2 \rightleftharpoons A + A$ (fast)

   (b) $A + B_2 \rightarrow AB + B$ (slow)

   (c) $A + B \rightarrow AB$ (fast)

   The overall order of reaction is

   (a) 0 (ii) 0.5 (iii) 1 (iv) 1.5

3. A graph between log $\frac{[R]}{[R]_o}$ versus time (t) is a straight line with slope equal to $-2.0/10^{-2}$ s^{-1}.

   The value of the rate constant is **[1]**

   (i) $1.15 \times 10^{+2}$ s^{-1} (ii) 4.606×10^{-2} s^{-1} (iii) 2.0×10^{-2} s^{-1} (iv) 8.68×10^{-3} s^{-1}

Assertion-Reason type Questions:

(i) If assertion and reason both are correct and reason is the correct explanation of assertion.

(ii) If assertion and reason both are correct and reason is not the correct explanation of assertion.

(iii) If assertion is correct and reason is wrong.

(iv) If assertion is wrong and reason is correct.

4. Assertion: In the equation, rate = $PZ_{AB}\, e^{-Ea/RT}$, the probability factor, P takes into account the fact that in a collision, molecules must be properly oriented in order to have an effective collision. **[1]**

   Reason: Rate of chemical reaction is determined by both energy of activation and probability factor.

5. Assertion: Catalyst catalyses only spontaneous reactions. **[1]**

   Reason: Catalyst provides an alternate pathway by reducing the activation energy between reactants and products.

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One word /One Sentence type Questions.

6. Give one example of a Pseudo first order reaction. **[1]**

7. For which order reaction, the rate and the rate constant have the same units. **[1]**

SECTION-B

8. How much time will it take to reduce the concentration of the reactant from 0.5 M to 0.3M?

   Given: $k = 1.36 \times 10^{-3}\ s^{-1}$. **[2]**

9. The half life of the tritium is 12.3 y. Calculate the fraction of the tritium left in a sample of water at the end of 49 y. **[2]**

10. Prove that the concentration of the reactant decreases exponentially with time for first order reaction.

11. The decomposition of a hydrocarbon is a first order reaction and the variation of rate constant k, with temperature T is expressed as **[3]**

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

   Calculate the Arrhenius parameters ($R = 8.314\ J\ mol^{-1}\ K^{-1}$)

12. For the reaction $CH_3CHO_{(g)} \rightarrow CO(g) + CH_{4(g)}$ **[3]**

   the rate equation is $\frac{-dP_{CH_3CHO}}{dt} = k\,p^{3/2}_{CH_3CHO}$

   (i) What is the order of the reaction?

   (ii) What are the units of the rate and the rate constants if pressure is in bar and time in seconds?

13. The rate of reaction increases from 1.02×10^{-3} mol $L^{-1}\ s^{-1}$ to 8.16×10^{-3} mol $L^{-1}\ s^{-1}$ when the concentration of reactant is increased from 0.02 M to 0.04 M. **[3]**

   (i) What is the order of the reaction?

   (ii) Calculate the units of k for this reaction.

   (iii) What is the effect of increasing temperature on the order of the reaction?

14. Explain the following terms: **[3]**

   (i) Energy of activation

   (ii) Orientation barrier

   (iii) Effect of catalyst

15. (a) For a zero order reaction, the rate constant is 7.5×10^{-2} mol $L^{-1}\ s^{-1}$. Calculate the time when the concentration is reduced to 0.35 M from 0.68 M. **[3+2]**

   Also, calculate the half-life of the reaction.

   (b) What do you understand by the elementary step and rate-determining step of the reaction.

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