PART : CHEMISTRY

1. Which complex will show facial and meridional form-

(1) $[Co(NH_3)_6]$ (2) $[Co(NH_3)_5Cl]$ (3) $[Co(NH_3)_4Cl_2]$ (4) $[Co(NH_3)Cl_3]$

Ans. **(4)**

Sol.

Facial form Meridional form

2. The depression in freezing point of 0.1 molal solution is 0.558, then complex will be-

(1) $[Co(NH_3)_6Cl_2]$ (2) $[Co(NH_3)_5Cl]Cl$ (3) $[Co(NH_3)_4Cl_2]$ (4) $[Co(NH_3)Cl_3]$

Ans. **(1)**

Sol. $\Delta T_f = i.K_f.m$

$0.558 = i \times 1.86 \times 0.1$

$$i = \frac{0.558}{1.86 \times 0.1} = 3$$

3. Which of the following element does not lie in same period.

(1) Osmium (2) Iridium (3) Palladium (4) Platinum

Ans. **(3)**

Sol.

4. Which of the following pair of ions are same coloured ?

(1) Ti^{4+}, V^{3+}, Sc^{3+} (2) Cr^{2+}, Cu^{2+}, V^{4+} (3) Cr^{3+}, Ni^{2+}, V^{4+} (4) $Mn^{3+}, Fe^{2+}, Zn^{2+}$

Ans. **(2)**

Sol. Cr^{2+}, Cu^{2+}, V^{4+} (Blue)

5. Find ΔG of reaction at 298 K

$N_2O_4(g) \rightleftharpoons 2NO_2$;

$\Delta H = +50$ kJ/mol & $\Delta S = 5$ J/mol-k

Ans. **(48.5)**

Sol. $\because \Delta G = \Delta H - T\Delta S$

$$= 50 \text{ kJ/mol} - 298 \times \frac{5}{1000} \text{ kJ}$$

$= 50 - 1.5$ kJ/mol

$= 48.5$ kJ/mol.

6. The pH of 0.1 M $C_2H_5NH_2$ solution is 9. if $K_b = 10^{-x}$ then find x.

Ans. **(9)**

Sol. $$pOH = \frac{1}{2}(pK_b - \log C)$$

$$5 = \frac{1}{2}(pK_b - \log 10^{-1})$$

$10 - 1 = pK_b = 9$

$k_b = 10^{-9} \Rightarrow x = 9$

7. Match the column-I and column-II

Column-I		Column-II	
(A)	Octet complete	(i)	BCl_3, $BeCl_2$
(B)	Octet expanded	(ii)	NO_2, NO
(C)	Octet incomplete	(iii)	CCl_4, CO_2
(D)	Odd electron	(iv)	H_2SO_4, PCl_5

(1) (A) → (iii) ; (B) → (iv) ; (C) → (i) ; (D) → (ii) (2) (A) → (iii) ; (B) → (i) ; (C) → (iv) ; (D) → (ii)
(3) (A) → (iv) ; (B) → (i) ; (C) → (ii) ; (D) → (iii) (4) (A) → (iv) ; (B) → (ii) ; (C) → (iii) ; (D) → (i)

Ans. **(1)**

8. If 10^{21} molecules are removed from x mg of $CO_2(g)$ then 2.8×10^{-3} mole are left. Calculate the value of x.

Ans. **(196.53)**

Sol. $(\text{mole})_i = \left(\frac{x \times 10^{-3}}{44}\right)$, $(\text{mole})_{\text{Removed}} = \left(\frac{10^{21}}{6 \times 10^{23}}\right) = \frac{1}{6} \times 10^{-2}$

$(\text{mole})_{\text{left}} = 2.8 \times 10^{-3}$

Now,

$(\text{mole})_i - (\text{mole})_{\text{Removed}} = (\text{mole})_{\text{left}}$

$$= \frac{x \times 10^{-3}}{44} - \frac{10^{21}}{6 \times 10^{23}} = 2.8 \times 10^{-3}$$

$$\frac{x \times 10^{-3}}{44} = 2.8 \times 10^{-3} + \frac{1}{6} \times 10^{-2} = \left(2.8 + \frac{10}{6}\right) \times 10^{-3}$$

$$\frac{x \times 10^{-3}}{44} = \left(\frac{16.8 + 10}{6}\right) \times 10^{-3}$$

$x = 196.53$

9. Incorrect statement among the following is :

(1) SO_2 act as oxidising agent but not reducing agent.
(2) NO_2 exist as dimer
(3) PF_5 exist but NF_5 does not
(4) PH_3 has lower proton affinity than NH_3

Ans. **(1)**

10. Two radioactive decays are

$A \xrightarrow{\lambda_1}$ product $\quad \lambda_1 = 3\lambda_2$

$B \xrightarrow{\lambda_2}$ product $\quad N_{A_0} = N_{B_0}$

Find ratio of $(N_A)_t$ and $(N_B)_t$ after one half life of A

Ans. **(4)**

Sol. Radioactive decays obeys 1st order kinetics

$$\frac{(N_B)_t}{(N_A)_t} = \frac{N_{B_0} e^{-\lambda_2 (t_{1/2})_A}}{N_{A_0} e^{-\lambda_1 (t_{1/2})_A}} \qquad (N_{A_0} = N_{B_0})$$

$$= \frac{e^{-\lambda_2 \times \frac{\ln 2}{\lambda_1}}}{e^{-\lambda_1 \times \frac{\ln 2}{\lambda_1}}} = \frac{e^{-\ln 8}}{e^{-\ln 2}} \Rightarrow \frac{(N_A)_t}{(N_B)_t} = 4$$

11. Calculate the percentage by weight of S if 160 g of organic compound produce 466 g of $BaSO_4$.

Ans. **(40)**

Sol. $S \rightarrow BaSO_4$

$(\text{atoms of S})_S = (\text{atoms of S})_{BaSO_4}$

$$\left(\frac{wt}{32}\right) \times N_A \times 1 = \left(\frac{466}{233}\right) \times N_A \times 1$$

$$(wt)_S = \left(\frac{466 \times 32}{233}\right)$$

$$(wt)_S = 64 \text{ g}$$

$$\%\,S = \frac{(wt)_S}{(wt)_{\text{org. compound}}} \times 100 = \frac{64}{160} \times 100 = 40\,\%$$

12. Find the spectral line of H-atom, which have $\lambda = 900$ nm, $R_H = 10^5\ cm^{-1}$

(1) $n_2 = \infty \rightarrow n_1 = 1$, Lyman (2) $n_2 = \infty \rightarrow n_1 = 2$, Balmer

(3) $n_2 = 5 \rightarrow n_1 = 3$, Paschan (4) $n_2 = \infty \rightarrow n_1 = 3$, Paschan

Ans. **(4)**

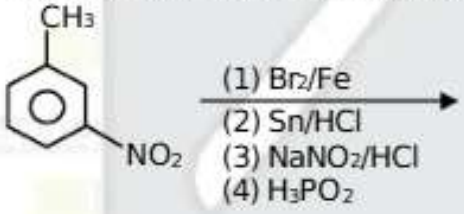
Sol. $$\frac{1}{\lambda} = R_H \times 2^2 \left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)$$

$$\frac{1}{\lambda} = 10^5 \times 1 \times \left(\frac{1}{3^2} - \frac{1}{\infty^2}\right)$$

$$\frac{1}{\lambda} = \frac{10^5}{9}$$

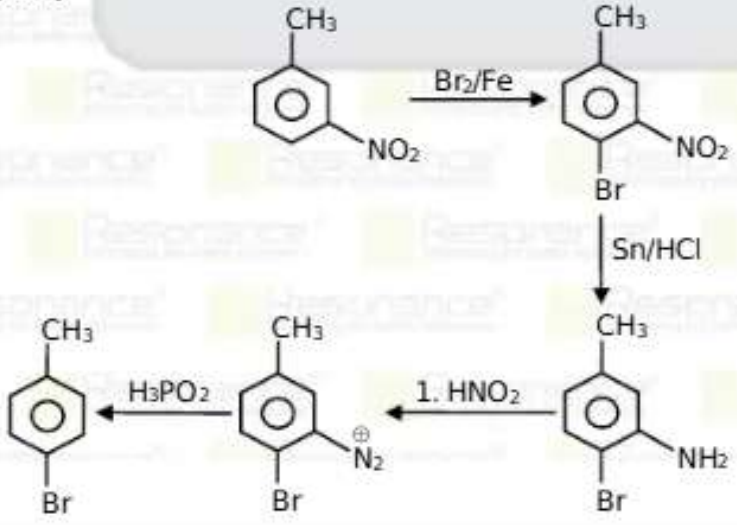
$$\Rightarrow \quad \lambda = 9 \times 10^{-5}\ cm = 900 \times 10^{-7}\ cm = 900\ nm$$

13. Find molecular mass of final product.

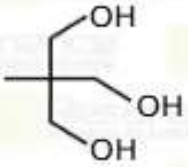


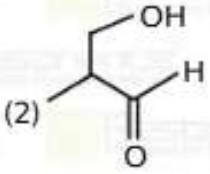
Ans. **(171)**

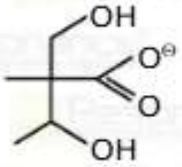
Sol.

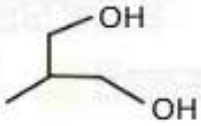


14. $CH_3-CH_2-\underset{\underset{O}{\|}}{C}-H + H-\underset{\underset{O}{\|}}{C}-H \xrightarrow[\text{(Excess)}]{\text{Alkali reflux}}$

(1) 

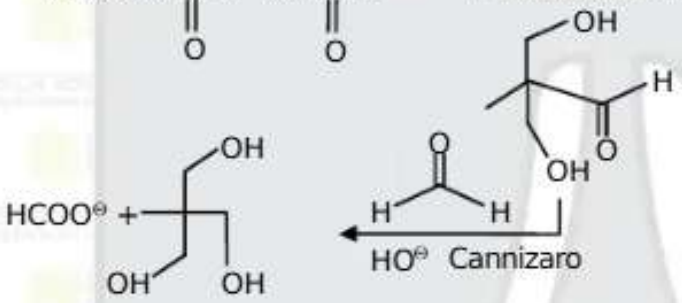
(2) 

(3) 

(4) 

Ans. **(1)**

Sol. $CH_3-CH_2-\underset{\underset{O}{\|}}{C}-H + H-\underset{\underset{O}{\|}}{C}-H \longrightarrow$ Aldol reaction



15. **Statement 1 :** Fructose gives silver mirror with Tollens reagent although $-\underset{\underset{O}{\|}}{C}-H$ group is absent in it.

Statement 2 : Fructose in Alkaline (Base) medium converts into Aldose Sugar Glucose which has $-\underset{\underset{O}{\|}}{C}-H$ group.

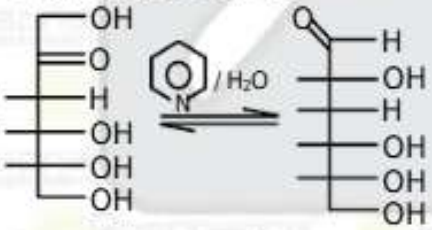
(1) Both Statement 1 and statement 2 are true (2) Both statement 1 and statement 2 are false

(3) Statement 1 is true but statement 2 is false (4) Statement 1 is false but statement 2 is true

Ans. **(1)**

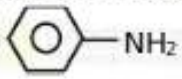
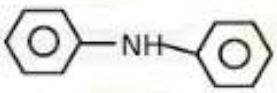
Sol. **Statement 1 :** Correct

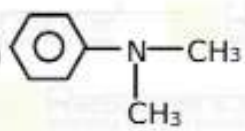
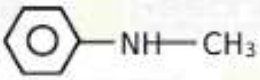
Statement 2 : Correct



Rearrangement or inter conversion between fructose and glucose.

16. Which of the following reacts with Hinsberg reagent.

(A)  (B) CH_3-NH_2 (C) 

(D)  (E) 

(1) A, B, C, E (2) B, C, D (3) A, C, D, E (4) C, D, E

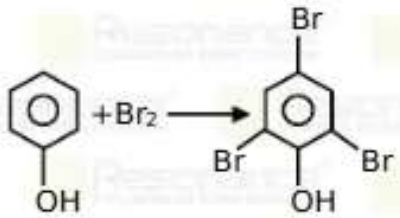
Ans. **(1)**

Sol. Only primary and sec. amine reacts with Hinsberg reagent.

17. 2 g phenol react with Br_2 water to give trisubstituted phenol.
How much Br_2 is needed to complete reaction in grams. (Rounded off to nearest integer)

Ans. **(10)**

Sol.

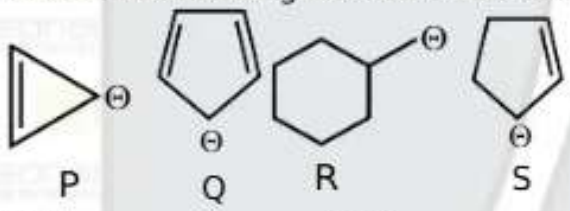


1 : 3 mol ratio

$\frac{2g}{94}$ $\frac{2}{94} \times 3$ mol Br_2

Hence $\frac{2\times3}{94} \times 160g\,Br_2$ used in reaction. $=10.21$ g

18 Which of the following the most stable carbanion is



(1) P (2) Q (3) R (4) S

Ans. **(2)**

Sol.

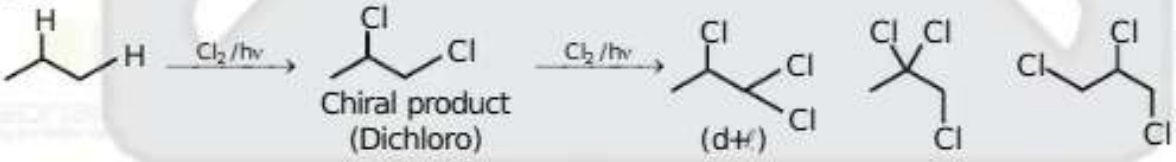
Follows Huckel rule hence is Aromatic stabilised resonance energy.

19. Propane reacts with Cl_2 in sunlight to give chiral product [x] which is dichloro product.

[x] is further chlorinated in sunlight to give how many trichloro product.

Ans. **(4)**

Sol.



Total 4 product are formed.

20. In estimation of sulphur by carius method, 160 g of organic compound gives 466 g of Barium sulphate.
% of sulphur in the organic compound is.

Ans. **(40)**

Sol. $BaSO_4(233)$

$\text{Moles} = \frac{466}{233} = 2$

$\text{Mass(s)} = 2 \times 32 = 64$

$\%\text{ of S} = \frac{64}{160} \times 100 = 40\%$

21. Match the reactions name in given column to correct product formed.

	Column-I		**Column-II**
(A)	Wurtz fittig reaction	(P)	Fluoride product
(B)	Finkelstein Reaction	(Q)	Iodide product
(C)	Sand Meyer Reaction	(R)	Chloride product
(D)	Swart Reaction	(S)	Hydrocarbon product

(1) A-(S); (B)-(Q); (C)-(R); (D)-(P)
(2) A-(R); (B)-(P); (C)-(S); (D)-(P)
(3) A-(P); (B)-(R); (C)-(Q); (D)-(R)
(4) A-(Q); (B)-(R); (C)-(S); (D)-(P)

Ans. **(1)**