

FINAL JEE(Advanced) EXAMINATION – 2023

(Held On Sunday 04th June, 2023)

PAPER-1

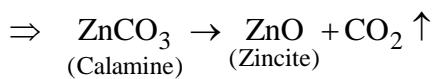
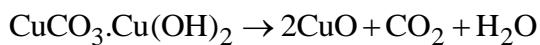
SOLUTION

CHEMISTRY

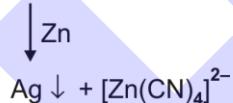
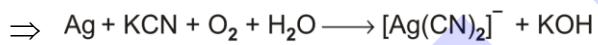
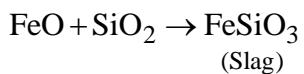
SECTION-1

1. Ans. (B,C,D)

Sol. \Rightarrow Under roasting condition, the malachite will be converted into

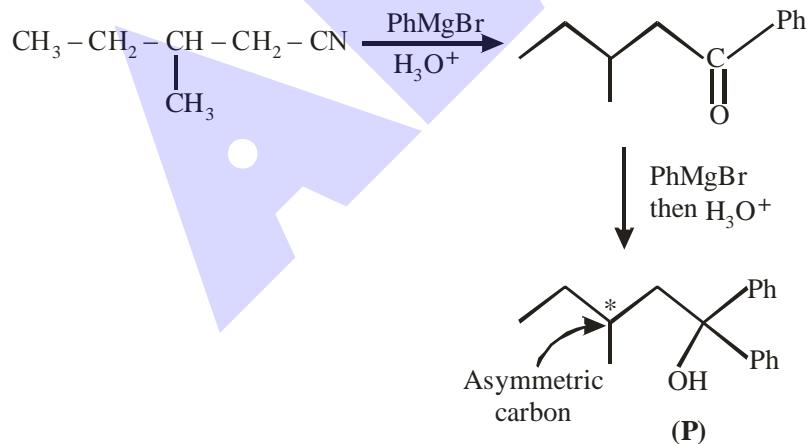


⇒ Copper pyrites is heated in a reverberatory furnace after mixing with silica. In the furnace, iron oxide 'slag' of as iron silicate and copper is produced in the form of copper matte.

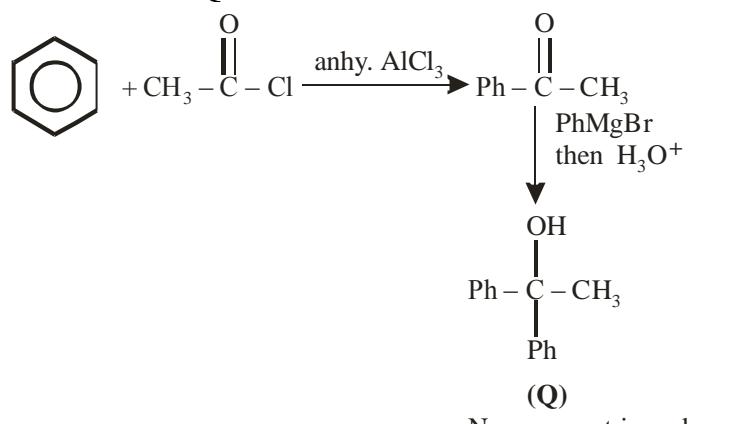


2. Ans. (C,D)

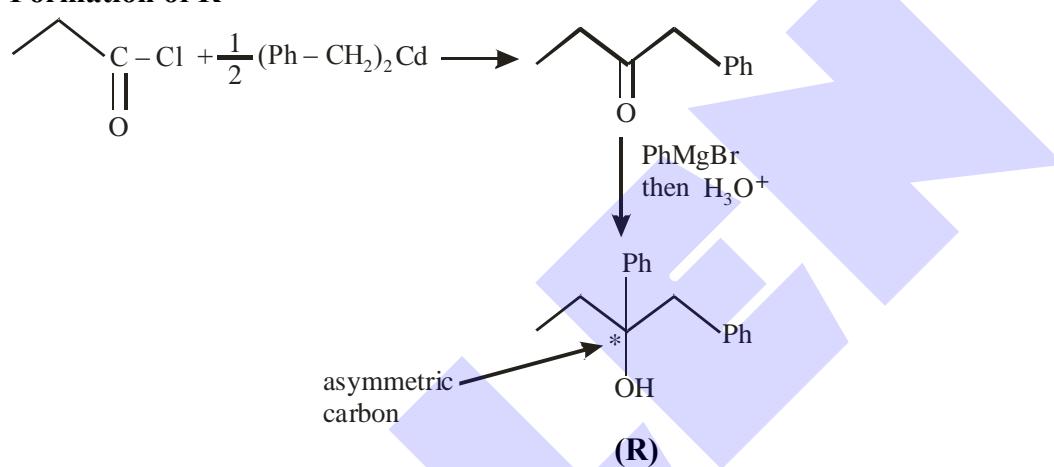
Sol. Formation of P



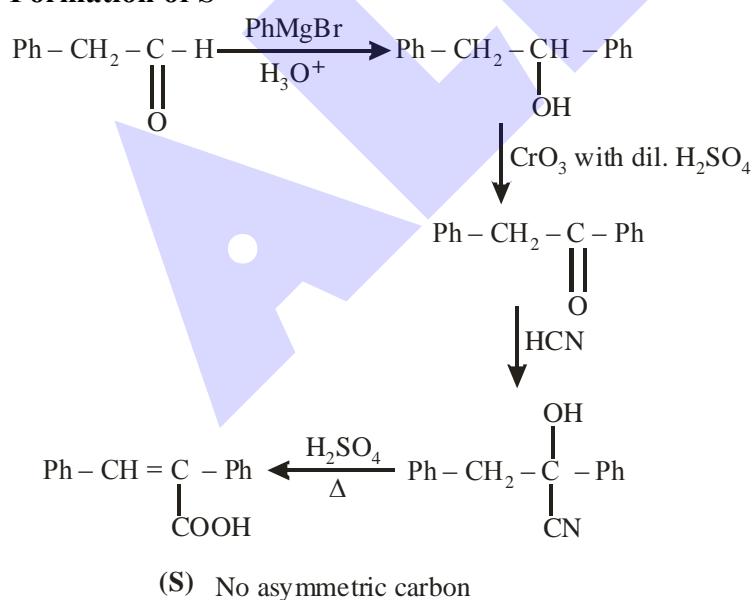
Formation of Q



Formation of R

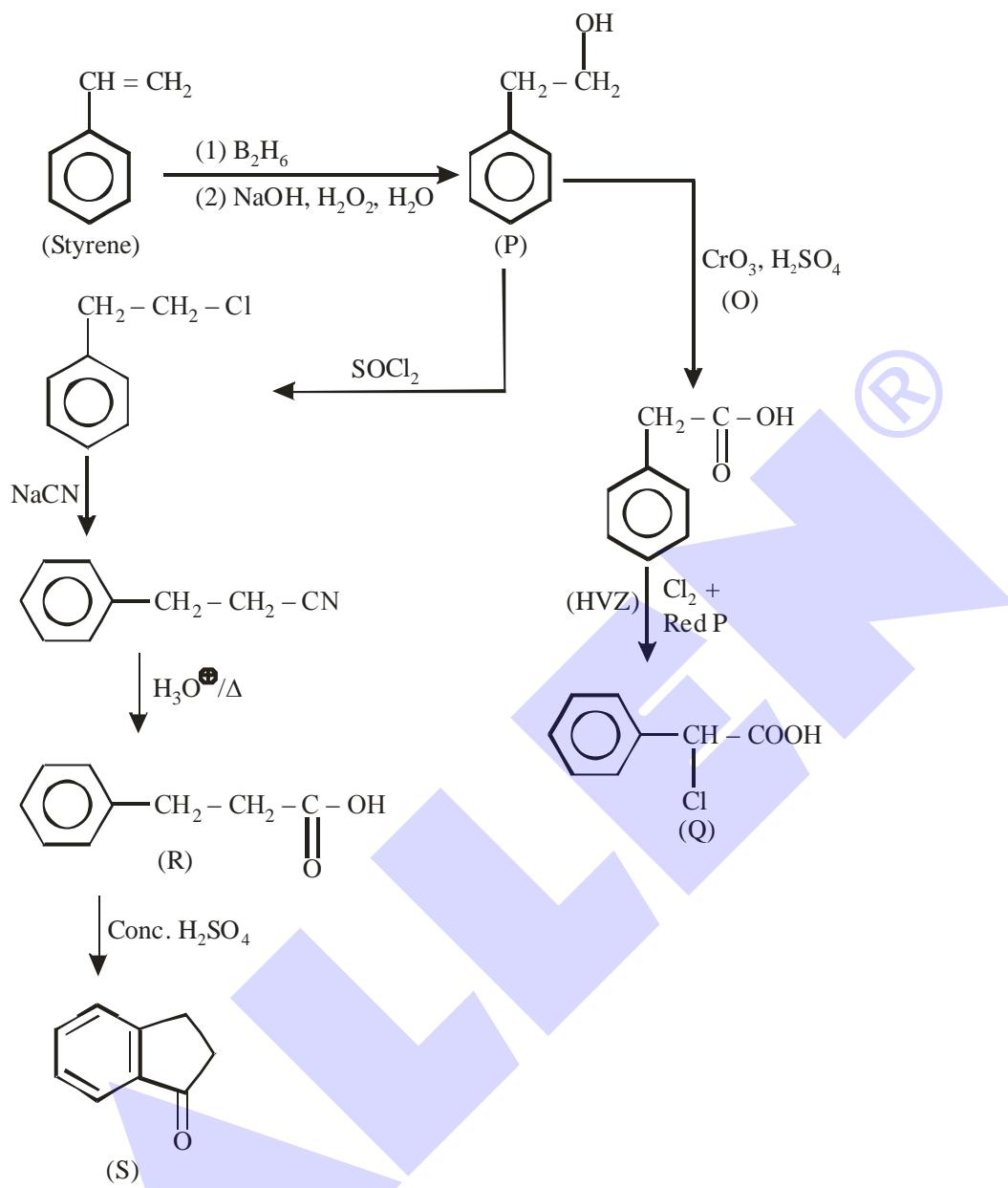


Formation of S

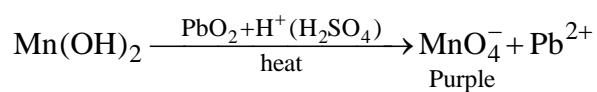
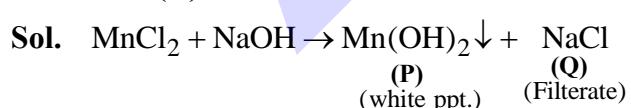


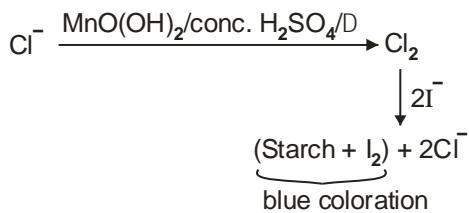
3. Ans. (B)

Sol.



4. Ans. (C)





5. Ans. (A)

Sol. For weak acid, $\alpha = \frac{\Lambda_m}{\Lambda_0}$

$$K_a = \frac{C\alpha^2}{1-\alpha} \Rightarrow K_a(1-\alpha) = C\alpha^2$$

$$\Rightarrow K_a \left(1 - \frac{\Lambda_m}{\Lambda_0}\right) = C \left(\frac{\Lambda_m}{\Lambda_0}\right)^2$$

$$\Rightarrow K_a - \frac{\Lambda_m K_a}{\Lambda_0} = \frac{C \Lambda_m^2}{(\Lambda_0)^2}$$

Divide by ' Λ_m '

$$\Rightarrow \frac{K_a}{\Lambda_m} = \frac{C \Lambda_m}{(\Lambda_0)^2} + \frac{K_a}{\Lambda_0}$$

$$\Rightarrow \frac{1}{\Lambda_m} = \frac{C \Lambda_m}{K_a (\Lambda_0)^2} + \frac{1}{\Lambda_0}$$

Plot $\frac{1}{\Lambda_m}$ vs $C \Lambda_m$ has

$$\text{Slope} = \frac{1}{K_a (\Lambda_0)^2} = S$$

$$\text{y-intercept} = \frac{1}{\Lambda_0} = P$$

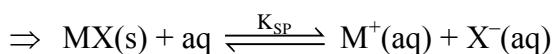
$$\text{Then, } \frac{P}{S} = \frac{\frac{1}{\Lambda_0}}{\frac{1}{K_a (\Lambda_0)^2}} = K_a \Lambda_0$$

6. Ans. (B)

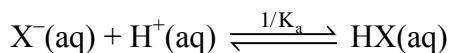
Sol. At pH = 7 \Rightarrow pure water

$$\text{solubility} = S_1 = \sqrt{K_{sp}}$$

At pH = 2



$$S \quad S-X$$



$$S-X \quad 10^{-2} \quad x \approx s$$

Approximation : $s - x \approx 0$ [X^- is limiting reagent]

$$\Rightarrow s \approx x$$

$$\Rightarrow s(s-x) = K_{sp}$$

$$\frac{s}{(s-x)(10^{-2})} = \frac{1}{K_a}$$

$$\text{Multiply (1) } \times \text{(2)} \Rightarrow \frac{s^2}{10^{-2}} = \frac{K_{sp}}{K_a}$$

$$\Rightarrow s = \frac{\sqrt{K_{sp}}}{10\sqrt{K_a}}$$

$$\text{Now given : } \frac{s}{s_1} = \frac{10^{-3}}{10^{-4}}$$

$$\Rightarrow \frac{\frac{\sqrt{K_{sp}}}{10\sqrt{K_a}}}{\sqrt{K_{sp}}} = 10$$

$$\Rightarrow \frac{1}{10\sqrt{K_a}} = 10$$

$$\Rightarrow \sqrt{K_a} = 10^{-2}$$

$$\Rightarrow K_a = 10^{-4}$$

$$\Rightarrow pK_a = 4$$

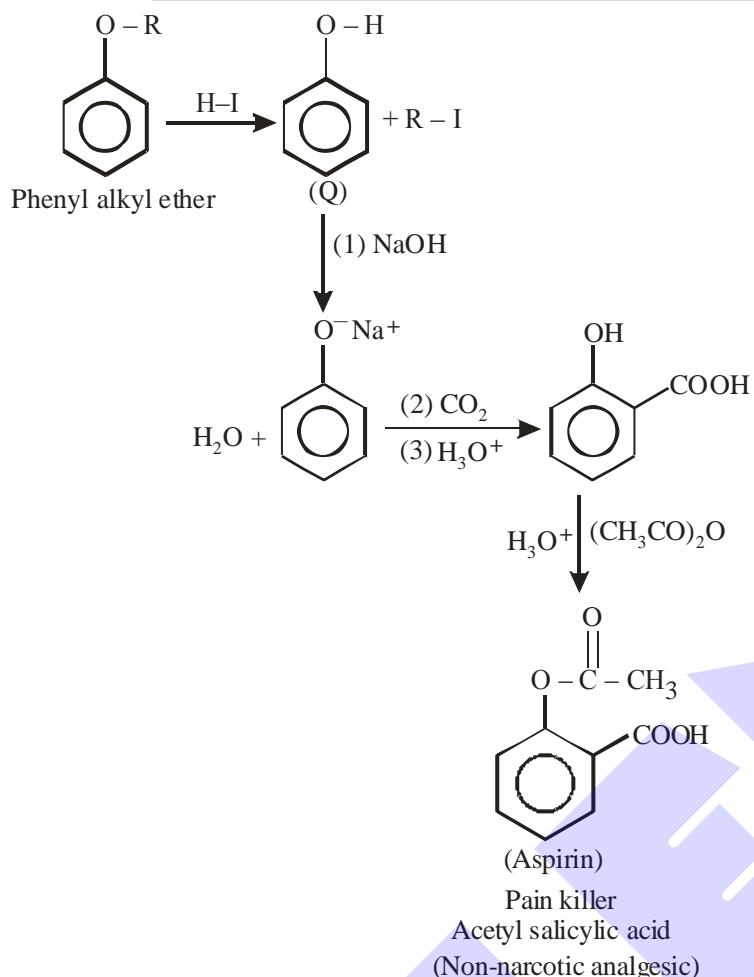
7. Ans. (B)

Sol. P is phenyl alkyl ether

Q is aromatic compound

R and S are the major product

i.e.

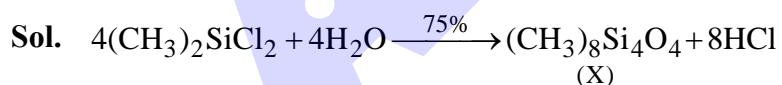


Correct ans is (B)

Aspirin inhibits the synthesis of chemicals known as prostaglandin's.

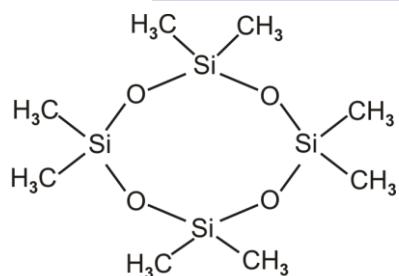
SECTION-3

8. Ans. (222)



$$w = 516 \text{ g}$$

$$\begin{aligned} n &= \frac{516}{129} \\ (\text{moles}) & \\ &= 4 \end{aligned}$$



weight = 296 g

% yield = 75

$$\text{The weight of X (in gram)} = 296 \times \frac{75}{100} = 222 \text{ g}$$

9. Ans. (100)

Sol. For gas : $Z = 0.5$, $V_m = 0.4 \text{ L/mol}$

$T = 800 \text{ K}$, $P = X \text{ atm.}$

$$\Rightarrow Z = \frac{PV_m}{RT}$$

$$\Rightarrow \frac{X(0.4)}{0.08 \times 800} = 0.5$$

$$\Rightarrow X = 80$$

For ideal gas, $PV_m = RT$

$$\Rightarrow V_m = \frac{RT}{P} = \frac{0.08 \times 800}{80} = 0.8 \text{ L mol}^{-1} = y$$

$$\text{Then, } \frac{x}{y} = \frac{80}{0.8} = 100.$$

10. Ans. (5)

Sol. For reaction $A(g) \rightleftharpoons P(g)$

$$\log k_f = \frac{-E_f}{2.303RT} + \log A_f \text{ [Arrhenius equation for forward reaction]}$$

$$\text{From plot when, } \frac{1}{T} = 0.002, \log k_f = 9$$

$$\Rightarrow 9 = \frac{-E_f}{2.303R} (0.002) + \log (A_f)$$

$$\text{Given : } A_f = 10^{15} \text{ s}^{-1}$$

$$\Rightarrow 9 = \frac{-E_f}{2.303R} (0.002) + 15$$

$$\Rightarrow \frac{E_f}{2.303R} = \frac{6}{0.002} = 3000$$

$$\text{Now, } K = \frac{k_f}{k_b} = \frac{A_f}{A_b} e^{-(E_f - E_b)/RT}$$

$$\log K = -\frac{1}{2.303} \frac{(E_f - E_b)}{RT} + \log \left(\frac{10^{15}}{10^{11}} \right)$$

At 500 K

$$\Rightarrow 6 = \frac{-(E_f - E_b)}{500R (2.303)} + 4$$

$$\Rightarrow (1000 R) (2.303) = E_b - E_f$$

$$\Rightarrow (1000 R) (2.303) = E_b - 3000 (2.303 R)$$

$$\Rightarrow E_b = 4000 R (2.303)$$

..... (1)

$$\text{Now } k_b = A_b e^{-E_b/RT}$$

$$\Rightarrow \log k_b = \frac{-E_b}{2.303 RT} + \log A_b$$

At 250 K

$$\Rightarrow \log k_b = -\frac{4000}{250} + \log (10^{11})$$

$$= -16 + 11 = -5$$

$$|\log k_b| = 5$$

[From equation (1)]

R

11. Ans. (7)

Sol. For $A \rightarrow B$

$$600 V_1^{\gamma-1} = 60 V_2^{\gamma-1} \quad (\gamma = 5/3)$$

(Reversible adiabatic)

$$\Rightarrow 600 (V_1)^{2/3} = 60 (V_2)^{2/3}$$

$$\Rightarrow 10 = \left(\frac{V_2}{V_1} \right)^{2/3}$$

$$\Rightarrow 10 = \left(\frac{V_2}{10} \right)^{2/3}$$

$$\Rightarrow V_2 = 10(10)^{3/2} = 10^{5/2}$$

$$\text{Now, } q_{\text{net}} = RT_2 \ln 10 = 60 R \ln 10 = q_{AB} + q_{BC}$$

$$\because q_{AB} = 0$$

$$\Rightarrow q_{BC} = 60 R \ln 10 = 60 R \ln \frac{V_3}{V_2} \quad [\because B \rightarrow C \text{ is reversible isothermal}]$$

$$\Rightarrow 60 R \ln 10 = 60 R \ln \left(\frac{V_3}{10^{5/2}} \right)$$

$$\Rightarrow \log 10 = \log V_3 - \frac{5}{2}$$

$$\Rightarrow \log V_3 = \frac{7}{2} \Rightarrow 2 \log V_3 = 7$$

12. Ans. (8)

Sol. At T_1 K : $A(g) \rightleftharpoons P(g)$

$$\begin{array}{ll} t = 0 & 6 \\ t = \infty & 6 - x \quad x = 4 \text{ (from plot)} \end{array}$$

$$\Rightarrow \text{At } T_1 \text{ K : } K_{P_1} = \frac{4}{2} = 2$$

At T_2 K : $A(g) \rightleftharpoons P(g)$

$$\begin{array}{ll} t = 0 & 6 \\ t = \infty & 6 - y \quad y = 2 \text{ (from plot)} \end{array}$$

$$\Rightarrow \text{At } T_2 \text{ K : } K_{P_2} = \frac{2}{4} = \frac{1}{2}$$

$$\text{Now, } \Delta G_2^{\circ} = -RT_2 \ln K_{P_2} = -RT_2 \ln \frac{1}{2}$$

$$\Rightarrow \Delta G_2^{\circ} = RT_2 \ln 2$$

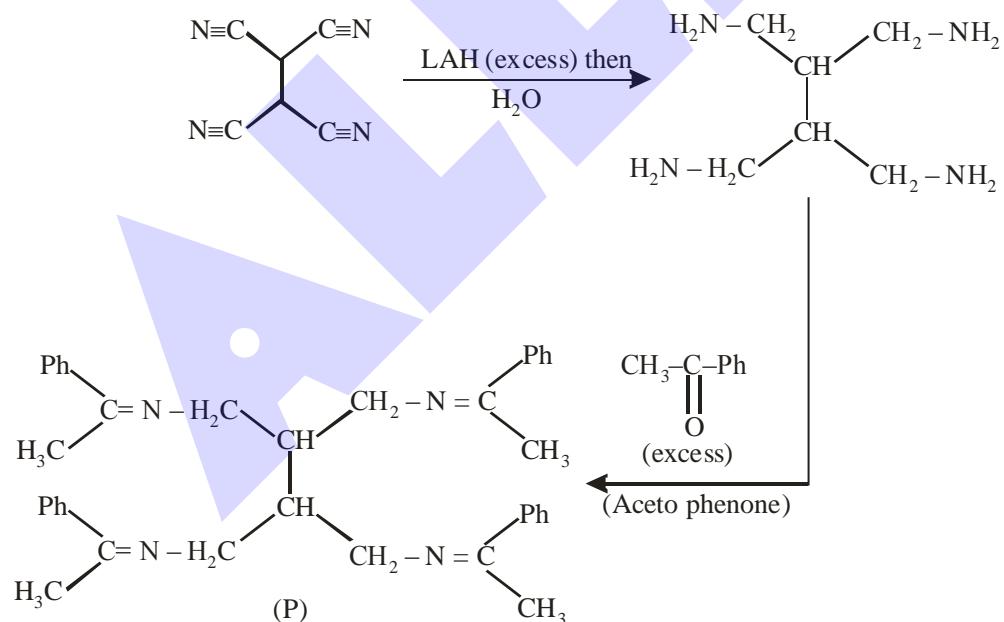
$$\Delta G_1^{\circ} = -RT_1 \ln K_{P_1} = -RT_1 \ln 2 = -2RT_2 \ln 2$$

$$\text{Given : } \Delta G_2^{\circ} - \Delta G_1^{\circ} = RT_2 \ln 2 + 2RT_2 \ln 2 = 3RT_2 \ln 2 = RT_2 \ln x$$

$$\Rightarrow x = 2^3 = 8$$

13. Ans. (28)

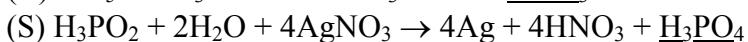
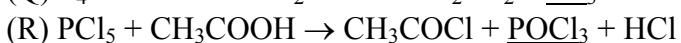
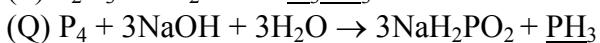
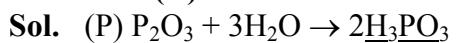
Sol.



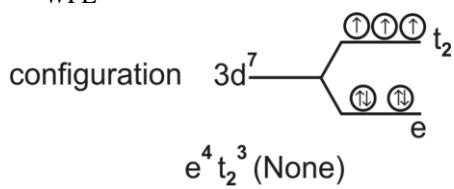
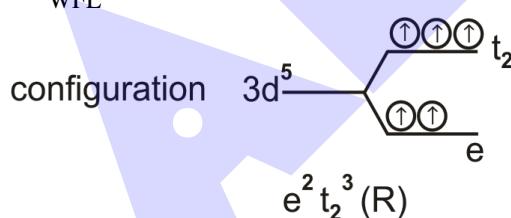
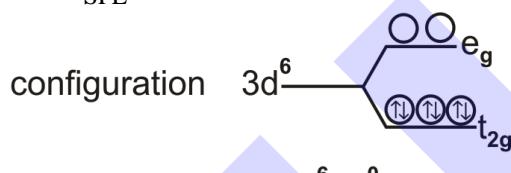
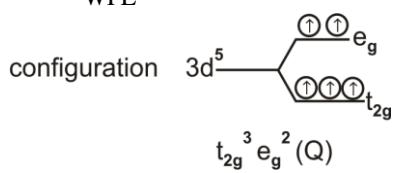
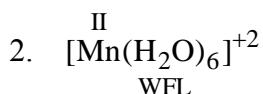
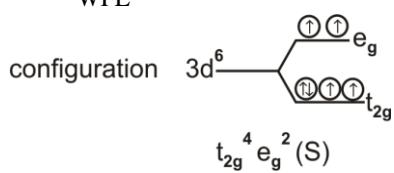
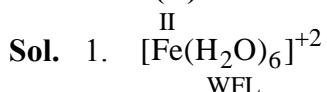
Total number of sp^2 hybridised C-atom in P = 28

SECTION-4

14. Ans. (D)

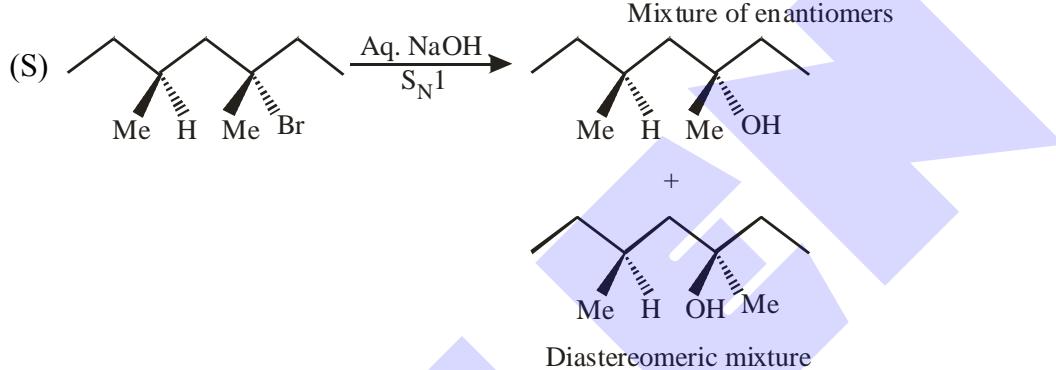
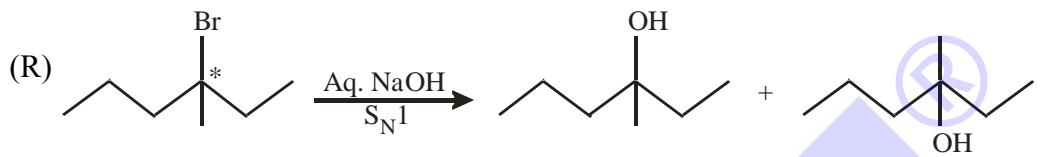
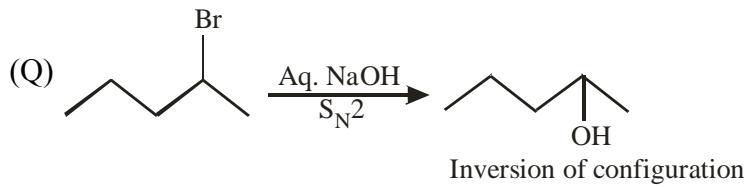
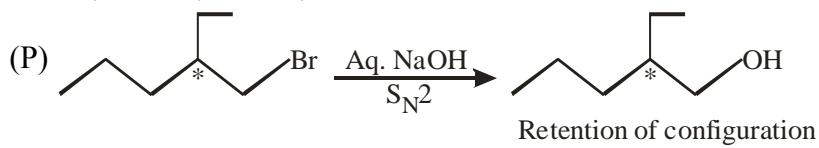


15. Ans. (D)



16. Ans. (B)

Sol. P → 2, Q → 1, R → 3, S → 5



17. Ans. (D)

Sol. P → 3, Q → 4, R → 5, S → 2

