DPP - Daily Practice Problems

Name : ____________________ Date : __________

Start Time : __________ End Time : __________

CHEMISTRY 35

SYLLABUS : Chemical Kinetics -I : Rate of a Reaction, Rate law & Rate constant

Max. Marks : 120 **Time : 60 min.**

GENERAL INSTRUCTIONS

- The Daily Practice Problem Sheet contains 30 MCQ's. For each question only one option is correct. Darken the correct circle/ bubble in the Response Grid provided on each page.
- You have to evaluate your Response Grids youself with the help of solution booklet.
- Each correct answer will get you 4 marks and 1 mark shall be deduced for each incorrect answer. No mark will be given/ deducted if no bubble is filled. Keep a timer in front of you and stop immediately at the end of 60 min.
- The sheet follows a particular syllabus. Do not attempt the sheet before you have completed your preparation for that syllabus. Refer syllabus sheet in the starting of the book for the syllabus of all the DPP sheets.
- After completing the sheet check your answers with the solution booklet and complete the Result Grid. Finally spend time to analyse your performance and revise the areas which emerge out as weak in your evaluation.

DIRECTIONS (Q.1-Q.21) : There are 21 multiple choice questions. Each question has 4 choices (a), (b), (c) and (d), out of which ONLY ONE choice is correct.

Q.1 The rate law for the reaction RCl + NaOH(aq) $\rightarrow$ ROH + NaCl is given by rate = K_1[RCl]. The rate of the reaction will be

(a) doubled on doubling the concentration of sodium hydroxide

(b) halved on reducing the concentration of alkyl halide to one half

(c) decreased on increasing the temperature of the reaction

(d) unaffected by increasing the temperature of the reaction

Q.2 If doubling the concentration of a reactant 'A' increases the rate 4 times and tripling the concentration of 'A' increases the rate 9 times the rate is proportional to

(a) concentration of 'A'

(b) square root of the concentration of 'A'

(c) under root of the concentration of 'A'

(d) cube of concentration of 'A'

Q.3 For the reaction $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$ under certain conditions of temperature and partial pressure of the reactants, the rate of formation of NH_3 is $0.001 kg h^{-1}$. The rate of conversion of H_2 under the same conditions is

(a) 1.82×10^{-4} kg / hr (b) 0.0015 kg / hr

(c) 1.52×10^{4} kg / hr (d) 1.82×10^{-14} kg / hr

RESPONSE GRID	1. ⓐⓑⓒⓓ	2. ⓐⓑⓒⓓ	3. ⓐⓑⓒⓓ

Space for Rough Work

Get More Learning Materials Here : CLICK HERE www.studentbro.in

EBD_7157

Q.4 For a given reaction $3A + B \rightarrow C + D$ the rate of reaction can be represented by

(a) $-\frac{1}{3}\frac{d[A]}{dt} = -\frac{d[B]}{dt} = +\frac{d[C]}{dt} = +\frac{d[D]}{dt}$

(b) $-\frac{1}{3}\frac{d[A]}{dt} = \frac{d[C]}{dt} = K[A]^m[B]^n$

(c) $+\frac{1}{3}\frac{d[A]}{dt} = -\frac{d[C]}{dt}\ K[A]^n[B]^m$

(d) None of these

Q.5 For the reaction $N_2 + 3H_2 \rightarrow 2NH_3$

if $\frac{\Delta[NH_3]}{\Delta t} = 2 \times 10^{-4}$ mol $l^{-1}s^{-1}$, then value of $\frac{\Delta[H_2]}{\Delta t}$ would be

(a) 1×10^{-4} mol $L^{-1}s^{-1}$ (b) 3×10^{-4} mol $L^{-1}s^{-1}$
(c) 4×10^{-4} mol $L^{-1}s^{-1}$ (d) 6×10^{-4} mol $L^{-1}s^{-1}$

Q.6 A gaseous hypothetical chemical equation $2A \rightarrow 4B + C$ is carried out in a closed vessel. The concentration of B is found to increase by 5×10^{-3} mol l^{-1} in 10 second. The rate of appearance of B is

(a) 5×10^{-4} mol $L^{-1}sec^{-1}$ (b) 5×10^{-5} mol $L^{-1}sec^{-1}$
(c) 6×10^{-5} mol $L^{-1}sec^{-1}$ (d) 4×10^{-4} mol $L^{-1}sec^{-1}$

Q.7 The rate of disappearance of SO_2 in the reaction $2SO_2 + O_2 \rightarrow 2SO_3$ is 1.28×10^{-3} g/sec then the rate of formation of SO_3 is

(a) 0.64×10^{-3} g / sec (b) 0.80×10^{-3} g / sec
(c) 1.28×10^{-3} g / sec (d) 1.60×10^{-3} g / sec

Q.8 The velocity of the chemical reaction doubles every 10°C rise of temperature. If the temperature is raised by 50°C, the velocity of the reaction increases to about

(a) 32 times (b) 16 times
(c) 20 times (d) 50 times

Q.9 The temperature coefficient for reaction in which food deteriorates is 2. Then food deteriorates ..... times as rapidly at 25° C as it does at 5°C

(a) Two (b) Four (c) Six (d) Twenty

Q.10 The main function of a catalyst in speeding up a reaction is

(a) To increase the rate of the forward reaction
(b) To change the reaction path so as to decrease the energy of activation for the reaction
(c) To reduce the temperature at which the reaction can occur
(d) To increase the energy of the molecules of the reactants

Q.11 For the reaction $2N_2O_5(g) \rightarrow 4NO_2(g) + O_2(g)$, if concentration of NO_2 in 100 seconds is increased by 5.2×10^{-3}M. Then rate of reaction will be

(a) 1.3×10^{-5} Ms^{-1} (b) 5×10^{-4} Ms^{-1}
(c) 7.6×10^{-4} Ms^{-1} (d) 2×10^{-3} Ms^{-1}

Q.12 In the reaction $2N_2O_5 \rightarrow 4NO_2 + O_2$, initial pressure is 500 atm and rate constant K is 3.38×10^{-5} sec^{-1}. After 10 minutes the final pressure of N_2O_5 is

(a) 490 atm (b) 250 atm (c) 480 atm (d) 420 atm

Q.13 The reaction $2NO(g) + O_2(g) \rightarrow 2NO_2(g)$ is of first order. If volume of reaction vessel is reduced to 1/3, the rate of reaction would be

(a) 1/3 times (b) 2/3 times
(c) 3 times (d) 6 times

Q.14 For a reaction $2A + B \rightarrow$ Products, doubling the initial concentration of both the reactants increases the rate by a factor of 8, and doubling the concentration of B alone doubles the rate. The rate law for the reaction is

(a) $r = k[A][B]^2$ (b) $r = k[A]^2[B]$
(c) $r = k[A][B]$ (d) $r = k[A]^2[B]^2$

Q.15 For a reactions $A + B \rightarrow$ product, it was found that rate of reaction increases four times if concentration of 'A' is doubled, but the rate of reaction remains unaffected, if concentration of 'B' is doubled. Hence, the rate law for the reaction is

(a) rate $= k[A][B]$ (b) rate $= k[A]^2$
(c) rate $= k[A]^2[B]^1$ (d) rate $= k[A]^2[B]^2$

Q.16 The rate constant of a reaction depends on

(a) temperature (b) mass
(c) weight (d) time

Q.17 In a first order reaction the concentration of reactant decreases from 800 mol/ dm^3 to 50 mol / dm^3 in 2×10^2 sec. The rate constant of reaction in sec^{-1} is

(a) 2×10^4 (b) 3.45×10^{-5}
(c) 1.386×10^{-2} (d) 2×10^{-4}

RESPONSE GRID					
	4. ⓐⓑⓒⓓ	5. ⓐⓑⓒⓓ	6. ⓐⓑⓒⓓ	7. ⓐⓑⓒⓓ	8. ⓐⓑⓒⓓ
	9. ⓐⓑⓒⓓ	10. ⓐⓑⓒⓓ	11. ⓐⓑⓒⓓ	12. ⓐⓑⓒⓓ	13. ⓐⓑⓒⓓ
	14. ⓐⓑⓒⓓ	15. ⓐⓑⓒⓓ	16. ⓐⓑⓒⓓ	17. ⓐⓑⓒⓓ	

Space for Rough Work

Get More Learning Materials Here : CLICK HERE www.studentbro.in

Q.18 The reaction

N_2O_5 (in CCl_4 solution) $\rightarrow 2NO_2$ (solution) $+ \frac{1}{2}O_2(g)$ is of first order in N_2O_5 with rate constant $6.2 \times 10^{-1} s^{-1}$. What is the value of rate of reaction when $[N_2O_5] = 1.25$ mole^{-1}

(a) 7.75×10^{-1} mol $L^{-1}s^{-1}$ (b) 6.35×10^{-1} mol $L^{-1}s^{-1}$

(c) 5.15×10^{-5} mol $L^{-1}s^{-1}$ (d) 3.85×10^{-1} mol $L^{-1}s^{-1}$

Q.19 A reaction that is of the first order with respect to reactant A has a rate constant 6 min^{-1}. If we start with $[A] = 0.5$mol l^{-1}, when would $[A]$ reach the value 0.05 mol l^{-1}

(a) 0.384 min (b) 0.15 min

(c) 3 min (d) 3.84 min

Q.20 The rate law of the reaction $2N_2O_5 \rightarrow 4NO_2 + O_2$ is

(a) $r = K[N_2O_5]$ (b) $r = K[N_2O_5]^2$

(c) $r = K[N_2O_5]^0$ (d) $r = K[NO_2]^4[O_2]$

Q.21 An example of a pseudo – unimolecular reaction is

(a) Dissociation of hydrogen iodide

(b) Hydrolysis of methyl acetate in dilute solution

(c) Dissociation of phosphorus pentachloride

(d) Decomposition of hydrogen peroxide

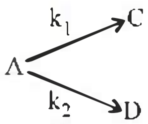
DIRECTIONS (Q.22-Q.24) : In the following questions, more than one of the answers given are correct. Select the correct answers and mark it according to the following codes:

Codes :

(a) 1, 2 and 3 are correct **(b)** 1 and 2 are correct

(c) 2 and 4 are correct **(d)** 1 and 3 are correct

Q.22 Consider the following case of completing 1st order reactions.



After the start of the reaction at t = 0 with only A, the [C] is equal to the [D] at all times. The time in which all three concentrations will be equal is given by–

(1) $t = \frac{1}{2k_1} \ln 3$ (2) $t = \frac{1}{2k_2} \ln 3$

(3) $t = \frac{1}{3k_1} \ln 2$ (4) $t = \frac{1}{3k_2} \ln 2$

Q.23 Which of the following statements regarding the molecularity of a reaction are correct?

(1) It is the number of molecules of the reactants taking part in a single step chemical reaction

(2) It is calculated from reaction mechanism

(3) It depends on the rate determining step in the reaction

(4) It always whole number.

Q.24 For the reaction $A \rightarrow B$, the rate law expression is : Rate = k [A]

Which of the following statements are correct?

(1) The reaction is said to follow first order kinetics

(2) The rate law provides a simple way of predicting the concentration of reactants and products at any time after the start of the reaction

(3) k is constant for the reaction at a constant temperature

(4) The half life of the reaction will depend on the initial concentration of the reactant

DIRECTIONS (Q.25-Q.27) : Read the passage given below and answer the questions that follows :

The reaction $S_2O_8^{2-} + 3I^- \rightarrow 2SO_4^{2-} + I_3^-$ is of first order both with respect to the persulphate and iodide ions. Taking the initial concentration as 'a' and 'b' respectively and taking x as the concentration of the triodide at time t, a differential rate equation can be written.

Two suggested mechanisms for the reaction are :

(I) $S_2O_8^{2-} + I^- \longrightarrow SO_4I^- + SO_4^{2-}$ (fast)

$I^- + SO_4I^- \xrightarrow{k_1} I_2 + SO_4^{2-}$ (slow)

$I^- + I_2 \xrightarrow{k_2} I_3^-$ (fast)

(II) $S_2O_8^{2-} + I^- \xrightarrow{k_1} S_2O_8I^{3-}$ (slow)

$S_2O_8I^{3-} \xrightarrow{k_2} 2SO_4^{2-} + I^+$ (fast)

$I^+ + I^- \xrightarrow{k_3} I_2$ (fast)

$I_2 + I^- \xrightarrow{k_4} I_3^-$ (fast)

RESPONSE GRID					
	18. ⓐⓑⓒⓓ	19. ⓐⓑⓒⓓ	20. ⓐⓑⓒⓓ	21. ⓐⓑⓒⓓ	22. ⓐⓑⓒⓓ
	23. ⓐⓑⓒⓓ	24. ⓐⓑⓒⓓ			

Space for Rough Work

Get More Learning Materials Here : CLICK HERE www.studentbro.in

Q.25 The general differential equation for the above reaction is

(a) $\frac{dx}{dt} = k[a-x][b-3x]\ (k>0)$

(b) $\frac{dx}{dt} = -k[a-x][b-3x](k>0)$

(c) $\frac{dx}{dt} = k[a-x][b-x](k>0)$

(d) $\frac{dx}{dt} = -k[a-x][b-x](k>0)$

Q.26 How could the progress of this reaction be best monitored?

(a) By monitoring the colour of the reaction mixture
(b) By titration of I_3^- with hypo
(c) By precipitation of I^- with Ag^+
(d) By monitoring the change in pressure

Q.27 Which mechanism is consistent with the facts given about the reaction rate equation –

(a) Mechanism (I)
(b) Mechanism (II)
(c) Both (I) and (II)
(d) Neither (I) nor (II)

DIRECTIONS (Q.28-Q.30) : Each of these questions contains two statements: Statement-1 (Assertion) and Statement-2 (Reason). Each of these questions has four alternative choices, only one of which is the correct answer. You have to select the correct choice.

(a) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
(b) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1.
(c) Statement -1 is False, Statement-2 is True.
(d) Statement -1 is True, Statement-2 is False.

Q.28 Statement -1 : Molecularity has no meaning for a complex reaction.

Statement -2 : The overall molecularity of a complex reaction is equal to the molecularity of the slowest step.

Q.29 Statement -1 : The rate of reaction is always negative.

Statement - 2: Minus sign used in expressing the rate shows that concentration of reactant is decreasing.

Q.30 Statement -1 : The kinetic of the reaction mA + nB + pC $\rightarrow$ m'X + n'Y + p'Z obeys the rate expression as $\frac{dx}{dt} = k[A]^m[B]^n$.

Statement -2 : The rate of the reaction does not depend upon the concentration of C.

RESPONSE GRID	
	25.ⓐⓑⓒⓓ 26.ⓐⓑⓒⓓ 27.ⓐⓑⓒⓓ 28.ⓐⓑⓒⓓ 29. ⓐⓑⓒⓓ
	30.ⓐⓑⓒⓓ

DAILY PRACTICE PROBLEM SHEET 35 - CHEMISTRY			
Total Questions	30	Total Marks	120
Attempted		Correct	
Incorrect		Net Score	
Cut-off Score	36	Qualifying Score	56
Success Gap = Net Score – Qualifying Score			
Net Score = (Correct × 4) – (Incorrect × 1)			

Space for Rough Work

Get More Learning Materials Here : CLICK HERE www.studentbro.in

DAILY PRACTICE PROBLEMS
CHEMISTRY SOLUTIONS 35

1. (b) R = K[RCl], if [RCl] = 1/2, then rate = R/2.

2. (b) $2^2 = 4, 3^2 = 9$

3. (b) $\frac{-dN_2}{dt} = -\frac{-1}{3}\frac{dH_2}{dt} = \frac{1}{2}\frac{dNH_3}{dt}$

$= \frac{dH_2}{dt} = \frac{3}{2} \times 0.001 = 0.0015 \text{kg hr}^{-1}$.

4. (a) $-\frac{1}{3}\frac{d[A]}{dt} = -\frac{d[B]}{dt} = \frac{+d[C]}{dt} = \frac{+d(D)}{dt}$

5. (b) $N_2 + 3H_2 \rightarrow 2NH_3$

$\frac{-\Delta[N_2]}{\Delta t} = -\frac{1}{3}\frac{\Delta[H_2]}{\Delta t} = \frac{1}{2}\frac{\Delta[NH_3]}{\Delta t}$

$\therefore \frac{\Delta[H_2]}{\Delta t} = \frac{3}{2} \times \frac{\Delta[NH_3]}{\Delta t} = \frac{3}{2} \times 2 \times 10^{-4}$

$= 3 \times 10^{-4}$ mol litre^{-1} sec^{-1}

6. (a) Increase in concentration of B = 5×10^{-3} molL^{-1}

Time = 10 sec

Rate of appearance of B

$= \frac{\text{Increase in concentration of B}}{\text{Time taken}}$

$= \frac{5 \times 10^{-3} \text{ mol} L^{-1}}{10 \text{sec}} = 5 \times 10^{-4}$ mol L^{-1} Sec^{-1}

7. (c) The rate of formation of SO_3 is 1.28×10^{-3} g/sec.

8. (a) $\frac{K_t + 10}{K_t} = \frac{r_t + 10}{r_t} = 2$; For an increase of temperature to 50°C, i.e. 5 times, the rate increases by 2^5 times. i.e., 32 times.

9. (b) $\frac{K_t + 10}{K_t} = \frac{r_t + 10}{r_t} = 2$.

For an increase of temperature to 20°C i.e. 2 times, the rate increase by 2 times, i.e. 4 times.

10. (b) Catalyst decrease energy of activation.

11. (a) $2N_2O_5(g) \rightarrow 4NO_2(g) + O_2(g)$

Rate of reaction with respect to NO_2

$= \frac{1}{4}\frac{d[NO_2]}{dt} = \frac{1}{4} \times \frac{5.2 \times 10^{-3}}{100} = 1.3 \times 10^{-5}$ Ms^{-1}

12. (a) $p_0 = 500$ atm

$K = \frac{2.303}{t}\log_{10}\frac{p_0}{p_t} = 3.38 \times 10^{-5}$

$= \frac{2.3030}{10 \times 60}\log\frac{500}{p_t}$ or 0.00880

$= \log\frac{500}{p_t} \Rightarrow \frac{500}{1.02} = 490 \text{atm} = p_t$

13. (c) For following reaction, $2NO(g) + O_2(g) \rightarrow 2NO_2(g)$

When the volume of vessel is reduced to $\frac{1}{3}$ then concentration of reactant becomes three times.

The rate of reaction for first order reaction $\propto$ concentration. So rate of reaction will increase three times.

14. (b) 2A + B → Products

According to question : Rate of reaction of 'A' $\propto$ [B] as increase in rate is double when [B] is doubled. Further rate of reaction $\propto$ [A] [B] as increase in rate is 8 times when concentration of both reactant is doubled. It means that order of reaction is 3 and overall rate reaction should be $r = K[A]^2[B]$

15. (b) Let the rate of reaction depends on x^{th} power of [A]. Then

$r_1 = K[A]^x$ and $r_2 = K[2A]^x$

$\therefore \frac{r_1}{r_2} = \frac{[A]^x}{[2A]^x} = \frac{1}{4} = \left(\frac{1}{2}\right)^x \quad (\because r_2 = 4r_1)$

or

$\left(\frac{1}{2}\right)^2 = \left(\frac{1}{2}\right)^x$

$\therefore$ x = 2. As the reaction rate does not depend upon the concentration of B. Hence, the correct rate law will be rate = $K[A]^2[B]^0$ or $= K[A]^2$

16. (a) $K = Ae^{-E_a/RT}$ by this equation it is clear that rate constant of a reaction depends on temperature

17. (c) $K = \frac{2.303}{t}\log_{10}\frac{a}{a-x}$; $t = 2 \times 10^2$, a = 800, a – x = 50

$K = \frac{2.303}{2 \times 10^2}\log_{10}\frac{800}{50} = \frac{2.303}{2 \times 10^2}\log_{10}16$

$= \frac{2.303}{2 \times 10^2}\log_{10}2^4 = \frac{2.303}{2 \times 10^2} \times 4 \times 0.301$

$= 1.38 \times 10^{-2}$ s^{-1}

18. (a) Rate = $K(N_2O_5) = 6.2 \times 10^{-1} \times 1.25$

$= 7.75 \times 10^{-1}$ mol $L^{-1}s^{-1}$

19. (a) We know that for first order kinetics

$k = \frac{2.303}{t}\log\frac{a}{a-x}$, $(a - x) = 0.05$ moll^{-1},

$6 = \frac{2.3030}{t}\log\frac{0.5}{0.05}$

or $t = \frac{2.303}{6}\log\frac{0.5}{0.05} = \frac{2.303}{6} = 0.384$ min

Get More Learning Materials Here : CLICK HERE www.studentbro.in

20. **(a)** Rate law for the reaction
$2N_2O_5 \rightarrow 4NO_2 + O_2$ is
$r = k[N_2O_5]$ first order reaction.

21. **(b)** $CH_3COOCH_3 + H_2O \xrightarrow{H^+} CH_3COOH + CH_3OH$
It is a pseudo-unimolecular reaction.

22. **(b)** $k_1 = k_2 \Rightarrow \frac{2}{3}$ rd of A has reacted for $[A] = [C] = [D]$

$$\therefore\ k_1 + k_2 = \frac{1}{t}\ln\frac{[A]_0}{\frac{1}{3}[A]_0}$$

$$\Rightarrow\ t = \frac{1}{k_1 + k_2}\ln 3 = \frac{1}{2k_1}\ln 3 = \frac{1}{2k_2}\ln 3$$

23. **(a)** Molecularity can never be fractional. Complex reactions, proceed in more than one step. In each step, only a very limited number of reactions are involved. In the complex reactions only the steps have the molecularity. The reaction, as a whole has no molecularity.

24. **(a)** For Ist order reaction half life is independent of concentration.

25. **(a)** When x moles of I_3^- form per litre then decrease in concentrations of the reactants are x and 3x.

26. **(b)** $I_2 + 2S_2O_3^{2-} \rightarrow 2I^- + S_4O_6^{2-}$.

27. **(b)** Rate is determined by the slow step of the mechanism.

28. **(b)** Molecularity of a reaction can be defined only for an elementary reaction because complex reaction does not take place in one single step and it is almost impossible for all the total molecules of the reactants to be in a state of encounter simultaneously.

29. **(c)** The rate of reaction is never negative. Minus sign used in expressing the rate only shows that the concentration of the reactant is decreasing.

30. **(a)** Rate expression $\frac{dx}{dt} = K[A]^m[B]^n$, shows that the total order of reaction is m + n + 0 = m + n as the rate of reaction is independent of concentration of C, i.e. the order with respect to C is zero. This is the reason that C does not figure in the rate expression.

Get More Learning Materials Here : CLICK HERE www.studentbro.in