CHEMISTRY
JEE-MAIN (February-Attempt) 26
February (Shift-1) Paper

SECTION - A

1. $\underset{(C_4H_8Cl_2)}{A} \xrightarrow[373\ K]{\text{Hydrolysis}} \underset{(C_4H_8O)}{B}$

B reacts with Hydroxyl amine but does not give Tollen's test. Identify A and B.

(1) 1, 1-Dichlorobutane and 2-Butanone

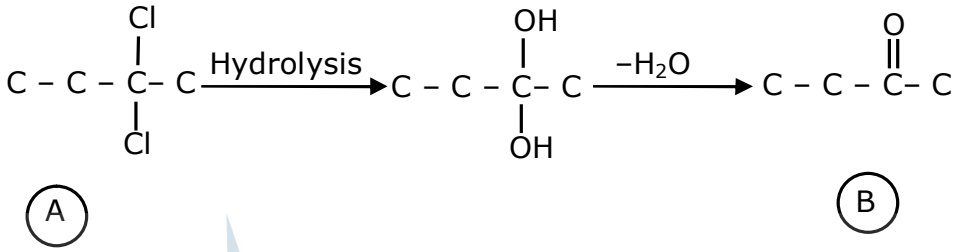
(2) 2, 2- Dichlorobutane and Butan-2-one

(3) 2, 2- Dichlorobutane and Butanal

(4) 1, 1- Dichlorobutane and Butanal

Ans. **(2)**

Sol.



A B

Compound 'B' does not gives Tollen's test due to presence of kenotic group but react with hydroxyl amine

2. Match List-I with List-II.

List –I (Ore)	**List-II (Element Present)**
(a) Kernite	(i) Tin
(b) Cassiterite	(ii) Boron
(c) Calamine	(iii) Fluorine
(d) Cryolite	(iv) Zinc

Choose the most appropriate answer from the option given below :

(1) (a) – (ii), (b) – (iv), (c) – (i), (d) – (iii)

(2) (a) – (ii), (b) – (i), (c) – (iv), (d) – (iii)

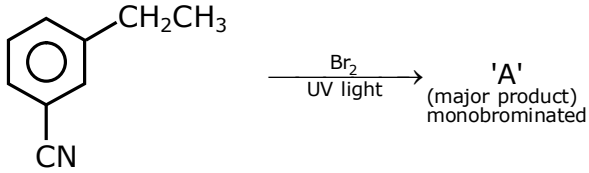
(3) (a) – (i), (b) – (iii), (c) – (iv), (d) – (ii)

(4) (a) – (iii), (b) – (i), (c) – (ii), (d) – (iv)

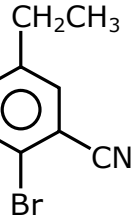
Ans. **(2)**

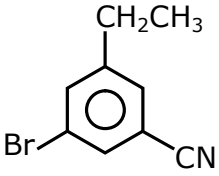
Sol. Fact

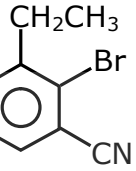
3. For the given reaction :

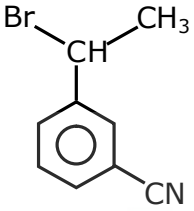


What is 'A' ?

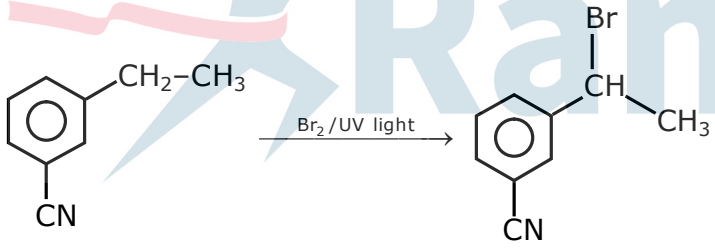
(1) 

(2) 

(3) 

(4) 

Ans. **(4)**

Sol. 

It is bezylic substitution reaction

4. The orbital having two radial as well as two angular nodes is

(1) 5d (2) 4f (3) 3p (4) 4d

Ans. **(1)**

Sol. A.N. = ℓ

R.N = n – ℓ – 1

Orbital	Angular Node	Radial Node
5d	2	2
4f	3	0
3p	1	1
4d	0	1

5. Given below are two statement :

Statement I : o-Nitrophenol is steam volatile due to intramolecular hydrogen bonding

Statement II : o-Nitrophenol has high melting point due to hydrogen bonding.

In the light of the above statements, choose the most appropriate answer from the options given below :

(1) Both Statement I and Statement II are false

(2) Statement I is false but Statement II is true

(3) Both Statement I and Statement II are true

(4) Statement I is true but Statement II is false

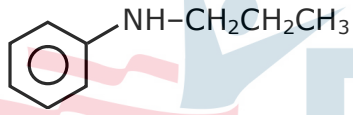
Ans. **(4)**

Sol. o-Nitrophenol is steam volatile due to intramolecular hydrogen H-bonding. but m-Nitrophenol has more melting point due to its symmetry.

6. An amine on reaction with benzenesulphonyl chloride produces a compound insoluble in alkaline solution. This amine can be prepared by ammonolysis of ethyl chloride. The correct structure of amine is :

(1) $CH_3CH_2CH_2\overset{H}{N}-CH_2CH_3$

(2) $CH_3CH_2CH_2NHCH_3$

(3) 

(4) $CH_3CH_2NH_2$

Ans. **(1)**

Sol.

$$R-NH_2 \xrightarrow{C_6H_5SO_2Cl} R-NH-\overset{\overset{O}{\|}}{\underset{\underset{O}{\|}}{S}}-C_6H_5$$

1°–amine

Soluble in alkalines

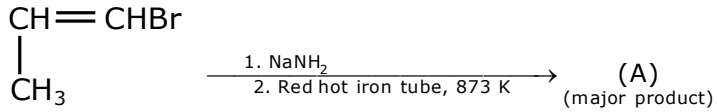
$$R-NH-R \xrightarrow{C_6H_5SO_2Cl} R-\underset{R}{N}-\overset{\overset{O}{\|}}{\underset{\underset{O}{\|}}{S}}-C_6H_5$$

2°–amine

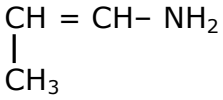
(In soluble in alkalines)

According to the question the amine should be 2°-amine, in which one of the alkyl group should be ethyl, because it can be formed by ammonolysis of ethyl chloride

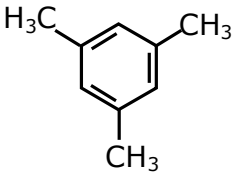
7. For the given reaction :



What is 'A'

(1) 

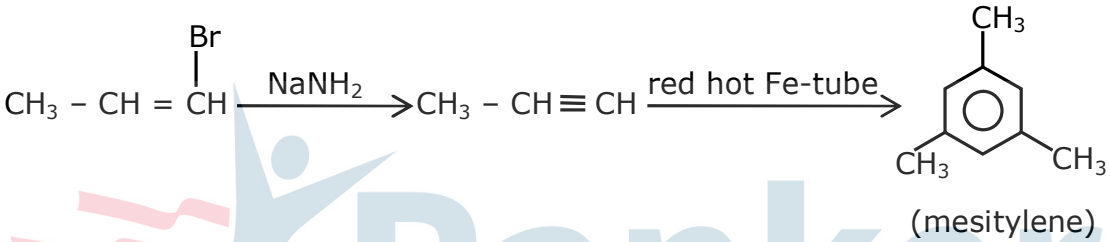
(2) 

(3) 

(4) $CH_3CH_2CH_2NH_2$

Ans. **(3)**

Sol.



(mesitylene)

8. Statement about heavy water are given below

A. Heavy water is used in exchange reactions for the study of reaction mechanisms

B. Heavy water is prepared by exhaustive electrolysis of water

C. Heavy water has higher boiling point than ordinary water

D. Viscosity of H_2O is greater than D_2O

(1) A and B only (2) A and D only

(3) A, B and C only (4) A and C only

Ans. **(3)**

Sol. Fact

9. Which of the following is 'a' FALSE statement ?

(1) Carius tube used in the estimation of sulphur in an organic compound

(2) Kjedahl's method is used for the estimation of nitrogen in an organic compound

(3) Phosphoric acid produced on oxidation of phosphorus present in an organic compound is precipitated as $Mg_2P_2O_7$ by adding magnesia mixture

(4) Carius method is used for the estimation of nitrogen in an organic compound

Ans. **(4)**

Sol. Fact

10. Given below are two statements :

Statement I : A mixture of chloroform and aniline can be separated by simple distillation

Statement II : When separating aniline from a mixture of aniline and water by steam distillation aniline boils below its boiling point

In the light of the above statements, choose the most appropriate answer from the options given below

(1) Statement I is true, statement II is false

(2) Both Statement I and Statement II are true

(3) Both Statement I and Statement II are false

(4) Statement I is false, Statement II is true

Ans. **(2)**

Sol. A suitable method for separating a mixture of aniline and chloro form would be steam distillation. Steam distillation is the process used to separate aromatic compound from a mixture because of their temperature sensitivity. Therefore, steam distillation is an ideal method for their separation

11. Which of the following vitamin is helpful in delaying the blood clotting ?

(1) Vitamin B (2) Vitamin C (3) Vitamin K (4) Vitamin E

Ans. **(3)**

Sol. Vitamin K is used by the body to help blood clot.

12. The presence of ozone in troposphere :

(1) generates photochemical smog (2) Protects us from the UV radiation

(3) Protects us from the X-ray radiation (4) Protects us from greenhouse effect

Ans. **(2)**

Sol. The presence of ozone in troposphere protect earth from ultra violet rays

13. On treating a compound with warm dil. H_2SO_4, gas X is evolved which turns $K_2Cr_2O_7$ paper acidified with dil. H_2SO_4 to a green compound Y. X and Y respectively are :

(1) X = SO_2, Y = $Cr_2(SO_4)_3$ (2) X = SO_2, Y = Cr_2O_3

(3) X = SO_3, Y = Cr_2O_3 (4) X = SO_3, Y = $Cr_2(SO_4)_3$

Ans. **(1)**

Sol. $\underset{(X)}{SO_2} + K_2Cr_2O_7 + H_2SO_4 \longrightarrow \underset{(Y)}{Cr_2(SO_4)_3} + K_2SO_4 + H_2O$

14. Find A, B and C in the following reaction :

$NH_3 + A + CO_2 \rightarrow (NH_4)_2CO_3$

$(NH_4)_2CO_3 + H_2O + B \rightarrow NH_4HCO_3$

$NH_4HCO_3 + NaCl \rightarrow NH_4Cl + C$

(1) A – H_2O ; B – CO_2 ; C – $NaHCO_3$ (2) A – H_2O ; B – O_2 ; C – Na_2CO_3

(3) A – O_2 ; B – CO_2 ; C – Na_2CO_3 (4) A – H_2O ; B – O_2 ; C – $NaHCO_3$

Ans. (1)

Sol. (1) $NH_3 + \underset{(A)}{H_2O} + CO_2 \rightarrow (NH_4)_2CO_3$

(2) $(NH_4)_2CO_3 + H_2O + \underset{(B)}{CO_2} \rightarrow NH_4HCO_3$

(3) $NH_4HCO_3 + NaCl \rightarrow NH_4Cl + \underset{(C)}{NaHCO_3}$

15. Given below are two statements : one is labelled as Assertion A and the other is labelled as Reason R.

Assertion A : Dipole-dipole interactions are the only non-covalent interactions, resulting in hydrogen bond formation

Reason R : Fluorine is the most electronegative element and hydrogen bonds in HF are symmetrical

In the light of the above statements, choose the most appropriate answer from the options given below :

(1) A is false but R is true

(2) Both A and R are true and R is the correct explanation of A

(3) A is true but R is false

(4) Both A and R are true and R is not the correct explanation of A

Ans. (3)

Sol. Fact

16. Match List-I with List-II.

List –I Electronic configuration of elements	**List-II Δ_iH in kJ mol^{-1}**
(a) $1s^2 2s^2$	(i) 801
(b) $1s^2 2s^2 2p^4$	(ii) 899
(c) $1s^2 2s^2 2p^3$	(iii) 1314
(d) $1s^2 2s^2 2p^1$	(iv) 1402

(1) (a) – (ii), (b) – (iii), (c) – (iv), (d) – (i) (2) (a) – (iv), (b) – (i), (c) – (ii), (d) – (iii)

(3) (a) – (i), (b) – (iv), (c) – (iii), (d) – (ii) (4) (a) – (i), (b) – (iii), (c) – (iv), (d) – (ii)

Ans. (1)

Sol. Order of I.E. in second period

Li < B < Be < C < O < N < F < Ne

$2p^1$ $2s^2$ $2p^2$ $2p^4$ $2p^3$

17. Which one of the following lanthanoids does not form MO_2 ?

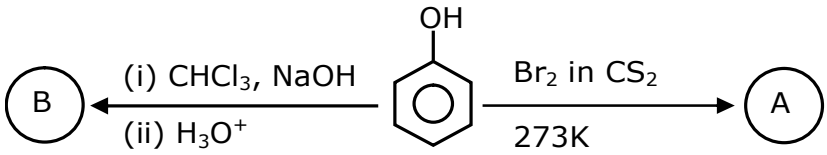
[M is lanthanoid metal]

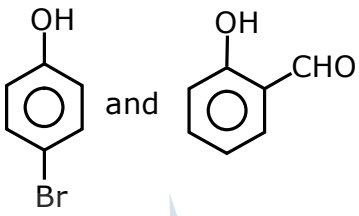
(1) Nd (2) Yb (3) Dy (4) Pr

Ans. **(2)**

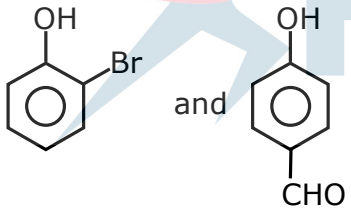
Sol. Fact

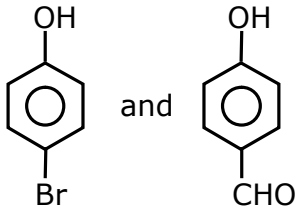
18. Identify the major products A and B respectively in the following reaction of phenol :



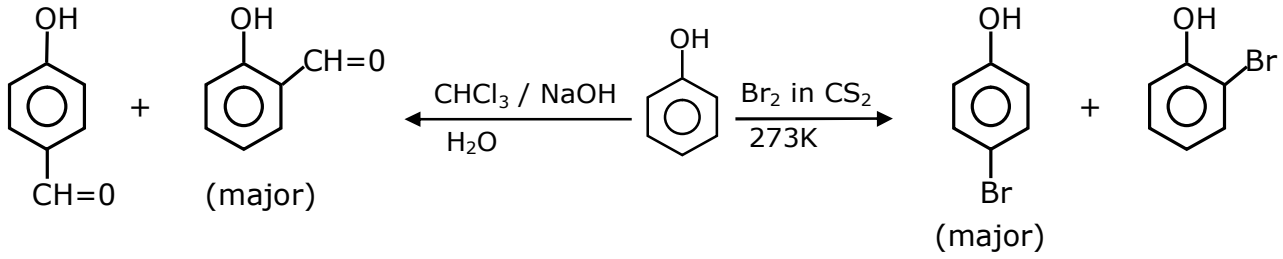
(1) 

(2) 

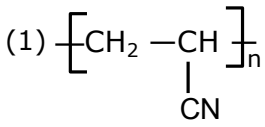
(3) 

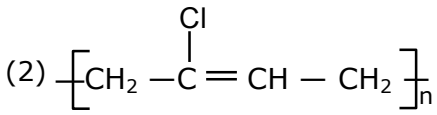
(4) 

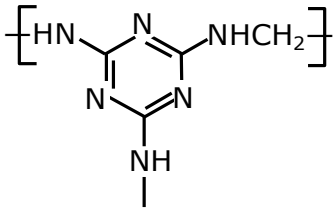
Ans. **(1)**

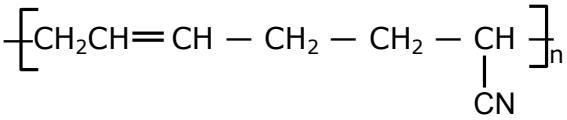
Sol. 

19. The structure of Neoprene is :

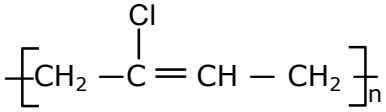
(1) 

(2) 

(3) 

(4) 

Ans. **(2)**

Sol. 

neoprene

20. Compound A used as a strong oxidizing agent is amphoteric in nature. It is the part of lead storage batteries. Compound A is :

(1) Pb_3O_4 (2) PbO_2 (3) $PbSO_4$ (4) PbO

Ans. **(2)**

Sol. lead storage batteries PbO_2 is used. In this O.S. of Pb is +4 so it is always reduced and behaves as oxidizing agent

SECTION - B

1. 224 mL of $SO_{2(g)}$ at 298 K and 1 atm is passed through 100 mL of 0.1 M NaOH solution. The non-volatile solute produced is dissolved in 36 g of water. The lowering of vapour pressure of solution (assuming the solution is dilute) ($P^*_{(H_2O)}$ = 24 mm of Hg) is $x \times 10^{-2}$ mm of Hg, the value of x is _____ .

Ans. **(0.18)**

Sol. The balanced equation is

$SO_2 + 2NaOH \longrightarrow Na_2SO_3 + H_2O$

moles of NaOH = molarity × volume (in litre)

= 0.1 × 0.1

= 0.01 moles

Here NaOH is limiting Reagent

2 mole NaOH $\longrightarrow$ 1 mole Na_2SO_3

0.01 mole NaOH $\longrightarrow \frac{1}{2} \times 0.01$ mole Na_2SO_3

Moles of $Na_2SO_3 \longrightarrow 0.005$ mole

$Na_2SO_3 \longrightarrow 2Na^+ + SO_3^{2-}$

i = 3

Moles of $H_2O = \frac{36}{18} = 2$ moles

Accoding to RLVP -

$$\frac{P_A^o - P_A}{P_A^o} = iX_B$$

$$\frac{P_A^o - P_A}{P_A^o} = \frac{in_A}{in_A + n_B} \quad (in_A \simeq 0)$$

$n_B << n_A$

$\{n_A + n_B \simeq n_A\}$

$$\frac{P_A^o - P_A}{P_A^o} = i \times \frac{n_B}{n_A}$$

$$\frac{2H - P_A}{2H} = 3 \times \frac{0.005}{2}$$

$\Rightarrow$ 2H – P_A = 0.18

Lowering in pressure = 0.18 mm of Hg

lowering in pressure = 18×10^{-12} mm of Hg

$\boxed{x = 18}$

2. Consider the following reaction

$MnO_4^- + 8H^+ + 5e^- \rightarrow Mn^{+2} + 4H_2O$, $E^\circ = 1.51$ V.

The quantity of electricity required in Faraday to reduce five moles of MnO_4^- is____.

Ans. **(25)**

Sol. $MnO_4^- + 8H^+ + 5e^- \rightarrow Mn^{+2} + 4H_2O$

1 mole of MnO_4^- require 5 faraday charge

5 moles of MnO_4^- will require 25 faraday charge.

3. 3.12 g of oxygen is adsorbed on 1.2 g of platinum metal. The value of oxygen adsorbed per gram of the adsorbent at 1 atm and 300 K in L is _____.

[R = 0.0821 L atm K^{-1} mol^{-1}]

Ans. **(2)**

Sol. Moles of $O_2 = \frac{3.12}{32} = 0.0975$

volume of $O_2 = \frac{nRT}{p} = \frac{0.0975 \times 0.082 \times 300}{1}$

$= 2.3985L \simeq 2.4$ L

volume of O_2 absorbed per gm of pt $= \frac{2.4}{1.2} = 2$

4. The number of significant figures in 50000.020×10^{-3} is _____.

Ans. **(7)**

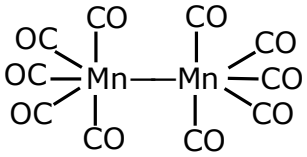
Sol. $\underline{50000.020} \times 10^{-3}$

Number of significant figure = 7

5. Number of bridging CO ligands in $[Mn_2(CO)_{10}]$ is _____.

Ans. **(0)**

Sol. Fact



6. For a chemical reaction $A + B \rightleftharpoons C + D$

($\Delta_r H^{\ominus} = 80$ kJ mol^{-1}) the entropy change $\Delta_r S^{\ominus}$ depends on the temperature T (in K) as $\Delta_r S^{\ominus} = 2T$ (J K^{-1} mol^{-1}).

Minimum temperature at which it will become spontaneous is _____K.

Ans. **(200)**

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

To make the process spontaneous

$\Delta G° < 0$

$\Delta H° - T\Delta S° < 0$

$$T > \frac{\Delta H°}{\Delta S°}$$

$$T > \frac{80000}{2T}$$

$2T^2 > 80000$

$T^2 > 40000$

$T > 200$

The minimum temperature to make it spontaneous is 200 K.

7. An exothermic reaction $X \rightarrow Y$ has an activation energy 30 kJ mol^{-1}. If energy change ΔE during the reaction is –20 kJ, then the activation energy for the reverse reaction in kJ is _____.

Ans. **(50)**

Sol. $\Delta H = E_{a,f} - E_{a,b}$

$-20 = 30 - E_{a,b}$

$E_{a,b} = 50$ kJ/mole

8. A certain gas obeys $P(V_m - b) = RT$. The value of $\left(\frac{\partial Z}{\partial P}\right)_T$ is $\frac{xb}{RT}$. The value of x is _____.

Ans. **(1)**

Sol. $P(v - b) = RT$

$PV - Pb = RT$

$\frac{PV}{RT} - \frac{Pb}{RT} = 1$

$Z = 1 + \frac{PV}{RT}$

$\frac{dz}{dp} = 0 + \frac{b}{RT}$

$\Rightarrow \frac{b}{RT} = \frac{xb}{RT}$

$x = 1$

9. A homogeneous ideal gaseous reaction $AB_{2(g)} \rightleftharpoons A_{(g)} + 2B_{(g)}$ is carried out in a 25 litre flask at 27°C. The initial amount of AB_2 was 1 mole and the equilibrium pressure was 1.9 atm. The value of K_p is $x \times 10^{-2}$. The value of x is _____.
[$R = 0.08206\ dm^3\ atm\ K^{-1}\ mol^{-1}$]

Ans. **(74)**

Sol. $AB_{2(g)} \rightleftharpoons A_{(g)} + 2B_{(g)}$

initial $1-x$ x $2x$

at eq. $\frac{1}{1+2x}$ $\frac{1}{1.9}$

By ratio of pressure & mole

$\frac{1}{1+2x} = \frac{0.985}{1.9}$

$1.9 = 0.985 + 1.9\ x$

$0.915 = 1.9\ x$

$\frac{0.915}{1.9} = x\ ;\ K_p = \frac{4x^2.x}{(1-x)}\left[\frac{P_{total}}{n_{total}}\right]^2$

$\Rightarrow \frac{4x^3}{1-x}\left(\frac{RT}{V}\right)^2$

On substituting the values

$K_p = 74 \times 10^{-2}$

10. Dichromate ion is treated with base, the oxidation number of Cr in the product formed is :

Ans. **(6)**

Sol. $Cr_2O_7^{2-} + 2OH^- \rightleftharpoons 2CrO_4^{2-} + H_2O$

$2CrO_7^{2-}$

$x + (-2 \times 4) = -2$

$x = 6$