

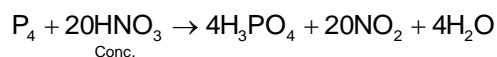
Chemistry JEE Solutions 2022

Chemistry

1. (White) $P_4 \xrightarrow{\text{Conc. HNO}_3}$

- (1) $H_3PO_3 + N_2$ (2) $NO_2 + PH_3$
 (3) $H_3PO_4 + NO_2$ (4) $H_3PO_4 + NO_2$

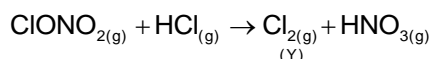
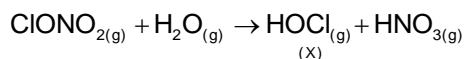
Sol. Answer (3)



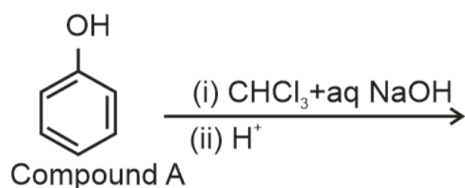
2. Chlorine nitrate on hydrolysis produces X along with HNO_3 and chlorine nitrate on reaction with HCl produces Y along with HNO_3 . X and Y are respectively,

- (1) $HOCl, HClO_2$ (2) $HOCl, Cl_2$
 (3) HCl, Cl_2 (4) $HOCl, HClO_3$

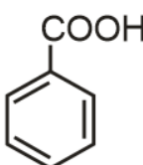
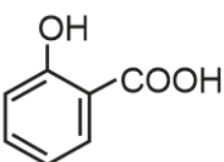
Sol. Answer (2)

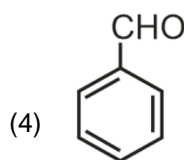
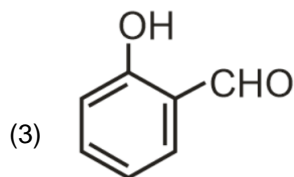


3. Consider the following reaction

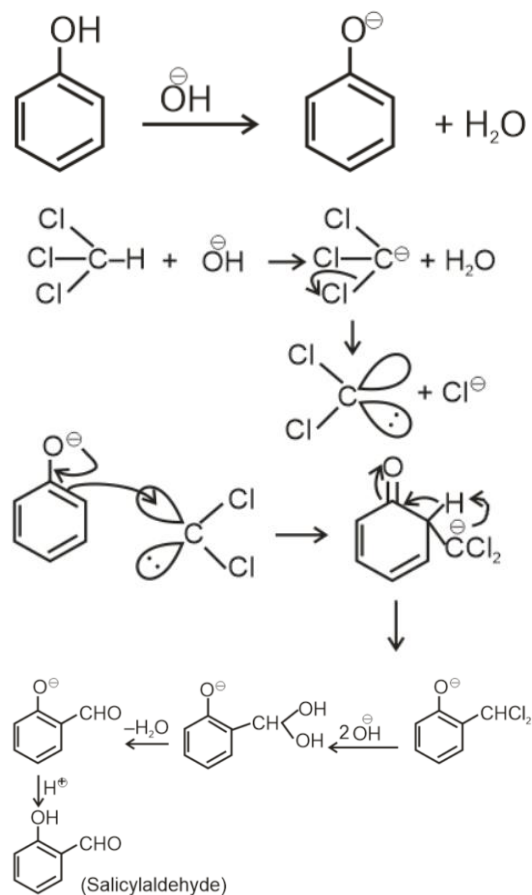


The major product formed in the above reaction is

- (1) 
 (2) 



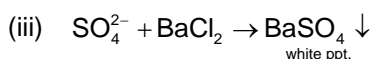
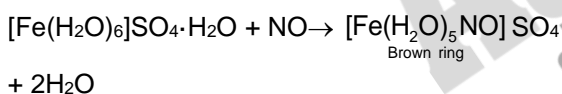
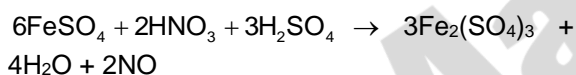
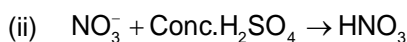
Sol. Answer (3)



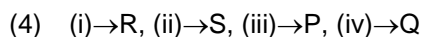
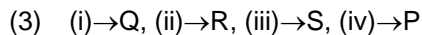
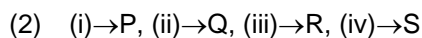
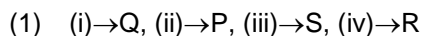
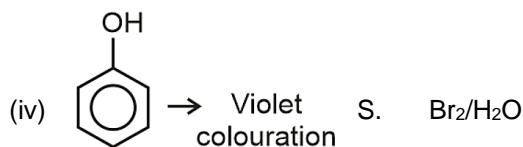
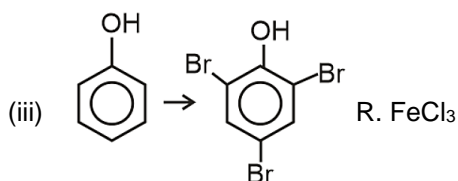
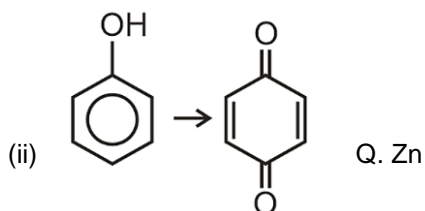
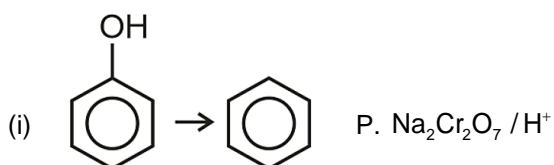
4. Match the acidic radicals present in column I with their characteristic observations in column II

| Column I | Column II |
|--------------------------|-------------------------|
| (i) CO_3^{2-} | (P) Brisk Effervescence |
| (ii) NO_3^- | (Q) White Precipitate |
| (iii) SO_4^{2-} | (R) Brown Ring |
| (iv) S^{2-} | (S) Rotten egg smell |
| (i) – S | (i) – P |
| (1) (ii) – R | (2) (ii) – Q |
| (iii) – Q | (iii) – R |
| (iv) – P | (iv) – S |
| (i) – P | (i) – P |
| (3) (ii) – R | (4) (ii) – R |
| (iii) – Q | (iii) – S |
| (iv) – S | (iv) – Q |

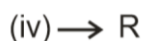
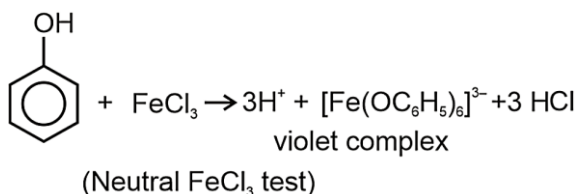
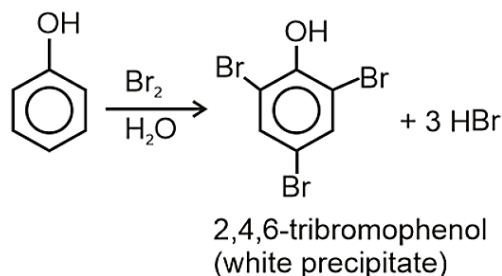
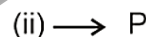
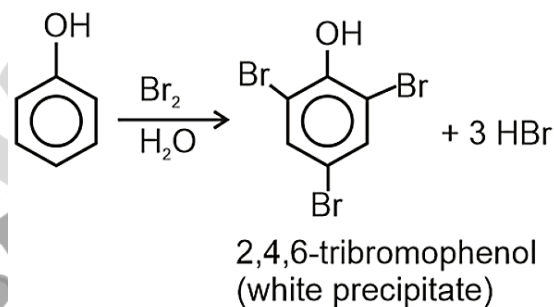
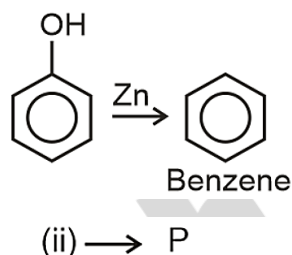
Sol. Answer (3)



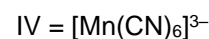
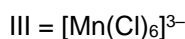
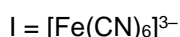
5. Match the reagent with the organic conversion



Sol. Answer (1)



6. Arrange the following coordination complexes in increasing order of their magnetic moments



- (3) IV < II < I < III (4) II < I < IV < III

Sol. Answer (2)

- (i) $[\text{Fe}(\text{CN})_6]^{3-}$
 e^- configuration of $\text{Fe}^{+3} = [\text{Ar}]3d^5 4s^0$
 i.e. $t_{2g}^5 e_g^0 \Rightarrow 1 \text{ unpaired } e^-$
- (ii) $[\text{FeF}_6]^{3-}$
 e^- configuration of $\text{Fe}^{+3} = [\text{Ar}]3d^5 4s^0$
 i.e. $t_{2g}^3 e_g^2 \Rightarrow 5 \text{ unpaired } e^-$
- (iii) $[\text{MnCl}_6]^{3-}$
 e^- configuration of $\text{Mn}^{+3} = [\text{Ar}]3d^4 4s^0$
 i.e. $t_{2g}^3 e_g^1 \Rightarrow 4 \text{ unpaired } e^-$
- (iv) $[\text{Mn}(\text{CN})_6]^{3-}$
 e^- configuration of $\text{Mn}^{+3} = [\text{Ar}]3d^4 4s^0$
 i.e. $t_{2g}^4 e_g^0 \Rightarrow 2 \text{ unpaired } e^-$

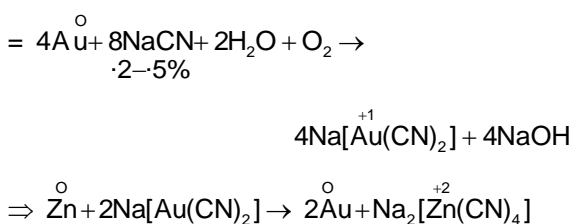
7. Statement -1 : In extraction of gold, the oxidation state of gold in the cyanide complex form is +3

Statement 2 : When the cyanide complex is treated with zinc, Zn get oxidised to +2 state

- (1) Statement 1 and 2 both are correct
 (2) Statement 1 is correct but statement 2 is wrong
 (3) Statement 1 wrong but statement 2 is correct
 (4) Statement 1 and 2 both are wrong.

Sol. Answer (3)

Extraction of gold – by leaching



Statement 1 is wrong

Statement 2 is correct

8. Arrange the following compounds in increasing order of H-bonding

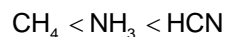
HCN, NH_3 , CH_4

- (1) $\text{CH}_4 < \text{NH}_3 < \text{HCN}$
 (2) $\text{HCN} < \text{NH}_3 < \text{CH}_4$
 (3) $\text{NH}_3 < \text{CH}_4 < \text{HCN}$
 (4) $\text{CH}_4 < \text{HCN} < \text{NH}_3$

Sol. Answer (1)

Usually C–H bond is not that polar but here in $\text{H}-\text{C}\equiv\text{N}$ carbon is sp hybridized resulting in high polarity of $\text{C}-\text{H}$ bond

Hence order of H-bonding :



9. Match column I with column II

| Column I | Column II |
|------------------------------------|------------------------------|
| (i) Tranquilizers | (a) Relieve pain |
| (ii) Analgesics | (b) Lowers body temperatures |
| (iii) Antipyretic | (c) Control acidity |
| (iv) Antacids | (d) Reduce stress |
| (1) (i)-d, (ii)-a, (iii)-b, (iv)-c | |
| (2) (i)-b, (ii)-c, (iii)-d, (iv)-a | |
| (3) (i)-c, (ii)-d, (iii)-b, (iv)-a | |
| (4) (i)-b, (ii)-d, (iii)-a, (iv)-c | |

Sol. Answer (1)

Tranquilizers : They are neurologically active drugs and are used for treatment of stress and mild or even severe mental diseases.

(i) \rightarrow d

Analgesics : It reduces or abolishes pain without causing impairment of consciousness, mental confusion or other disturbances of nervous system

(ii) \rightarrow a

Antipyretic : Lowers body temperature

(iii) \rightarrow b

Antacids : Controls acidity

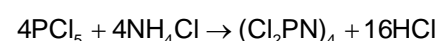
(iv) \rightarrow c

10. The gas releases in the following reaction is

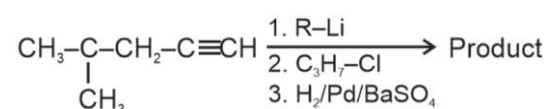


- (1) NCl_3 (2) PCl_3
 (3) HCl (4) N_2

Sol. Answer (3)



11. The Product of the following reaction is



$$[\text{OH}^-] = 10^{-3} \text{M}$$

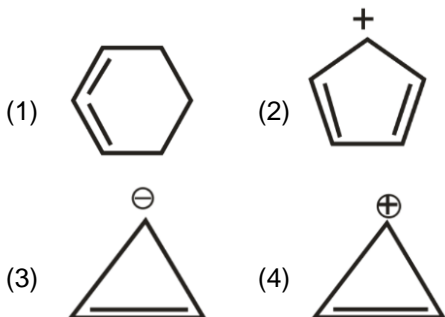
$$\text{pOH} = -\log[\text{OH}^-]$$

$$= 3$$

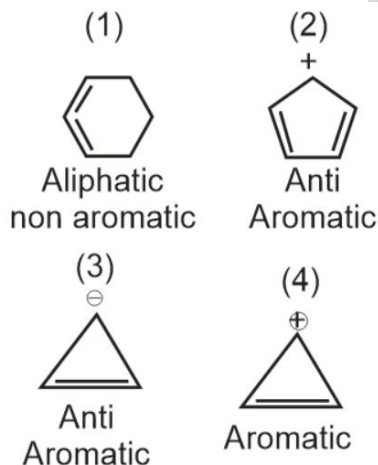
$$\text{pH} + \text{pOH} = 14$$

$$\text{pH} = 14 - 3 = 11$$

16. Among the following most stable species is,



Sol. Answer (4)

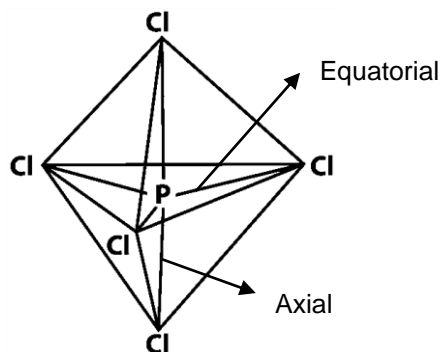


Aromatic > Non aromatic > Anti Aromatic

17. Correct Statement about PCl_5 is/are

- (a) PCl_5 has TBP geometry
 (b) Axial bonds are stronger than equatorial bond
 (c) All equatorial bonds are in same plane
 (d) PCl_5 shows sp^3d hybridization
- (1) a,b,c (2) a,b,d
 (3) a,c,d (4) b,c,d

Sol. Answer (3)



- (a) Trigonal Bipyramidal geometry
 (b) Axial bond lengths are longer due to no %s character than equatorial bond, so weak in nature
 (c) All equatorial bonds are in same plane
 (d) sp^3d hybridisation

18. Which of the following elements has the highest value of $E^\circ_{\text{M}^{2+}/\text{M}}$?

- (1) Ni (2) Mn
 (3) Cu (4) Fe

Sol. Answer (3)

From electrochemical series :

$$E^\circ_{\text{Cu}^{2+}/\text{Cu}} = +0.34\text{V}$$

$$E^\circ_{\text{Ni}^{2+}/\text{Ni}} = -0.25\text{V}$$

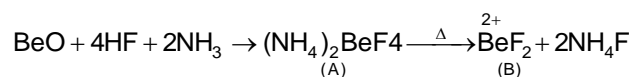
$$E^\circ_{\text{Mn}^{2+}/\text{Mn}} = -1.18\text{V}$$

$$E^\circ_{\text{Fe}^{2+}/\text{Fe}} = -0.44\text{V}$$

Hence Cu has highest SRP value.

19. When BeO reacts with HF in the presence of ammonia, a compound A is formed. On heating, a compound B is formed along with ammonium fluoride. The oxidation state of Be in compound B is

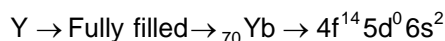
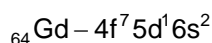
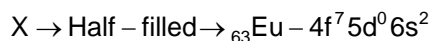
Sol. Answer (2)



20. Among the elements with Atomic Number 57 to 70, the number of elements with half-filled configuration are X and fully filled configuration are Y.

The sum of X and Y is

Sol. Answer (3)



$$\text{Sum of } X+Y = 2+1 = 3$$

- 21.** In carius method of estimation of halogen, 0.25 g of an organic compound gave 0.40 g of AgCl. Find out the percentage of chlorine in the compound.

Sol. Answer (29.58)

$$\text{Weight of organic compound} = 0.25 \text{ gm}$$

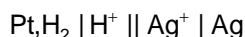
$$143.5 \text{ gm AgCl contains Cl} = 35.5 \text{ gm}$$

$$0.4 \text{ gm AgCl contains Cl} = \frac{35.5}{143.5} \times 0.4 \text{ gm}$$

$$\% \text{ Cl} = \frac{\text{weight of chlorine}}{\text{weight of organic compound}} \times 100$$

$$= \frac{35.5 \times 0.4}{143.5 \times 0.25} \times 100 = 39.58\%$$

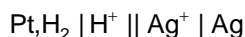
- 22.** Consider an electrochemical cell



$$\text{Given, } E_{\text{Ag}^+/\text{Ag}}^0 = +0.80 \text{ V}$$

the value of ΔG^0 for the cell represented above is $-x$ kJ, then the value of x in nearest integer is.

Sol. Answer (77)



$$E_{\text{Ag}^+/\text{Ag}}^0 = 0.80 \text{ V}$$

$$E_{\text{H}^+/\text{H}_2/\text{Pt}}^0 = 0$$

$$E_{\text{cell}}^0 = E_{\text{cathode}}^0 - E_{\text{anode}}^0$$

$$= 0.80 - 0 = 0.80 \text{ V}$$

$$\Delta G_{\text{cell}}^0 = -nF E_{\text{cell}}^0$$

$$= -1 \times 96500 \times 0.80$$

$$= -77200 \text{ J}$$

$$= -77.2 \text{ kJ}$$

$$\text{Hence, } -x = -77.2 \text{ kJ}$$

$$x = 77.2 \approx 77$$

- 23.** How many of the following set of quantum numbers are possible.

| | n | l | m |
|-------|---|---|---|
| (i) | 3 | 3 | 3 |
| (ii) | 2 | 1 | 1 |
| (iii) | 3 | 2 | 2 |
| (iv) | 2 | 2 | 2 |

Sol. Answer (2)

'l' can take value from 0 to $n-1$

'm_l' can take all integral values from $-l$ to $+l$ including 0.

- | | | | |
|-------|---------|---------|--------------------|
| (i) | $n = 3$ | $l = 3$ | not possible |
| (ii) | $n = 2$ | $l = 1$ | $m_l = 1$ possible |
| (iii) | $n = 3$ | $l = 2$ | $m_l = 2$ possible |
| (iv) | $n = 2$ | $l = 2$ | not possible |

\therefore Only 2 set of quantum numbers are possible

- 24.** The boiling point of pure water is 373.15 K. It changes to 373.535 K, when 2.5×10^{-3} kg of a non-volatile and non-electrolyte solute has been added to 75×10^{-3} kg water.

Find the molecular mass of solute in g/mol

$$K_b(\text{H}_2\text{O}) = 0.52 \text{ K kg mol}^{-1}$$

[Round off to the nearest integer]

Sol. Answer (45)

$$T_b = 373.15 \text{ K}$$

$$T_b' = 373.535 \text{ K}$$

$$\Delta T_b = 373.535 - 373.15$$

$$= 0.385 \text{ K}$$

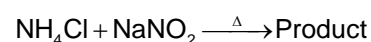
$$\text{Now, } \Delta T_b = K_b m$$

$$0.385 = 0.52 \times \frac{2.5 \times 10^{-3} \times 10^3}{M_{\text{solute}} \times 75 \times 10^{-3}}$$

$$M_{\text{solute}} = \frac{0.52 \times 2.5}{0.385 \times 75 \times 10^{-3}}$$

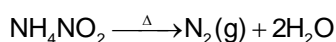
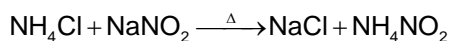
$$= 45 \text{ gm/mole}$$

- 25.** Which gas is produced during following reaction:

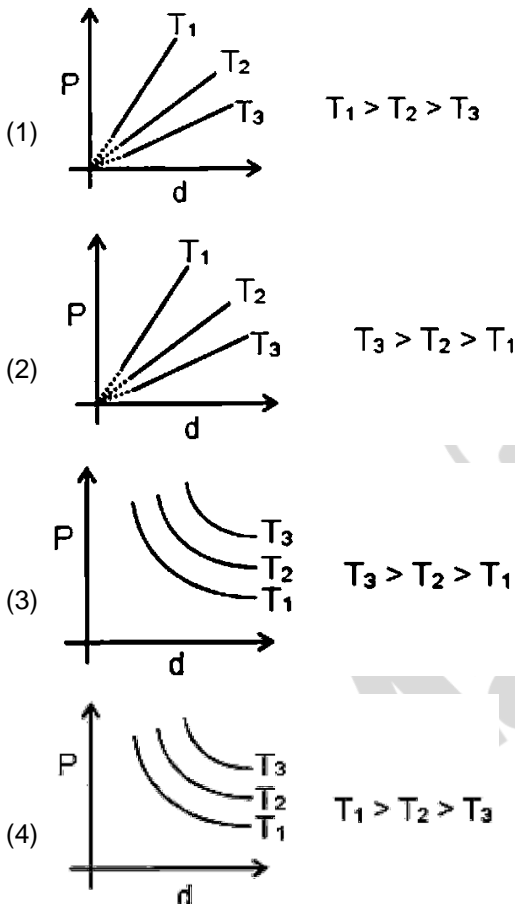


- | | |
|-------------------|--------------------------|
| (1) NH_3 | (2) N_2 |
| (3) Cl_2 | (4) N_2O |

Sol. Answer (2)



26. Which of the following graph is correct for an ideal gas



Sol. Answer (1)

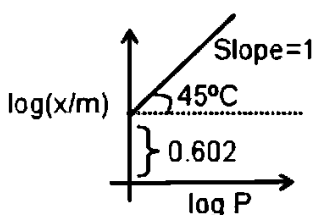
$$PV = nRT$$

$$P = \left[\frac{w}{V} \right] \frac{RT}{M}$$

$$P = \frac{dRT}{M} \text{ so } P \propto d \quad \text{Slope} = \frac{RT}{M}$$

Greater is slope greater is Temperature.

27. At 1.003 atm pressure, value of $\left(\frac{x}{m} \right)$ will be



Report your answer to nearest integer.

Sol. Answer (4)

$$\left(\frac{x}{m} \right) = KP^{1/n}$$

$$\log \left(\frac{x}{m} \right) = \log K + \frac{1}{n} \log P$$

$$\text{Intercept } \log K = 0.602 = \log 4$$

$$K = 4$$

$$\text{Slope} \Rightarrow \frac{1}{n} = 1 \quad \text{so } n = 1$$

$$\text{so } \left(\frac{x}{m} \right) = 4(1.003) = 4.012$$

28. 5 mole of an ideal gas change it's volume from 10 L to 20 L. reversible isothermally at 300 K then work done by gas isKCal.
[Given $R = 2 \text{ Cal}$]

Sol. Answer (2)

For isothermal reversible process

$$W = -2.303 nRT \log \left(\frac{V_2}{V_1} \right)$$

$$= -2.303 \times 5 \times 2 \times 300 \log \left(\frac{20}{10} \right)$$

$$= -2079.82 \text{ Cal} = -2.0798 \times 10^3 \text{ Cal}$$

$$= -2 \text{ K Cal} = |W| = 2 \text{ K Cal}$$

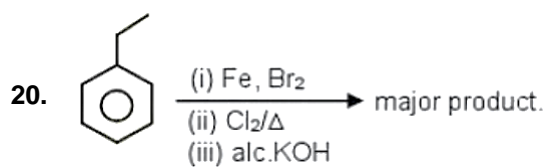
29. **Statement-I:** $\frac{n_2}{n_1} \uparrow \quad h\nu = (E_2 - E_1) \text{ absorb photon.}$

Statement-II: $\frac{n_2}{n_1} \downarrow \quad h\nu = E_2 - E_1 = \text{emitted photon.}$

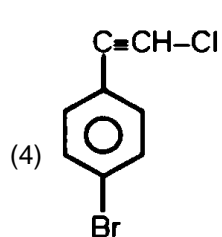
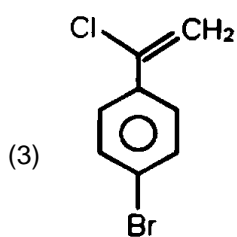
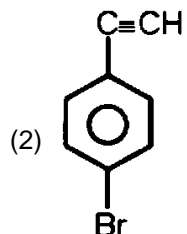
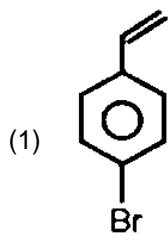
- (1) Both Statement-I & Statement-II are true
(2) Both Statement-I & Statement-II are false
(3) Statement-I is true & Statement-II is false
(4) Statement-I is false & Statement-II is true

Sol. Answer (1)

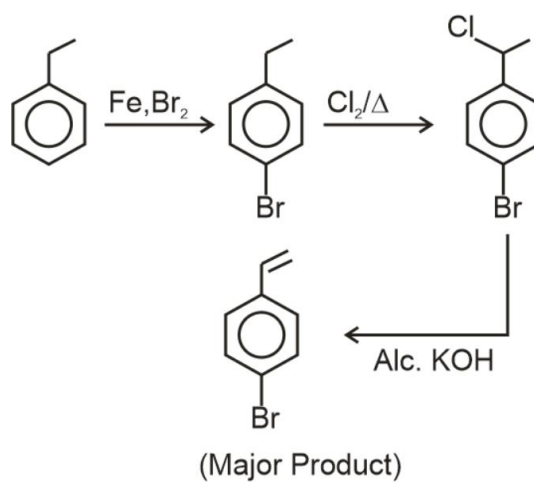
In this process absorbed & emitted photon have equal energy.



Major product is:



Sol. Answer (1)



☐ ☐ ☐