CHEMISTRY
JEE-MAIN (July-Attempt)
27 July (Shift-1) Paper Solution

SECTION - A

1. 250 g solution of D-glucose in water contains 10.8% of carbon by weight. The molality of the solution is nearest to
(Given: Atomic weights are, H,1 u; C,12 u; O,16 u)
(A) 1.03 (B) 2.06 (C) 3.09 (D) 5.40

Sol. **B**
$C_6H_{12}O_6 \rightarrow$ Glucose
We know: $\frac{\text{mass of C}}{\text{mass of glucos e}} = \frac{72}{180}$
Given: % C = 10.8 = $\frac{\text{mass of C}}{\text{mass of solution}} \times 100$
$\frac{10.8 \times 250}{100}$ = mass of C ⇒ Mass of C = 27 gm
∴ mass of glucose = 67.5 gm
∴ moles of glucose = 0.375 moles
Mass of solvent = 250 – 67.5 gm = 182.5 gm
∴ Molality = $\frac{0.375}{0.1825} = 2.055 \approx 2.06$

2. Given below are two statements.
Statement I: O_2, Cu^{2+}, and Fe^{3+} are weakly attracted by magnetic field and are magnetized in the same direction as magnetic field.
Statement II : NaCl and H_2O are weakly magnetized in opposite direction to magnetic field.
In the light of the above statements, choose most appropriate answer from the options given belwo:
(A) Both statement I and statement II are correct.
(B) Both statement I and statement II are incorrect
(C) statement I is correct but statement II is incorrect
(D) statement I is incorrect but statement II is correct

Sol. **A**
(A) O_2, Cu^{+2} and Fe^{+3} are peramegnetic substance weakly attracted by magnetic field (Correct)
(R) H2O and NaCl are diamagnetic substance and weakly oppose by magnetic field.
[Correct Option (A)]

3. Given below are two statement. One labelled as Assertion A and the other is labelled as Reason R.
Assertion A: Energy of 2s orbital of hydrogen atom is greater than that of 2s orbital of lithium.
Reason R: Energies of the orbitals in the same subshell decrease with increase in the atomic number.
In the light of the above statements, choose the correct answer from the options given below.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is NOT the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

Sol. **A**
(A) Energy of 2s orbital H atom > G atom
(R) Energy of orbital in sami sub shell dec. with ine in atomic number

4. Given below are two statement. One is labelled as assertion A and the other is labelled as Reason R.

Assertion A: Activated charcoal adsorbs SO_2 more efficiently than CH_4.

Reason R: Gases with lower critical temperatures are readily adsorbed by activated charcoal.

In the light of the above statements, choose the correct answer from the options given below.

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

(B) Both A and R are correct but R is NOT the correct explanation of A.

(C) A is correct but R is not correct

(D) A is not correct but R is correct.

Sol. **C**

Adsorption of gas $\propto$ polarity of gas

$\propto$ critical temperature

(A) Adsorption $\rightarrow$ SO_2 > CH_4

Polar gas   Non polar gas

(Correct)

(R) Lewer critical Himp-lower adsorption

(Wrong)

Ans. : (C)

5. Boiling point of a 2% aqueous solution of a non-volatile solute A is equal to the boiling point of 8% aqueous solution of a non-volatile solute B. The relation between molecular weights of A and B is

(A) $M_A=4M_B$ (B) $M_B=4M_A$ (C) $M_A=8M_B$ (D) $M_B=8M_A$

Sol. **B**

$\pi A = \pi B \rightarrow$ Isotoric

$C_1RT = C_2RT$

$C_1 = C_2$

$\frac{2}{M_A} \times \frac{1}{100} = \frac{8\times1}{M_B\times100} \Rightarrow \frac{2}{M_A} \times \frac{1}{100} = \frac{8\times1}{M_B\times100}$

$\frac{M_A}{M_B} = \frac{1}{4}$

$\boxed{M_B = 4M_A}$

Ans. (B) option

6. The incorrect statement is

(A) The first ionization enthalpy of K is less than that of Na and Li.

(B) Xe does not have the lowest first ionization enthalpy in its group.

(C) The first ionization enthalpy of element with atomic number 37 is lower than that of the element with atomic number 38.

(D) The first ionization enthalpy of Ga is higher than that of the d-block element with atomic number 30.

Sol. **D**

(A) Li, Na, K ↓ (1.E↓) So, K< Na< Li

(B) In the period, noble gas has maximum 1.E

(C) atomic number 37 ⇒ 2, 8, 8, 18 + 1 ⇒ s Block S^1

atomic number 38 ⇒ 2, 8, 8, 18 + 2 ⇒ s Block S^2

So, Z = 37 has lesser 1.E than

Z = 38

(D) actually the first 1.E of Zn > $1.E_1$ of Ga

Due to completely filled orbitals

7. Which of the following methods are not used to refine any metal?

A. Liquation
B. Calcination
C. Electrolysis
D. Leaching
E. Distillation

Choose the correct answer from the options given below:

(A) B and D only
(B) A, B, D and E only
(C) B, D and E only
(D) A, C and E only

Sol. **A**

Methods for concentration	methods for refining
Calcination	Liquation
Leaching	Electrolysis
	Distillation

8. Given below are two statements.

Statement I: Hydrogen peroxide can act as an oxidizing agent in both acidic and basic conditions.

Statement II: Density of hydrogen peroxide at 298 K is lower than that of D_2O.

In the light of the above statements, choose the correct answer from the options given below.

(A) Both statement I and statement II are true
(B) Both statement I and II statement II are false
(C) statement I is true but statement II is false
(D) statement I is false but statement II is true

Sol. **C**

$H_2\overset{-1}{O_2} \rightarrow H_2O + O_2$

→ the oxidation state of oxygen in hydrogen peroxide is –1, means it can be oxidized to zero; and reduced to –2. Hence it can act as both oxidising as was as reducing agent; so statement is correct

→ Density of H_2O_2 is 1.44 g/ml which is more than D_2O {1.106 g/ml} at 298 K so statement 2 is false

9. Given below are two statements.

Statement I: The chlorides of Be and Al have Cl-bridged structure. Both are soluble in organic solvents and act as Lewis bases.

Statement II: Hydroxides of Be and Al dissolve in excess alkali to give beryllate and aluminate ions.

In the light of the above statements, choose the correct answer from the options given below.

(A) Both statement I and statement II are true

(B) Both statement I and statement II are false

(C) statement I is true but statement II is false

(D) statement I is false but statement II is true

Sol. **D**

Statement-I false

$BeCl_2$ and $AlCl_3$ act as lewis acid due to incomplete octet and having vacant orbitals

$Be(OH)_2 + OH^- \rightarrow [Be(H_2O)_4]^2$

Berylate ion

$Al(OH)_3 + OH^- \rightarrow [Al(OH)_4]^-$

Aluminate ion

⇒ so statement-II is true

10. Which oxoacid of phosphorous has the highest number of oxygen atoms present in its chemical formula?

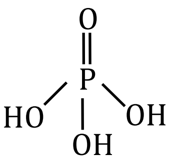
(A) Pyrophosphorus acid (B) Hypophosphoric acid

(C) Phosphoric acid (D) Pyrophosphoric acid

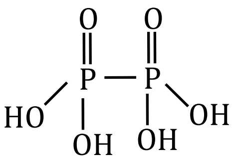
Sol. **D**

Which oxo acid of phasphorous has the highest number of oxygen atoms present in its chemical formull

Phosphoric acid — H_3PO_4



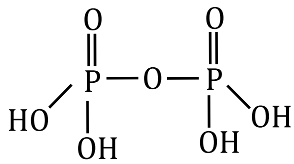
Hypo phosphoric acid — $H_2P_2O_6$



2(Phosphoric acid) – H_2O_2

⇒ Hypophosphoric acid

Pyrophosphoric acid — $H_4P_2O_7$



$2(H_3PO_4) - H_2O \Rightarrow H_4P_2O_7$

2(Phosphoric acid – H_2O)

⇒Pyro phosphoric acid

Phosphoric acid –O ⇒ Phosphorous acid

$H_3PO_4 - O \Rightarrow H_3PO_3$

$2(H_3PO_3) - H_2O \Rightarrow H_6P_2O_6 - H_2O \Rightarrow H_4P_2O_5$

So pyrophosphoric acid has maximum number of oxygen

11. Given below are two statements.

Statement I: Iron (III) catalyst, acidified $K_2Cr_2O_7$ and neutral $KMnO_4$ have the ability to oxidise I^- to I_2 independently.

Statement II: Manganate ion is paramagnetic in nature and involves pπ-pπ bonding.

In the light of the above statements, choose the correct answer from the options given below.

(A) Both statement I and statement II are true

(B) Both statement I and statement II are false

(C) statement I is true but statement II is false

(D) statement I is false but statement II is true

Sol. **B**

$Cr_2O_7^{2-} + I^- \xrightarrow{H^+} Cr^{3+} + I_2$

$KM_nO_4^- + I^- \xrightarrow{H^+} Mn^{2+} + I_2$

But Fe^{3+} can not Oxidise I^- to I_2 because $E^o_{(Fe^{3+}/Fe^{2+})}$ is lower than that of $E^o_{(I^-/I2)}$

Statement-I is false

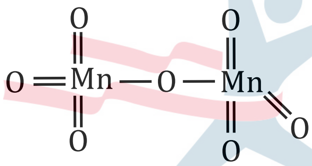
Statement-II magnate ion is paramagnetic but it consists of dπ-pπ bonding

12. The total number of Mn=O bonds in Mn_2O_7 is______.

(A) 4 (B) 5 (C) 6 (D) 3

Sol. **C**

Mn_2O_4



Mn = O ⇒ 6 bonds

13. Match List I with List II.

List I Pollutant	List II Disease/sickness
A. Sulphate (>500 ppm)	I. Methemoglobinemia
B. Nitrate (>50 ppm)	II. Brown mottling of teeth
C. Lead (>50 ppb)	III. Laxative effect
D. Fluoride (>2 ppm)	IV. Kidney damage

Choose the correct answer from the options given below:

(A) A-IV, B-I, C-II, D-III (B) A-III, B-I, C-IV, D-II

(C) A-II, B-IV, C-I, D-III (D) A-II, B-IV, C-III, D-I

Sol. **B**

Suphate (>500 ppm) → Laxative effect

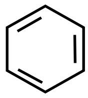
Nitrate (> 50 ppm) → methemoglobinemia

Lead (>50 ppb) → Kidney damage

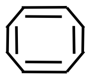
Fluoride (>2 ppm) → Brown mottling of teeth

14. Given below are two statement: one is labelled as Assertion A and, the other is labelled as Reason R.

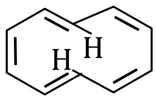
Assertion A: [6] Annulene, [8] Annulene and cis-[10] Annulene, are respectively aromatic, not-aromatic and aromatic.



[6] Annulene



[8] Annulene



Cis-[10] Annulene

Reason R: Planarity is one of the requirements of aromatic systems.

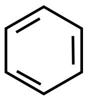
In the light of the above statements, choose the most appropriate answer from the options given below.

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

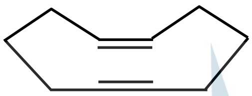
(B) Both A and R are correct but R is NOT the correct explanation of A.

(C) A is correct but R is not correct (D) A is not correct but R iscorrect.

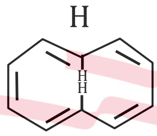
Sol. **D**



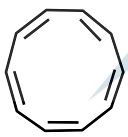
Aromatic
6π e^-, planar



Tab-shop.
Non-planar
Aromatic

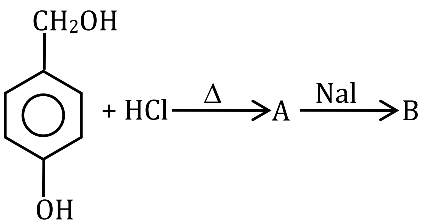


Not-Aromatic
steric hindrance due to internal H
(Non-planar)



Non-planar
Hence-non-aromatic

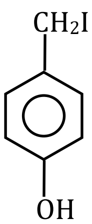
15.



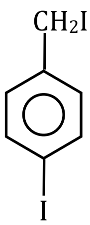
In the above reaction product B is:

Product B is

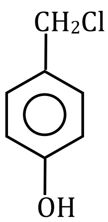
(A)



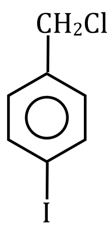
(B)



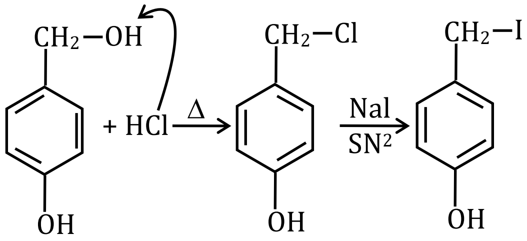
(C)



(D)



Sol. **A**



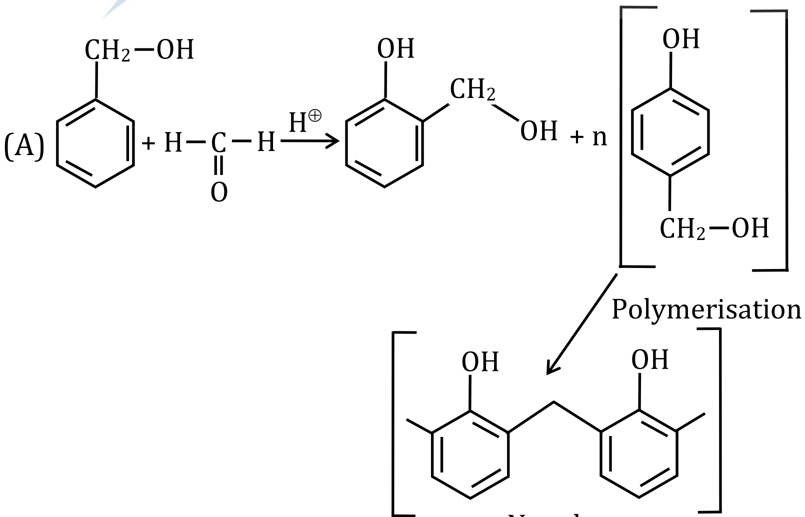
16. Match List I with List II.

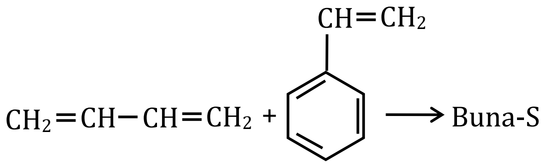
List I Polymers	List II Commercial names
A. Phenol-formaldehyde resin	I. Glyptal
B. Copolymer of 1,3-butadiene and styrene	II. Novolac
C. Polyester of glycol and Phthalic acid	III. Buna-S
D. Polyester of glycol and terephthalic acid	IV. Dacron

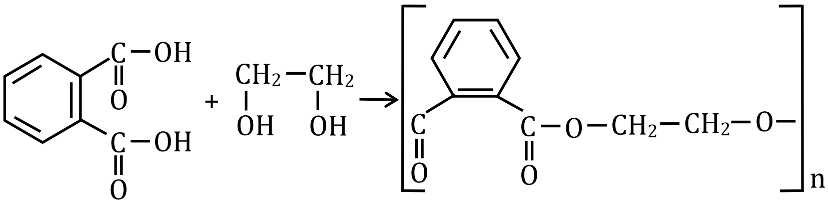
Choose the correct answer from the options given below:

(A) A-II, B-III, C-IV, D-I
(B) A-II, B-III, C-I, D-IV
(C) A-II, B-I, C-III, D-IV
(D) A-III, B-II, C-IV, D-I

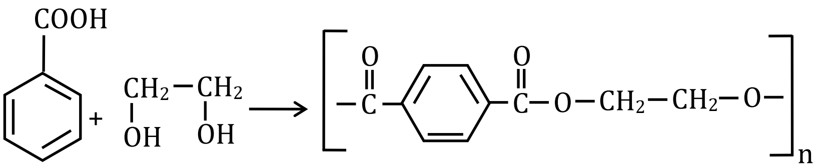
Sol. **B**



(B) 

(C) 

Glyptal

(D) 

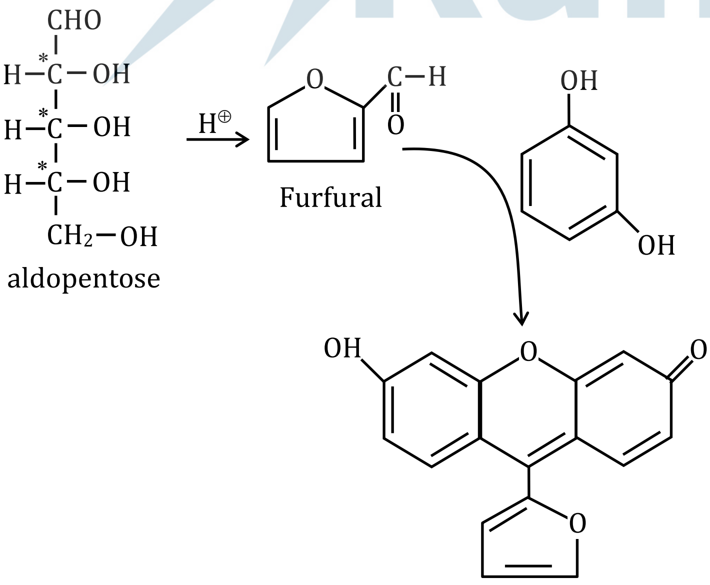
Dacron

17. A sugar 'X' dehydrates very slowly under acidic condition to give furfural which on further reaction with resorcinol gives the coloured product after sometime.

Sugar 'X' is

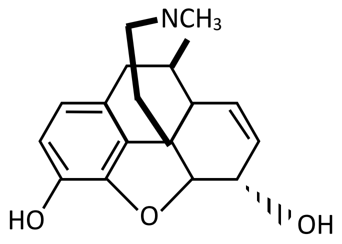
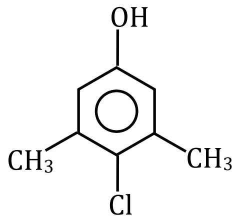
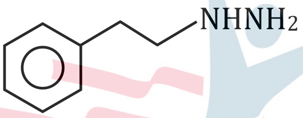
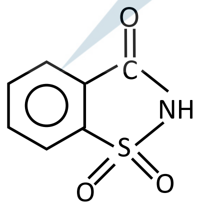
(A) Aldopentose (B) Aldotetrose (C) Oxalic acid (D) Ketotetrose

Sol. **A**



red colour

18. Match List I with List II.

List I	List II
A. 	I. Anti-depressant]
B. 	II> 550 times sweeter than cane sugar
C. 	III. Narcotic analgesic
D. 	IV. Antiseptic

Choose the coorect answer from the options given below:

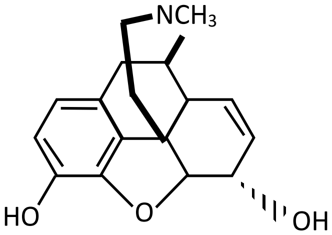
(A) A-IV, B-III, C-II, D-I

(B) A-III, B-I, C-II, D-IV

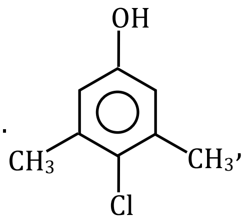
(C) A-III, B-IV, C-I, D-II

(D) A-III, B-I, C-IV, D-II

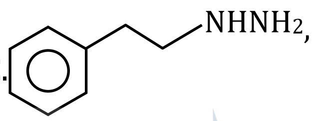
Sol. **C**

A. 

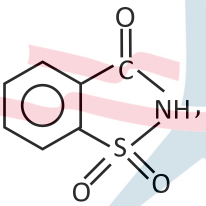
, marphine reduce the pain, hence it is narcotic-analgesic

B. 

, chloroxylenol is used as antiseptic

C. 

, phenelize use as antidepresant

D. 

, Saccharin is 550 times sweeter than cane sugan

19. In carius method of estimation of halogen, 0.45 g of an organic compound gave 0.36 g of AgBr. Find out the percentage of bromine in the compound.
(Molar masses : AgBr = 188 mol^{-1} ; Br= 80 g mol^{-1})

(A) 34.04% (B) 40.04% (C) 36.03% (D) 38.04%

Sol. **A**

$AgNO_3 + \underset{\substack{\uparrow \\ \text{Organic compound}}}{Br^-} \rightarrow AgBr$

Mass of AgBr = 0.36 g

Moler mass of AgBr = 108 + 80 = 188 g

Moles of AgBr = $\frac{0.36}{188}$

Moles of Br = $\frac{0.36}{188}$

Mass of Br = $\frac{0.36}{188} \times 80$

% of Br = $\frac{mass\ of\ Br}{Mass\ of\ O.C.} \times 100$

$= \frac{0.36}{188} \times \frac{80}{0.45} \times 100 = 34\%$

20. Match List I with List II.

List I	List II
A. Benzenesulphonyl chloride	I. Test for primary amines
B. Hoffmann bromamide reaction	II. Anti Saytzeff
C. Carbylamine reaction	III. Hinsberg reagent
D. Hoffmann orientation	IV. Known reaction of Isocyanates.

Choose the correct answer from the options given belwo:

(A) A-IV, B-III, C-II, D-I
(B) A-IV, B-II, C-I, D-III
(C) A-III, B-IV, C-I, D-II
(D) A-IV, B-III, C-I, D-II

Sol. **C**

(A) Benzenesulphonyl chloride → Hinsberg reagent
Hinsberg reagent is use to tistinguish between 1°, 2°, 3° amines

(B) Hoffmann bromamide reaction → Known reaction of Isocyanates reaction.

$$R-\underset{\underset{O}{\|}}{C}-NH_2 + K_2 + 4NaOH \longrightarrow R-NH_2 + 2NaX + Na_2CO_3 + 2H_2O$$

(C) Carbylamine reaction → It is used for test of primary amine

$$R\text{–}NH_2 + CHCH_3 + 3\,KOH \rightarrow RNC + 3KCl + H_2O$$

(D) Hoffmann orientation → Anit saytzeff rule

21. 20 mL of 0.02 M $X_2Cr_2O_7$ solution is used for the titration of 10 mL of Fe^{2+} solution in the acidic medium.
The molarity of Fe^{2+} solution is_____$\times 10^{-2}$ M. (Nearest Integer)

Sol. **24**

$Cr_2O_7^{-2} + 6Fe^{+2} + 14H^{+} \rightarrow 2Cr^{+3} + 6Fe^{+3} + 7H_2O$

$K_2Cr_2O_7$ equivalent = Fe+2 equivalent

$N_1V_1 = N_2V_2$

$M_1n_1v_2 = M_2n_2V_2$

$0.02 \times 6 \times 20 = M_2 \times 1 \times 10$

$\boxed{M_2 = 0.24}$

$M_1 = 24 \times 10^{-2}$ **Ans. :** 24

22. $2NO + 2H_2 \rightarrow N_2 + 2H_2O$

The above reaction has been studied at 800°C. The related data are given in the table below

Reaction serial number	Initial Pressure of H_2/kPa	Initial Presure of NO/kPa	Initial rate $\left(\frac{-dp}{dt}\right)$/s)
1	65.6	40	0.135
2	65.6	20.1	0.033
3	38.6	65.6	0.214
4	19.2	65.6	0.106

The order of the reaction with respect to NO is_____.

Sol. **2**

$\text{Rate}_1 = K[40]^n = 0.135 \quad ....(1)$
$\text{Rate}_2 = K[20.1]^n = 0.033 \quad ....(2)$] Order w.r.t. No.

Eq. (1) ÷ (2)

$\frac{0.135}{0.033} = [\frac{40}{20.1}]^n$

n = 2

Ans. : 2

23. Amongst the following, the number of oxide(s) which are paramagnetic in nature is

Na_2O, KO_2, NO_2, N_2O, ClO_2, NO, SO_2, Cl_2O

Sol. **4**

If total electron = even ⇒ diamagnetic except {10, 16, 32}

If total electron = odd = parmagnetic

Na_2O	KO_2	NO_2	N_2O	CO_2	NO	SO_2	Cl_2O
⇓	⇓				⇓		
O^{-2}					(odd)		
⇓							
$10e^{-}$							
para	para	para	dia	dia	para	dia	dia

24. The molar heat capacity for an ideal gas at constant pressure is 20.785 J $K^{-1}mol^{-1}$. The change in internal energy is 5000 J upon heating it from 300 K to 500 K. The number of moles of the gas at constant volume is____.[Nearest integer] (Given: R = 8.314 J K^{-1} mol^{-1})

Sol. 2

$C_{p,m} = C_{v,m} + R$

$\Rightarrow C_{v,m} = 20.785 - 8.314 = 12.471 \text{ J } k^{-1} \text{ ml}^{-1}$

$\Delta U = nC_{v,m}\Delta T$

$\Rightarrow n = \frac{5000}{12.471 \times 200} = \frac{25}{12.471} \approx 2$

25. According to MO theory, number of species/ions from the following having identical order is___.

CN^-, NO^+, O_2, O_2^+, O_2^{2+}

Sol. **3**

Number of electron in species		**Bond order**
10	→	1
11	→	1.5
12	→	2
13	→	2.5
14	→	3
15	→	2.5
16	→	2
17	→	1.5
18	→	1

(10 to 15: short trick)

$CN^- = 14e^- \Rightarrow B.O. = 3$

$NO^+ = 14e^- \Rightarrow B.O = 3$

$O_2 = 16e^- \Rightarrow B.O = 2$

$O_2^+ = 15e^- \Rightarrow B.O = 2.5$

$O_2^{2+} = 14e^- \Rightarrow B.O = 3$

So here CN^-, NO^+, O_2^{2+} have identical bond order

26. At 310 K, the solubility of CaF_2 in water is 2.34×10^{-3} g/100 mL. The solubility product of CaF_2 is___$\times10^{-8}$ $(mol/L)^3$. (Give molar mass: CaF_2=78 g mol^{-1})

Sol. 0

Solubility of $CaF_2 = 2.34 \times 10^{-3}$ g/100 ml

$= 2.34 \times 10^{-2}$ g/1000 ml

$= 3 \times 10^{-4}$ mole/lit

Ksp of $CaF_2 = 4S^3 = 4 \times (3 \times 10^{-4})^3$

$= 10.8 \times 10^{-9} = 10.8 \times 10^{-9}(\frac{M}{L})^3$

27. The conductivity of a solution of complex with formula $CoCl_3(NH_3)_4$ corresponds to 1:1 electrolyte, then the primary valency of central metal ion is_____

Sol. **Official Ans. by NTA (1)**

Motion Ans. (3)

$[Co(NH_3)_4Cl_2]Cl$

Primary valency = oxidation no. = +3

28. In the titration of $KMnO_4$ and oxalic acid in acidic medium, the change in oxidation number of carbon at the end point is____

Sol. **1**

$MnO_4^- + CrO_4^{-2} \rightarrow Mn^{+2} + CO_2$

O. No. of C in $C_2O_4^{-2}$ = +3

O. No. of C in CO_2 = + 4

Change in O. No. of C

Ans. = 1

29. Optical activity of an enantiomeric mixture is $+12.6^o$ and the specific rotation of (+) isomer is $+30^o$. The optical purity is____%

Sol. **42**

Optical acitivity enantiomeric mixture = $+ 12.6^o$

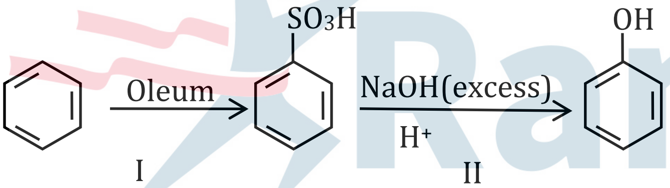
Speafic rotation of (+) isomer = + 30^oC

$$\% \text{ optical purity} = \frac{\text{rotation of mixture}}{\text{ratation of pure enantiomer}} \times 100$$

$$= \frac{+12.6^o}{+30^o} \times 100$$

= 42

30. In the following reaction

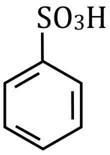


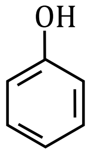
The % yield for reaction I is 60% and that of reaction II is 50%. The overall Yield of the complete reaction is___% [Nearest integer]

Sol. **30**

Let initial mole be n,

% yield for reaction I is 60%

Mole of  form $\frac{n\times 60}{100} = 0.6n$

Mole of  form $\frac{0.6n\times 50}{100} = 0.3n$

Overall yield of complete reaction = $\frac{0.3n}{n} \times 100$

= 30%