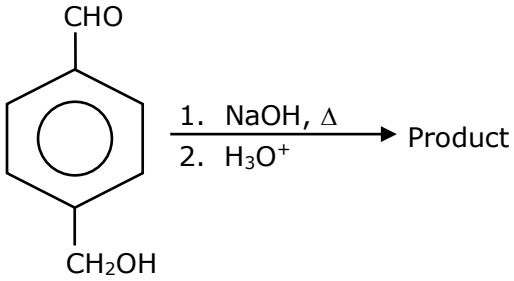
CHEMISTRY
JEE-MAIN (August-Attempt)
31 August (Shift-2) Paper

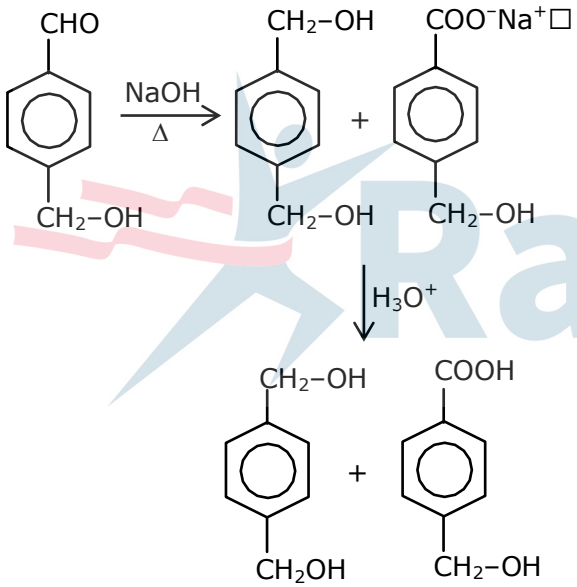
SECTION - A

1. For the reaction given below:



The compound which is not formed as a product in the reaction is a:
(1) Compound with both alcohol and acid functional groups
(2) dicarboxylic acid
(3) diol
(4) monocarboxylic acid

Sol. **(2)**



2. In which one of the following sets all species show disproportionation reaction?
(1) MnO_4^-, ClO_2^-, Cl_2 and Mn^{3+}
(2) ClO_4^-, MnO_4^-, ClO_2^- and F_2
(3) ClO_2^-, F_2, MnO_4^- and $Cr_2O_7^{2-}$
(4) $Cr_2O_7^{2-}$, MnO_4^-, ClO_2^- and Cl_2

Sol. **(1)**

Motion Bonus

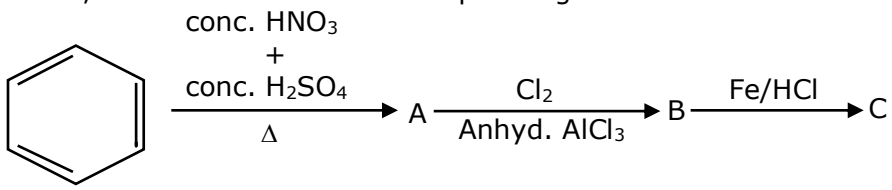
No option contains all species that show disproportionation reaction.

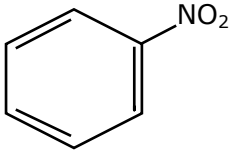
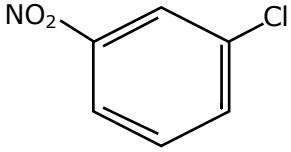
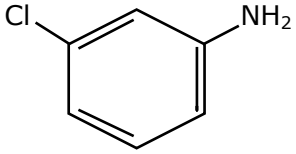
MnO_4^-

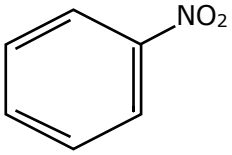
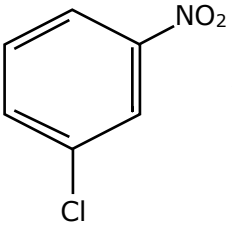
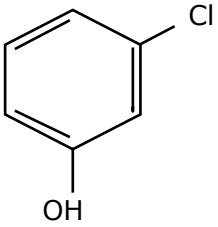
Mn is in +7 oxidation state (highest) hence cannot be simultaneously oxidized or reduced.

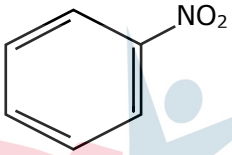
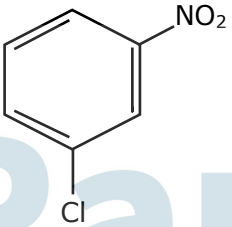
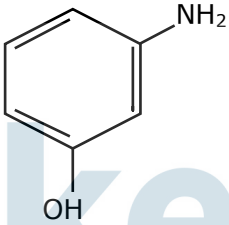
Rankers

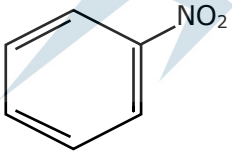
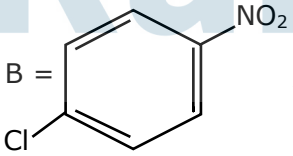
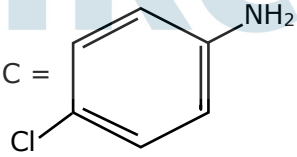
3. Identify correct A, B and C in the reaction sequence given below:



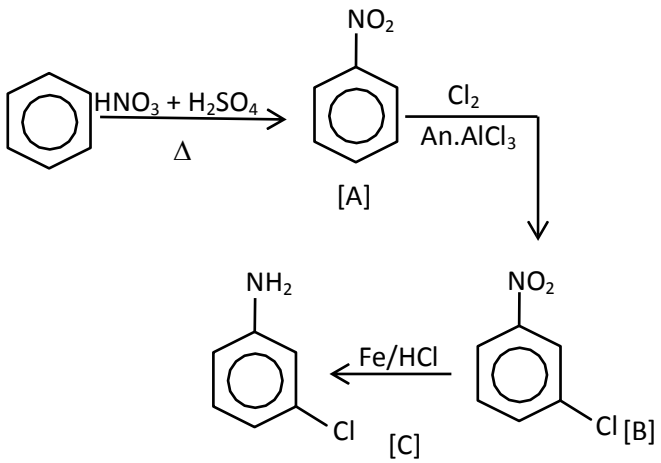
(1) A =  , B =  , C = 

(2) A =  , B =  , C = 

(3) A =  , B =  , C = 

(4) A =  , B =  , C = 

Sol. **(1)**



Rankers

4. The deposition of X and Y on ground surfaces is referred as wet and dry depositions, respectively. X and Y are:

(1) X = Ammonium salts, Y = CO_2 (2) X = SO_2, Y = Ammonium salts

(3) X = Ammonium salts, Y = SO_2 (4) X = CO_2, Y = SO_2

Sol. **(3)**

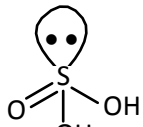
Oxides of nitrogen and sulphur are acidic and settle down on ground as dry depostion.

Ammonium salts in rain drops result in wet depostion

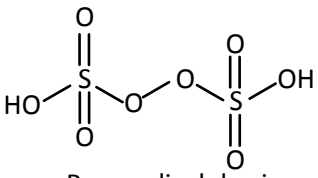
5. The number of S=O bonds present in sulphurous acid, peroxodisulphuric acid and pyrosulphuric acid, respectively are:

(1) 1, 4 and 3 (2) 2, 4 and 3 (3) 2, 3 and 4 (4) 1, 4 and 4

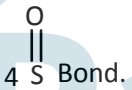
Sol. **(4)**

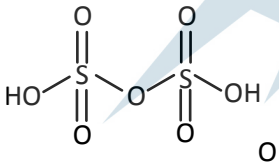


Sulphurous acid

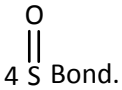


Peroxodisulphuric acid

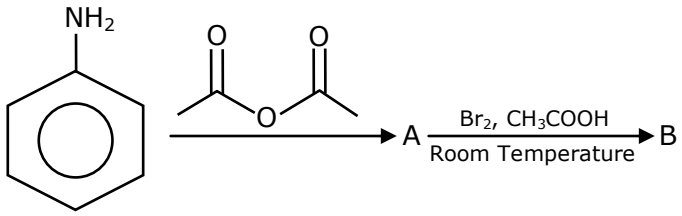




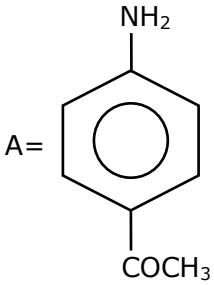
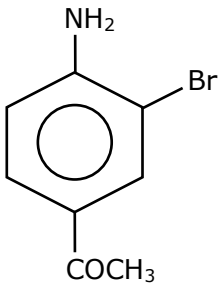
Pyrosulphuric acid

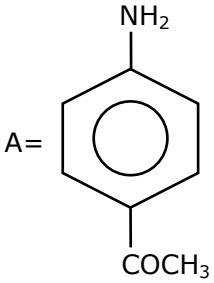
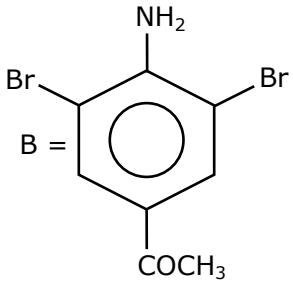


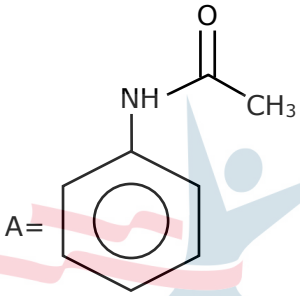
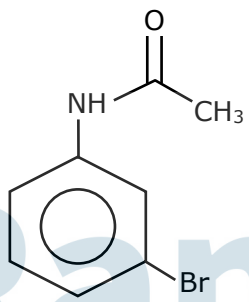
6. The major products A and B formed in the following reaction sequence are:

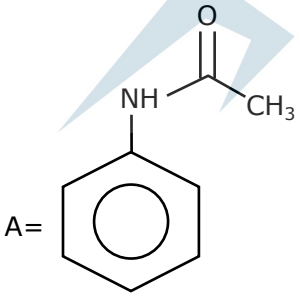
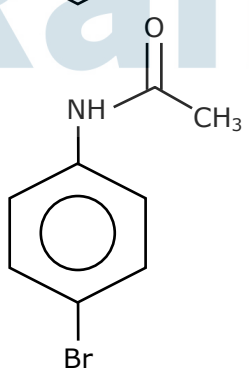


Rankers

(1) A=  , B = 

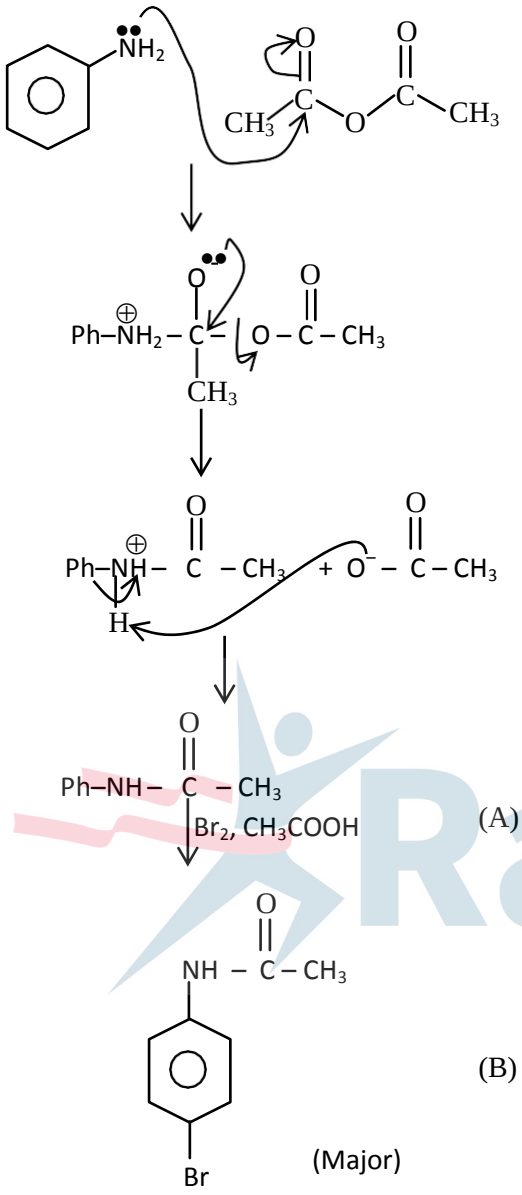
(2) A=  , B = 

(3) A=  , B = 

(4) A=  , B = 

Sol. (4)

Rankers



7. Given below are two statements: one is labelled as **Assertion (A)** and the other is labelled as **Reason (R).**
Assertion (A): Lithium salts are hydrated.
Reason (R) : Lithium has higher polarising power than other alkali metal group members.
In the light of the above statements, choose the **most appropriate** answer from the options given below:
(1) Both **(A)** and **(R)** are correct but **(R)** is not the correct explanation of **(A)**.
(2)**(A)** is correct but **(R)** is not correct.
(3)**(A)** is not correct but **(R)** is correct.
(4) Both **(A)** and **(R)** are correct and **(R)** is the correct explanation of **(A)**.

Sol. **(1)**
Lithium salts are hydrated due to high hydration energy of Li^+
Li^+ due to smallest size in IA group has highest polarizing power.

8. Which among the following is not a polyester?

(1)Glyptal

(2) PHBV

(3) Dacron

(4)Novolac

Sol. **(4)**

Novalac is a linear polymer of [Ph – OH + HCHO].

So ester linkage not present.

So novalac is not a polyester.

9. Which one of the following statements is **incorrect?**

(1) Dihydrogen is produced on reacting zinc with HCl as well as NaOH (aq.)

(2) Atomic hydrogen is produced when H_2 molecules at a high temperature are irradiated with UV radiation.

(3) Bond dissociation enthalpy of H_2 is highest among diatomic gaseous molecules which contain a single bond.

(4) At around 2000K, the dissociation of dihydrogen into its atoms is nearly 8.1%

Ans. **(4)**

Atomic hydrogen is produced at high temperature in an electric are or under ultraviolet radiations. The dissociation of dihydrogen at 2000 K is only 0.081%

H–H bond dissociation enthalpy is highest for a single bond for any diatomic molecule.

Dihydrogen can be produced onreacting Zn with dil. HCl as well as NaOH(aq).

10. The incorrect expression among the following is:

(1) For isothermal process $w_{reversible} = -nRT\ln\frac{V_f}{V_i}$

(2) $\ln K = \frac{\Delta H^0 - T\Delta S^0}{RT}$

(3) $K = e^{-\Delta G^0/RT}$

(4) $\frac{\Delta G_{system}}{\Delta S_{Total}} = -T$ (at constant P)

Sol. **(2)**

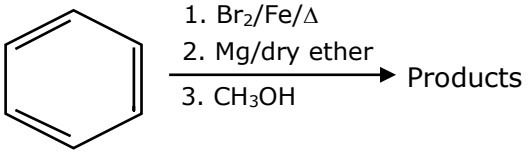
Option (2)is incorrect

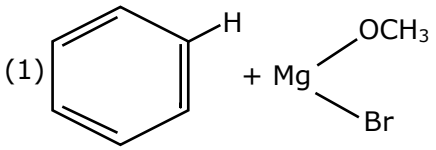
$\Delta G^o = -RT\ \ell nK$

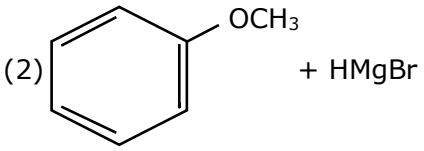
$\Delta H^o - T\Delta S^o = -RT\,\ell nK$

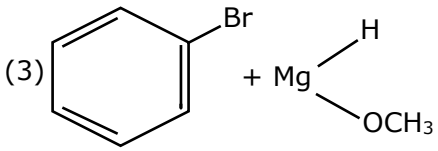
$\ell nK = -\left[\frac{\Delta H^o - \Delta S^o}{RT}\right]$

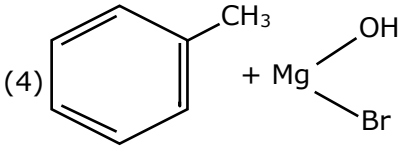
11. For the following sequence of reactions, the correct products are:



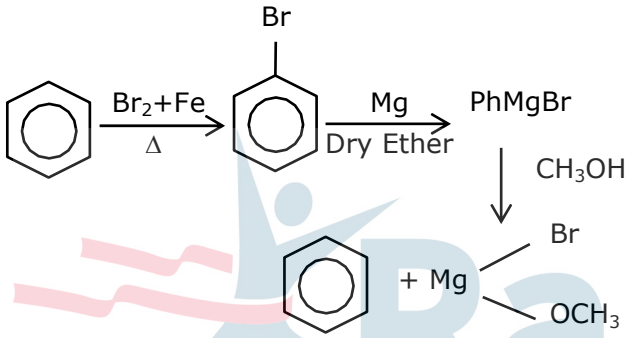
(1) 

(2) 

(3) 

(4) 

Sol. **(1)**



12. Which one of the following correctly represents the order of stability of oxides, X_2O; (X=Halogen)?

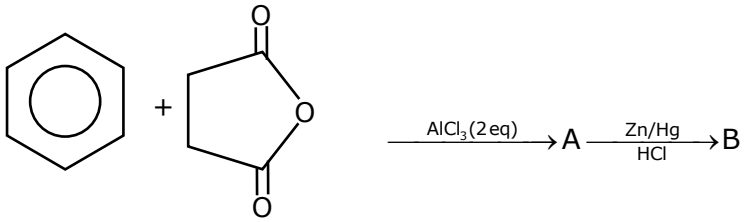
(1) Br > Cl > I (2) I > Cl > Br (3) Br > I > Cl (4) Cl > I > Br

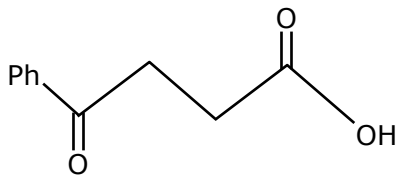
Sol. **(2)**

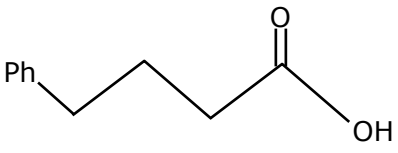
Stability of oxides of Halogens is

I > Cl > Br

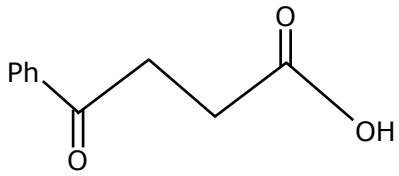
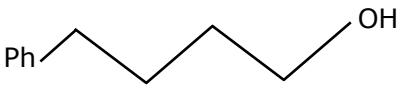
13. The structures of A and B formed in the following reaction are: [Ph = $-C_6H_5$]

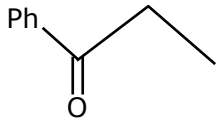
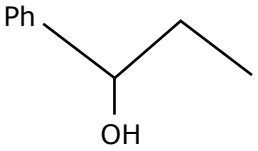


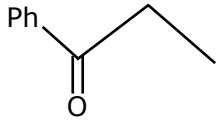
(1) **A =** 

, B = 

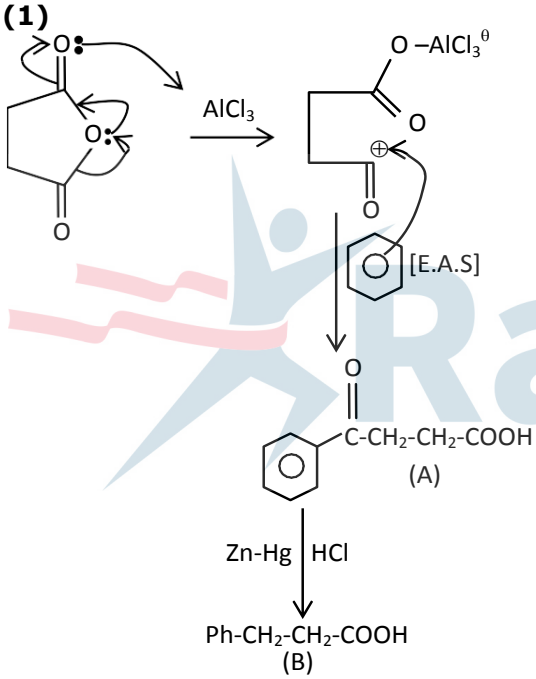
Rankers

(2) **A =**  **, B =** 

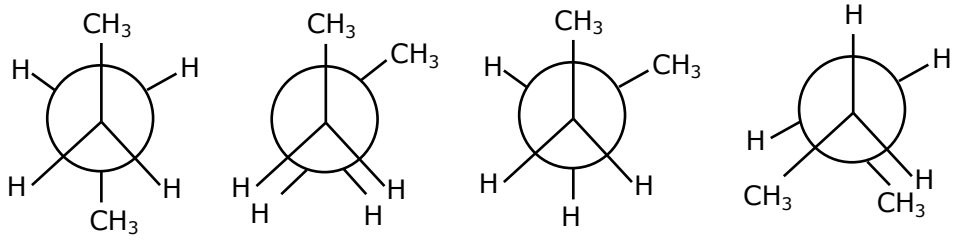
(3) **A =**  **, B =** 

(4) **A =**  **, B =** 

Sol. **(1)**



14. Arrange the following conformational isomers of n-butane in order of their increasing potential energy:



I **II** **III** **IV**

(1) II < III < IV < I
(2) I < III < IV < II
(3) I < IV < III < II
(4) II < IV < III < I

Rankers

Sol. **(2)**
More stable less potential energy.
Stability order : I > III > IV > II
So
Potential energy : II > IV > III > I

15. Which of the following is NOT an example of fibrous protein?
(1) Myosin (2) Collagen (3) Keratin (4) Albumin

Sol. **(4)**
Keratin, collagen and myosin are example of fibrous protein.

16. Match List-I with List-II

List-I (Metal Ion)	**List-II (Group in Qualitative analysis)**
(a) Mn^{2+}	(i) Group - III
(b) As^{3+}	(i) Group – II A
(c) Cu^{2+}	(i) Group - IV
(d) Al^{3+}	(i) Group – II-B

Choose the **most appropriate** answer from the options given below:
(1) (a)-(iii), (b)-(iv), (c)-(ii), (d)-(i) (2) (a)-(i), (b)-(ii), (c)-(iii), (d)-(iv)
(3) (a)-(iv), (b)-(ii), (c)-(iii), (d)-(i) (4) (a)-(i), (b)-(iv), (c)-(ii), (d)-(iii)

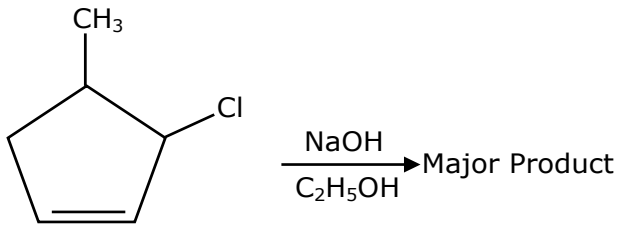
Sol. **(1)**
$Mn^{2+} \rightarrow$ III group , $As^{3+} \rightarrow$ II B group,
$Cu^{2+} \rightarrow$ II A group , $Al^{3+} \rightarrow$ IV group

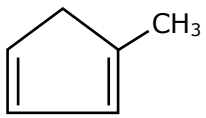
17. The Eu^{2+} ion is a strong reducing agent in spite of its ground state electronic configuration (outermost): [Atomic number of Eu = 63]

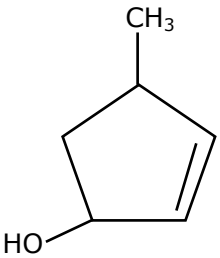
(1) $4f^6$ (2) $4f^6 6s^2$ (3) $4f^7$ (4) $4f^7 6s^2$

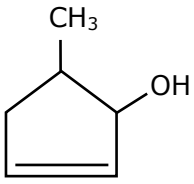
Sol. **(3)**
$Eu \rightarrow [Xe]^4f^7 6s^2$
$Eu^{2+} \rightarrow [Xe]4f^7$

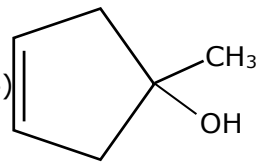
18. The major product of the following reaction is:



(1) 

(2) 

(3) 

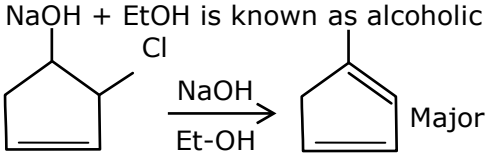
(4) 

Rankers

Sol. **(3)**

Motion Ans. 1

NaOH + EtOH is known as alcoholic NaOH, so it give E^2 reaction with given alkyl halide.

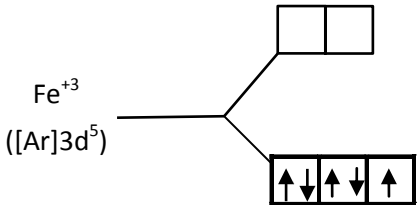


19. Spin only magnetic moment in BM of $[Fe(CO)_4\ (C_2O_4]^+$ is:

(1)1 (2) 0 (3) 5.92 (4) 1.73

Sol. **(4)**

$[Fe(CO)_4(C_2O_4)]^+$



One unpaired electron

Spin only magnetic moment

$= \sqrt{3}$ B.M. = 1.73 BM

20. Match **List-I**with**List-II**:

List-I (Parameter)	**List-II (Unit)**
(a) Cell constant	(i) S cm^2 mol^{-1}
(b) Molar conductivity	(ii) Dimensionless
(c) Conductivity	(iii) m^{-1}
(d) Degree of dissociation of electrolyte	(iv) $\Omega^{-1}m^{-1}$

Choose the **most appropriate** answer from the options given below:

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

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

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

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

Sol. **(3)**

Cell constant = $\left(\frac{\ell}{A}\right) \Rightarrow$ Units = m^{-1}

Molar conductivity (Λ_m) $\Rightarrow$ Units = Sm^2 $mole^{-1}$

Conductivity (K) $\Rightarrow$ Units = S m^{-1}

Degree of dissociation (α) $\rightarrow$ Dimensionless

$\therefore$ (a) – (iii)

(b) – (i)

(c) – (iv)

(d) – (ii)

Rankers

Section B

1. In the electrolytic refining of blister copper, the total number of main impurities, from the following, removed as anode mud is_____.
Pb, Sb, Se, Te, Ru, Ag, Au and Pt

Ans. 6
Anode mud contains Sb, Se, Te, Ag, Au and Pt

2. 1.22 g of an organic acid is separately dissolved in 100g of benzene (K_b = 2.6 K kg mol^{-1}) and 100 g of acetone (K_b = 1.7 K kg mol^{-1}). The acid is known to dimerize in benzene but remain as a monomer in acetone. The boiling point of the solution in acetone increases by 0.17°C. The increase in boiling point of solution in benzene in °C is $x\times10^{-2}$. The value of x is_____. (Nearest integer). [Atomic mass : C = 12.0, H = 1.0, O = 16.0]

Ans. 13
With benzene as solvent
$\Delta T_b = i\, K_b m$

$$\Delta T_b = \frac{1}{2}\times 2.6\times \frac{1.22/M_w}{100/1000} \quad \ldots(1)$$

With Acetone as solvent
$\Delta T_b = i\, K_b m$

$$0.17 = 1\times 1.17\times \frac{1.22/M_w}{100/1000} \quad \ldots(2)$$

(1)/(2)

$$\frac{\Delta T_b}{0.17} = \frac{\frac{1}{2}\times 2.6 + \frac{1.22/M_w}{100/1000}}{1\times 1.17\times \frac{1.22/M_w}{100/1000}}$$

$$\Delta T_b = \frac{0.26}{2}$$

$\Delta T_b = 13\times10^{-2} \quad \Rightarrow x = 13$

3. The empirical formula for a compound with a cubic close packed arrangement of anions and with cations occupying all the octahedral sites in A_xB. the value of x is_____.

Ans. 1
Anions froms CCP or FCC (A^-) = 4 A^- per unit cell
Cations occupy all octahedral voids (B^+) = 4 B^+ per unit cell
cell formula $\rightarrow$ A_4B_4
Empirical formula $\rightarrow$ AB
$\rightarrow$ (x = 1)

4. Sodium oxide reacts with water to produce sodium hydroxide. 20.0 g of sodium oxide is dissolved in 500 mL of water. Neglecting the change in volume, the concentration of the resulting NaOH solution is _____$\times 10^{-1}$ M. (Nearest integer).
[Atomic mass : Na = 23.0, O = 16.0, H = 1.0]

Rankers

Ans. 13

$Na_2O + H_2O \rightarrow 2NaOH$

$\frac{20}{62}$ moles

Moles of NaOH formed = $\frac{20}{62} \times 2$

$[NaOH] = \frac{\frac{40}{62}}{\frac{500}{1000}} = 1.29\ M = 13 \times 10^{-1} M$ (Nearest integer)

5. The transformation occurring in Duma's method is given below:

$$C_2H_7N + \left(2x + \frac{y}{2}\right)CuO \rightarrow xCO_2 + \frac{y}{2}H_2O + \frac{z}{2}N_2 + \left(2x + \frac{y}{2}\right)Cu$$

The value of y is _____. (Integer answer).

Ans. 7

$$C_2H_7N + \left(2x + \frac{y}{2}\right)CuO \rightarrow xCO_2 + \frac{y}{2}H_2O + \frac{z}{2}N_2 + \left(2x + \frac{y}{2}\right)Cu$$

On balancing

$$C_2H_7N + \frac{15}{2}CuO \rightarrow 2CO_2 + \frac{7}{2}H_2O + \frac{1}{2}N_2 + \frac{15}{2}Cu$$

On Comparing

y = 7

6. The pH of a solution obtained by mixing 50 mL of 1 M HCl and 30 mL of 1 M NaOH is $x \times 10^{-4}$. The value of x is _____. (Nearest integer).

[log 2.5 = 0.3979]

Ans. 6021

6021

$$HCl\ (aq.) + NaOH\ (aq.) \rightarrow NaCl(aq.) + H_2O(\ell)$$

	50 ml,1M	30ml, 1M	–	–
t = 0	50 mm	30 mm		
t = ∞	20 mm	–		

$[HCl] = \frac{20}{80} = \frac{1}{4} M = 2.5 \times 10^{-1} M$

$pH = -\log 2.15 \times 10^{-1} = 1 - 0.3979 = 0.6021$

$pH = 6021 \times 10^{-4}$

7. According to molecular orbital theory, the number of unpaired electron(s) in O_2^{2-} is:

Ans. 0

Molecular orbital configuration of O_2^{2-} is

$\sigma_{1s}^2 \sigma_{1s}^{*2} \sigma_{2s}^2 \sigma_{2s}^{*2} \left(\pi 2p_x^2 = \pi 2p_y^2\right) \left(\pi_{2px}^{*2} = \pi_{2py}^{*2}\right)$

Zero unpaired electron

Rankers

8. CH_4 is adsorbed on 1 g charcoal at 0°C following the Freundlich adsorption isotherm. 10.0 mL of CH_4 is adsorbed at 100 mm of Hg, whereas 15.0 mL is adsorbed at 200 mm of Hg. The volume of CH_4 adsorbed at 300 mm of Hg is 10^{x}mL. the value of x is _____ $\times 10^{-2}$. (Nearest integer).
[Use $\log_{10} 2 = 0.3010$, $\log_{10} 3 = 0.4771$]

Ans. 128

We know

$\frac{x}{m} = KP^{1/n}$; using $(x \propto V)$

$\Rightarrow \quad \frac{10}{1} = K \times (100)^{1/n}$ ...(1)

$\frac{15}{1} = K \times (200)^{1/n}$ ...(2)

$\frac{V}{1} = K \times (300)^{1/n}$ ...(3)

Divide

(2)/ (1)

$\frac{15}{10} = 2^{1/n}$

$\log\left(\frac{3}{2}\right) = \frac{1}{n}\log 2$

$\frac{1}{n} = \frac{\log 3 - \log 2}{\log 2} = \frac{0.4771 - 0.3010}{0.3010}$

$\frac{1}{n} = 0.585$

Divide

(3)/(1)

$\frac{V}{10} = 3^{1/n}$

$\log\left(\frac{V}{10}\right) = \frac{1}{n}\log 3, \quad \log\left(\frac{V}{10}\right) = 0.585 \times 0.4771 = 0.2791$

$\frac{V}{10} = 10^{0.279}$ $\Rightarrow V = 10 \times 10^{0.279}$

$\Rightarrow V = 10^{1.279} = 10^{x}$

$\Rightarrow x = 1.279$

$\Rightarrow x = 128 \times 10^{-2}$ (Nearest integer)

9. For the reaction A $\rightarrow$ B, the rate constant k (in s^{-1}) is given by $\log_{10} k = 20.35 - \frac{(2.47 \times 10^3)}{T}$

The energy of activation in kJ mol^{-1} is_____. (Nearest integer)
[Given : R = 8.314 J K^{-1} mol^{-1}]

Ans. 47

Given $\log K = 20.35 - \frac{2.47 \times 10^3}{T}$

We know $\log K = \log A - \frac{E_a}{2.303RT}$

Rankers

$\Rightarrow \quad \frac{E_a}{2.303RT} = 2.47 \times 10^3$

$E_a = 2.47 \times 10^3 \times 2.303 \times \frac{8.314}{1000}$ KJ/mole

=47.29 = 47 (Nearest integer)

10. The value of magnetic quantum number of the outermost electron of Zn^+ ion is _____. (Integer answer)

Ans. 0

$Zn^+ \rightarrow 1s^2 2s^2 2p^6 3p^6 3d^{10} 4s^1$

Outermost electron is in 4s subshell

m = 0

Rankers