JEE (Main) CHEMISTRY SOLVED PAPER

2023 25th Jan. Shift 1

Section A

Q. 1. In the cumene to phenol preparation in presence of air, the intermediate is









Q. 2. The compound which will have the lowest rate towards nucleophilic aromatic substitution on treatment with OH⁻is



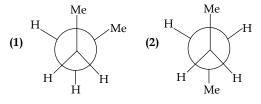
$$(2) \bigcirc \begin{matrix} Cl \\ \\ \\ \\ NO \end{matrix}$$

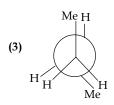
Q. 3. Match List I with List II

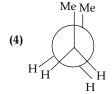
LIST I Elements	LIST II Colour imparted to the flame	
A. K	I. Brick Red	
B. Ca	II. Violet	
C. Sr	III. Apple Green	
D. Ba	IV. Crimson Red	

Choose the correct answer from the options given below:

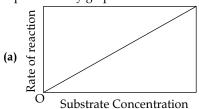
- (1) A-II, B-I, C-III, D-IV
- (2) A-II, B-I, C-IV, D-III
- (3) A-IV, B-III, C-II, D-I
- (4) A-II, B-IV, C-I, D-III
- **Q. 4.** Which of the following conformations will be the most stable ?

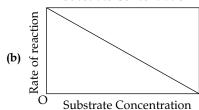


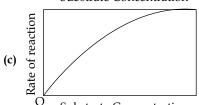


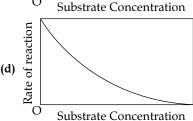


Q. 5. The variation of the rate of an enzyme catalyzed reaction with substrate concentration is correctly represented by graph









- (1) (b) (2) (a) (3) (d) (4) (c)
- Q. 6. Given below are two statements : one is labelled as Assertion A and the other is labelled as Reason R.

Assertion A: Acetal / Ketal is stable in basic medium.

Reason R: The high leaving tendency of alkoxide ion gives the stability to acetal/ ketal in basic medium.

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

- (1) A is true but R is false
- (2) A is false but R is true

- (3) Both A and R are true but R is NOT the correct explanation of A
- (4) Both A and R are true and R is the correct explanation of A
- A cubic solid is made up of two elements X and Q. 7. Y. Atoms of X are present on every alternate corner and one at the center of cube. Y is at

 $rac{1}{2}$ rd of the total faces. The empirical formula of

the compound is

(1)
$$XY_{2.5}$$
 (2) $X_2Y_{1.5}$

(3)
$$X_{2.5}Y$$

$$(4) X_{1.5}Y_2$$

Q. 8. Match the List-I with List-II:

	List-I Cations		List-II Group reagents		
A.	Pb ²⁺ , Cu ²⁺	(i)	H ₂ S gas in presence of dilute HCl		
B.	Al ³⁺ , Fe ³⁺	(ii)	(NH ₄) ₂ CO ₃ in presence of NH ₄ OH		
C.	Co ²⁺ ,Ni ²⁺	(iii)	NH ₄ OH in presence of NH ₄ Cl		
D.	Ba ²⁺ , Ca ²⁺	(iv)	H ₂ S in presence of NH ₄ OH		

Correct match is -

- (1) $A \rightarrow iii$, $B \rightarrow i$, $C \rightarrow iv$, $D \rightarrow ii$
- (2) $A \rightarrow i$, $B \rightarrow iii$, $C \rightarrow ii$, $D \rightarrow iv$
- (3) $A \rightarrow iv$, $B \rightarrow ii$, $C \rightarrow iii$, $D \rightarrow i$
- (4) $A \rightarrow i$, $B \rightarrow iii$, $C \rightarrow iv$, $D \rightarrow ii$
- Which of the following statements is incorrect for Q. 9. antibiotics?
 - (1) An antibiotic must be a product of metabolism.
 - (2) An antibiotic should promote the growth or survival of microorganisms.
 - (3) An antibiotic is a synthetic substance produced as a structural analogue of naturally occurring antibiotic.
 - (4) An antibiotic should be effective in low concentrations.
- Q. 10. The correct order in aqueous medium of basic strength in case of methyl substituted amines is:
 - (1) $Me_3 N > Me_2NH > MeNH_2 > NH_3$
 - (2) $Me_2NH > MeNH_2 > Me_3 N > NH_3$
 - (3) $Me_2NH > Me_3 N > MeNH_2 > NH_3$
 - (4) $NH_3 > Me_3 N > MeNH_2 > Me_2NH$
- Q. 11. '25 volume' hydrogen peroxide means
 - (1) 1 L marketed solution contains 25 g of H_2O_2 .
 - (2) 1 L marketed solution contains 75 g of H₂O₂.
 - (3) 1 L marketed solution contains 250 g of H_2O_2 .
 - (4) 100 mL marketed solution contains 25 g of
- H_2O_2 . **Q. 12.** The radius of the 2^{nd} orbit of Li^{2+} is x. The
 - expected radius of the 3rd orbit of Be³⁺ is

 (1) $\frac{27}{16}x$ (2) $\frac{4}{9}x$ (3) $\frac{9}{4}x$ (4) $\frac{16}{27}x$
- Q. 13. Reaction of thionyl chloride with white phosphorus forms a compound [A], which on hydrolysis gives [B], a dibasic acid. [A] and [B] are respectively
 - (1) P_4O_6 and H_3PO_3
- (2) PCl₅ and H₃PO₄
- (3) $POCl_3$ and H_3PO_4 (4) PCl_3 and H_3PO_3

- Q.14. Inert gases have positive electron gain enthalpy. Its correct order is
 - (1) He < Kr < Xe < Ne
 - (2) He < Xe < Kr < Ne
 - (3) He < Ne < Kr < Xe
 - (4) Xe < Kr < Ne < He
- **Q. 15.** Identify the product formed (and *E*)

$$\begin{array}{c} Me \\ & \searrow \\ O \end{array} \xrightarrow{Br_2} A \xrightarrow{Sn/HCl} B \xrightarrow{NaNO_2/HCl} \\ \xrightarrow{273 - 278 \text{ K}} \\ NO_2 C \xrightarrow{H_3PO_2/H_2O} D \xrightarrow{(i) \text{ KMnO}_4/\text{KOH}} E \end{array}$$

(1)
$$A = Br$$
 Br
 Br
 Br
 Br
 Br

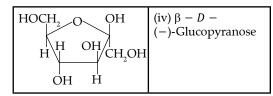
(2)
$$Br$$
 $E = NO_2$ Br

(3)
$$\stackrel{\text{Me}}{\downarrow}$$
 Br $E = \stackrel{\text{COOH}}{\downarrow}$ Br NO_2

(4)
$$\stackrel{\text{Me}}{\biguplus}$$
 Br $\stackrel{\text{COOH}}{\biguplus}$ Br OH

Q. 16. Match items of Row I with those of Row II.

Row I	Row II
CH ₂ OH H OH OH	(i) α – D – (–)-Fructofuranose,
CH ₂ OH H OH OH H OH H OH OH	(ii) β – D – (–) – Fructofuranose
HOCH ₂ O CH ₂ OH H OH OH OH H	(iii) $\alpha - D - (-)$ Glucopyranose,



- (1) $A \rightarrow i$, $B \rightarrow ii$, $C \rightarrow ii$, $D \rightarrow iv$
- (2) $A \rightarrow iv$, $B \rightarrow iii$, $C \rightarrow i$, $D \rightarrow ii$
- (3) $A \rightarrow iii$, $B \rightarrow iv$, $C \rightarrow ii$, $D \rightarrow i$
- (4) $A \rightarrow iii$, $B \rightarrow iv$, $C \rightarrow i$, $D \rightarrow ii$
- Q.17. Which one of the following reactions does not occur during extraction of copper?
 - (1) $2Cu_2S + 3O_2 \rightarrow 2Cu_2O + 2SO_2$
 - (2) $\text{FeO} + \text{SiO}_2 \rightarrow \text{FeSiO}_3$
 - (3) $2\text{FeS} + 3\text{O}_2 \rightarrow 2\text{FeO} + 2\text{SO}_2$
 - (4) $CaO + SiO_2 \rightarrow CaSiO_3$
- $\mathbf{Q.18.}$ Some reactions of NO_2 relevant to photochemical smog formation are

$$NO_2 = \frac{\text{sunlight}}{\bigvee_{B}^{A}} X + Y$$

Identify A, B X and Y

(1)
$$X = \frac{1}{2} O_2$$
, $Y = NO_2$, $A = O_3$, $B = O_2$

(2)
$$X = [O], Y = NO, A = O_2, B = O_3$$

(3)
$$X = N_2O$$
, $Y = [O]$, $A = O_3$, $B = NO$

Q.19.
$$(4) X = NO, Y = [O], A = O_2, B = N_2O_3$$

$$PhCOOH + PhCH_2OH$$

The correct sequence of reagents for the preparation of Q and R is:

- (1) (i) $CrO_2Cl_2H_3O^+$; (ii) Cr_2O_3 , 770 K, 20 atm; (iii) NaOH; (iv) H₂O⁺
- **(2)** (i) KMnO₄,OH⁻; (ii) Mo₂O₃, Δ; (iii) NaOH; (iv) H_3O^+
- (3) (i) Cr_2O_3 , 770 K, 20 atm; (ii) CrO_2Cl_2 , H_3O^+ ; (iii) NaOH; (iv) H_3O^+
- (4) (i) Mo_2O_3 , Δ ; (ii) CrO_2Cl_2 , H_3O^+ ; (iii) NaOH; (iv) H₃O⁴
- Q. 20. Compound A reacts with NH₄Cl and forms a compound B. Compound B reacts with H₂O and excess of CO2 to form compound C which on passing through or reaction with saturated NaCl solution forms sodium hydrogen carbonate.

Compound A, B and C, are respectively.

- (1) CaCl₂,NH₃,NH₄HCO₃
- (2) $Ca(OH)_2, NH_4^{\oplus}, (NH_4)_2CO_3$
- (3) $CaCl_2, NH_4^{\oplus}, (NH_4)_2CO_3$
- (4) Ca(OH)₂,NH₃,NH₄HCO₃

Section B

Q. 21. For the first order reaction $A \rightarrow B$, the half life is 30 min. The time taken for 75% completion of the reaction is ____min. (Nearest integer)

Given: $\log 2 = 0.3010$, $\log 3 = 0.4771$, $\log 5 = 0.6989$

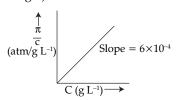
Q. 22. How many of the following metal ions have similar value of spin only magnetic moment in gaseous state?

(Given: Atomic number : V, 23; Cr, 24; Fe, 26; Ni, 28) $\rm \dot{V}^{3+}$, $\rm Cr^{3+}$, $\rm Fe^{2+}$, $\rm Ni^{3+}$

Q. 23. In sulphur estimation, 0.471 g of an organic compound gave 1.4439 g of barium sulphate. The percentage of sulphur in the compound is (Nearest Integer)

(Given: Atomic mass Ba: 137u, S: 32u, O: 16u)

The osmotic pressure of solutions of PVC in O. 24. cyclohexanone at 300 K are plotted on the graph. The molar mass of PVC is gmol⁻¹ (Nearest integer)



(Given : $R = 0.083 L atm K^{-1} mol^{-1}$)

- Q. 25. The density of a monobasic strong acid (Molar mass 24.2 g/mol) is 1.21 kg/L. The volume of its solution required for the complete neutralization of 25 mL of 0.24MNaOH is $\times 10^{-2}$ mL (Nearest
- **Q. 26.** An athlete is given 100 g of glucose $(C_6H_{12}O_6)$ for energy. This is equivalent to 1800 kJ of energy. The 50% of this energy gained is utilized by the athlete for sports activities at the event. In order to avoid storage of energy, the weight of extra water he would need to perspire is (Nearest integer) Assume that there is no other way of consuming stored energy.

Given: The enthalpy of evaporation of water is 45 kJ mol⁻

Molar mass of C,H&O are 12,1 and 16 g mol^{-1} The number of paramagnetic species from the Q. 27.

following is $[Ni(CN)_4]^{2-}$, $[Ni(CO)_4]$, $[NiCl_4]^{2-}$ $[Fe(CN)_6]_{-}^{4-}, [Cu(NH_3)_4]_{-}^{2+}$ $[Fe(CN)_6]^{3-}$ and $[Fe(H_2O)_6]^{2+}$

Q. 28. Consider the cell

 $Pt(s)|H_2(g)(1 \text{ atm})|H^+(aq, [H+] = 1)||Fe_3^+(aq),$

Fe²⁺(aq) | Pt(s) Given E_{Fe}° /Fe²⁺=0.771 V and $E_{H/1/2H2}^{\circ}$ = 0 V, T = 298 K

If the potential of the cell is 0.712 V, the ratio of concentration of Fe²⁺ to Fe³⁺ is (Nearest integer)

- Q. 29. The total number of lone pairs of electrons on oxygen atoms of ozone is
- Q.30. A litre of buffer solution contains 0.1 mole of each of NH₃ and NH₄Cl. On the addition of 0.02 mole of HCl by dissolving gaseous HCl, the pH of the solution is found to be $\times 10^{-3}$ (Nearest integer)

[Given: pK_b (NH₃) = 4.745, log 2 = 0.301 $\log 3 = 0.477, T = 298 \text{ K}$

Answer Key

Q. No.	Answer	Topic Name	Chapter Name	
1	(3)	Formation of a reaction intermediate	Alcohol, Phenol and Ether	
2	(3)	Nucelophillic aromatic substitution	Alkyl and Aryl halides	
3	(2)	Flame test	s-block elements	
4	(2)	Stable Conformational isomers	General organic chemistry	
5	(4)	Rate of reaxtion	Chemical kinetics	
6	(1)	Stability of hemi acetal and acetal	Aldehyde and ketone	
7	(Bonus)	Empirical formula	Some basic concept of chemistry	
8	(4)	Identification of basic radical	Qualitative analysis	
9	(2)	Antibiotic drug	Chemistry in everyday life	
10	(2)	Basic strength	Amines	
11	(1)	Volume strength of hydrogen per oxide	Hydrogen	
12	(1)	Bohr radius calculation Structure of atom		
13	(4)	Chemical properties of P block element p-block		
14	(2)	Electron gain enthalpy order	Periodic classification of elements	
15	(3)	Mixed reaction of organic compounds	Amines	
16	(4)	Haworth projection	Biomolecules	
17	(4)	Extraction of metals	Metallurgy	
18	(2)	Smog formation	Environmental chemistry	
19	(3)	Preparation of acid	Carboxylicacid	
20	(4)	Solvay ammonia process	s-block	
21	[60]	Order of reaction	Chemical kinetics	
22	[2]	Spin magnetic moment	Structure of atom	
23	[42]	Percentage composition	Some basic concept of chemistry	
24	[41500]	Osmotic pressure	Liquid solution	
25	[12]	Volumetric analysis	Ionic equilibrium	
26	[360]	Calculation of energy change	Thermodynamics	
27	[4]	Paramagnetic substances	Coordination chemistry	
28	[10]	EMF of the cell	Electro chemistry	
29	[6]	Number of lone pairs	Chemical bonding	
30	[9079]	Buffer solution	Ionic equilibrium	

Solutions

Section A

1. Option (3) is correct.

During the formation of phenol from cumene, Cumene hydroperoxide formed as an intermediate. The formation of cumene hydroperoxide from cumene takes place via free radical mechanism in which $\rm O_2$ acts as an initiator.

$$CH_3 \xrightarrow{CH_3} CH_3 \xrightarrow{O_2/\text{air}} CC \xrightarrow{CH_3} CH_3$$

Cumene

Cumene hydroperoxide

$$\begin{array}{c}
OH \\
 \hline
 H^+ \\
\hline
 H_2O
\end{array}$$
Pheno

2. Option (3) is correct.

Benzene or benzene derivative easily undergo electrophilic, aromatic substitution. The rate of nucleophillic aromatic substitution of benzene and its derivative depends upon presence of e-withdrawing group.

Rate of Nuelcophillic aromatic substitution α Number of e- withdrawing group. Also the reactivity is more when these EDW groups are present at ortho and para positions.

Amony the given molecule, option (3) is showing less reactivity towards nucleophilic aromatic substitution, because e-withdrawing group is attached at meta position

.. Thus meta chloro nitrobenzene has lowest reactivity towards nucleophillic aromatic substitution.

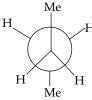
3. Option (2) is correct.

	Element	Colour in flame test		
Α	K	II Violet		
В	Ca	I	Brick red	
С	Sr	IV	V Crimson red	
D	Ba	III	Apple green	

4. Option (2) is correct.

Conformational isomerism is an isomerism in which

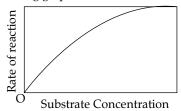
different structures are formed due to free rotation around carbon — carbon single bond. The structures which are obtained are called conformers of each other and the phenomenon is known as conformational isomerism.



Among the given conformations, the most stable conformer would be one in which bulky groups are present opposite to each other, because such conformer has lowest bond angle and torsional strain and it is called as staggerd-conformer.

5. Option (4) is correct.

The variation of the rate of an enzyme catalyzed reaction with substrate concentration is represented by the following graph



6. Option (1) is correct.

The stability of acetal/ketal in basic medium is more because they do not break down to give back carbonyl group as it do not contain any acidic H—atom, which can react with base. So Assertion is true. The alkoxide (RO¯) ion are less stable because the electron density on oxygen atom increases by +I effect of alkyl group therefore it is not a good leaving group, hence Reason is false.

7. Bonus

Contribution of an atom present at the corners $=\frac{1}{8}$

Contribution of an atom present at face centre = $\frac{1}{3}$

contribution of an atom present at body centre=1 Number of X-atom = 4(alternate corner) + 1(Body centre)

$$=4\times\frac{1}{8}+1\times1=\frac{3}{2}$$

Number of Y-atom = $\frac{1}{3}$ (Face centre) = $\frac{1}{3} \times 6 \times \frac{1}{2} = 1$

Empirical formula = $X_{\frac{3}{2}}Y_1$

No correct Option is given by NTA so Bonus marks will be awarded.

8. Option (4) is correct.

	Cation	Group No		Group Reagent	
A	Pb ²⁺ , Cu ²⁺	II	(i)	H ₂ S gas in presence of deil HC1	
B.	Al ³⁺ , Fe ³⁺	III	(ii)	NH ₄ OH in present of NH ₄ C1	
C.	Co ²⁺ , Ni ²⁺	IV	(iii)	H ₂ S in presence of NH ₄ OH	
D.	Ba ²⁺ , Ca ²⁺	V	(iv)	(NH ₄) ₂ CO ₃ in presence of NH ₄ OH	

9. Option (2) is correct.

An antibiotic is a class of drug which mainly used to kill or inhibit the growth or survival of micro organism mainly bacteria

Thus statement (2) is an incorrect statement.

10. Option (2) is correct.

In aqueous medium, basic strength of methylated substituted amines depends upon the +I effect, solvation effect(H bonding) and steric hindereance.

Ammonia would be less basic than its derivatives because +I effect of H is less than that of CH_3 group. Hence the basic strength the basic strength of methyl substituted amines in aqueous medium is:

 $Me_2NH > MeNH_2 > Me_3N > NH_3$

11. Option (1) is correct.

$$2H_2O_2 \rightarrow 2H_2O + O_2$$

Here 25 volume H₂O₂ means at STP,

1L of H₂O₂ on decomposition give 25L O₂

From formula Volume strength = $M \times 11.35$

$$M = \frac{25}{11.35} M$$

Strength in $\frac{g}{L} \Rightarrow M \times \text{molar mass}$

$$\Rightarrow \frac{25}{11.35} \frac{\text{mol}}{\text{L}} \times 34 \frac{\text{g}}{\text{mol}} \quad \Rightarrow 74.889 \approx 75 \text{ g}.$$

12. Option (1) is correct.

Formula used $r_n = 0.52g \times \frac{n^2}{z} A^o$ For Li^{2+} n = 2 Z = 3

$$r_{L:2+} = 0.529 \times \frac{2^2}{3} A^\circ = x$$
 ... (i)

for Be³⁺
$$n = 3$$
, $Z = 4$... (ii)
 $r_{Be^{3+}} = 0.529 \times \frac{(3)^2}{4}$

from (i) & (ii)

$$\frac{\mathbf{r}_{\text{Li2+}}}{\mathbf{r}_{\text{Be}^{3+}}} = \frac{0.529 \times \frac{4}{3}}{0.529 \times \frac{9}{4}} \implies \frac{\mathbf{n}}{\mathbf{r}_{\text{Be}^{3+}}} = \frac{16}{27} \implies \mathbf{r}_{\text{Be}^{3+}} = \frac{27}{16}x$$

13. Option (4) is correct.

The reaction of thionyl chloride with white phosphorous forms a phosphorous trichloride (PCl₃) $P_4 + 8SOCl_2 \rightarrow 4PCl_3 + 4SO_2 + 2S_2Cl_2 \end{tabular}$

Phosphorous trichloride on hydrolysis gives an acid called hypo phosphorous acid (H₃PO₃)

$$PCl_3 + 3H_2O \rightarrow H_3PO_3 + 3HCl$$
(B)

14. Option (2) is correct.

Inert gases have positive electron gain enthalpy due to its stable fully filled configuration

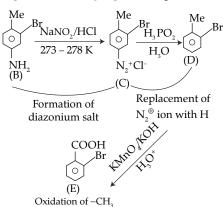
Also as we move down the group ,the sizes of atom increases and hence the magnitude of their positive electron enthalpies decreases from Ne to Xe.Due to small size of He ,it has highest tendency to accept an additional electron and thus it has lowest positive electron gain enthalpy. Therefore the correct order is

$$\frac{\text{He} < \text{xe} < \text{Kr} < \text{Ne}}{\text{increasing order of e-gain enthalpy}}$$

15. Option (3) is correct.

$$\begin{array}{c|c}
Me & Me & Me \\
\hline
O & Br & \hline
O & Rr & Me \\
NO_2 & NO_2 & NH_2 \\
\hline
(A) & (B)^2
\end{array}$$

halogenation Reduction of -NO₂ of p-nitrotoluere group into -NH₂



16. Option (4) is correct.

group into -COOH group.

A.	CH ₂ OH H OH H OH OH OH OH	(iii)	α–D–(–) Glu- copyranose
В.	CH ₂ OH H OH H OH H OH H	(iv)	β-D-(-) Glu- copyranose
C.	HOCH ₂ O CH ₂ OH H OH OH OH H	(i)	α-D-(-) Fructofura- nose

17. Option (4) is correct.

The extraction of copper mainly takes place from copper pyrite CuFeS₂ by Partial Roasting –

$$\mbox{CuFeS}_2 + \mbox{O}_2 \rightarrow \mbox{Cu}_2\mbox{S} + \mbox{FeO} + \mbox{SO}_2 + \mbox{FeS} + \mbox{Cu}_2\mbox{O}$$

$$2Cu_2S + 3O_2 \rightarrow 2Cu_2O + 2SO_2$$

$$2\text{FeS} + 3\text{O}_2 \rightarrow 2\text{FeO} + 2\text{SO}_2$$

$$FeO + SiO_2 \rightarrow FeSiO_3$$

Impurity flux (slag)

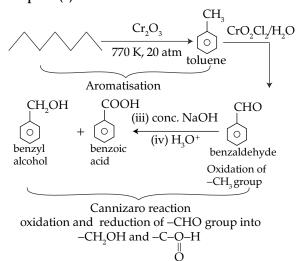
The formation of CaSiO₃ does not takes place during the extraction of copper.

18. Option (2) is correct.

The reaction of NO₂ in presence of sunlight gives the following –

$$\begin{array}{ccc}
NO_2 & \xrightarrow{hv} & O & + & NO \\
& & & (X) & (Y) \\
& & & \downarrow O_2(A) \\
& & & O_3(B)
\end{array}$$

19. Option (3) is correct.



20. Option (4) is correct.

The compound A is $Ca(OH)_2$ The compound B is NH_3 The compound C is NH_4HCO_3 $Ca(OH)_2 + 2NH_4Cl \rightarrow 2NH_3 + CaCl_2 + 2H_2O$ (A) (B) $NH_3 + H_2O + CO_2 \rightarrow NH_4HCO_3$ (B) (C) $NH_4HCO_3 + NaCl \rightarrow NaHCO_3 \downarrow + NH_4Cl$ (C)

Section B

21. The correct answer is [60].

Formula used For first order reaction,

$$K = \frac{2.303}{t} \log \frac{90}{90 - x}$$
Also $K = \frac{0.693}{t^{\frac{1}{2}}}$:: Given $t^{\frac{1}{2}} = 30 \text{ min}$

$$K = \frac{0.693}{30}$$

$$a_0 = 100\%$$

$$a_0 - x = 25\%$$

$$\frac{0.693}{30} = \frac{2.303}{t} \log \frac{100}{25}$$

$$t = \frac{2.303 \times 30}{0.693} \log 4, \ t = 60 \text{ min}$$

22. The correct answer is [2].

Formula used $\mu = \sqrt{n(n+2)}BM$

where n = number of unpaired electrons

 V^{3+} : [Ar] $3d^2 4s^0$, ,2 unpaired electrons

 Cr^{3+} : [Ar] $3d^3 4s^0$, 3 unpaired electrons

 Fe^{2+} : [Ar] $\mathrm{3d}^6$ $\mathrm{4s}^0$, 4 unpaired electrons

 Ni^{3+} : [Ar] $3d^7 4s^0$, 3 unpaired electrons

The species having same value of spin only magnetic moment will be those which have same number of unpaired electrons. Thus two species will have same value of μ i.e., Cr^{3+} and Ni^{3+} .

23. The correct answer is [42].

Formula used:

% of sulphur:

$$= \frac{\text{weight of BaSO}_4}{\text{weight of organic compound}} \times 100$$

233g of BaSO₄ contains 32g of sulphur

∴1.4439g of BaSO₄ contains sulphur = 32/233*1.4439 Given : Weight of organic compound 0.471 gm.

% of Sulphur=
$$\frac{1.443g}{0.471} \times \frac{32}{233} \times 100$$

= 42%

24. The correct answer is [41500].

Formula used \Rightarrow osmotic pressure, $\pi = CRT$

$$\pi = \frac{n}{v}RT$$

$$\pi = \frac{w}{M^{1} \times v}RT$$

$$\pi = C\left(\frac{RT}{M}\right)$$

$$\frac{\pi}{C} = \frac{RT}{M}$$

Slope=
$$\frac{RT}{M} = \frac{0.083 \times 300}{M}$$

 $6 \times 10^{-4} = \frac{0.083 \times 300}{M}$
 $M = 41500$

25. The correct answer is [12].

mole of NaOH = Molarity
$$\times$$
 V^(L)
= 0.24 M \times 25 \times 10⁻³L
= 6 \times 10⁻³mol

For acid

density =
$$1.21 \text{ kg/L}$$

i.e., 1.21 kg of monobasic acid present in 1 L.

$$\begin{split} \text{Molarity} &= \frac{\text{mole}}{V^{(L)}} = \frac{\text{weight}}{\text{mol.wt} \times V^{(L)}} \\ &= \frac{1.21 \times 10^{-3} \text{ gm}}{24.2 \text{ gm} / \text{mol} \times 1L} = 50 \text{m} \end{split}$$

Acid + NaOH
$$\rightarrow$$
 Salt +H₂O
From M₁V₁ = M₂V₂
50 M× V₁ = 0.24 M × 25 × 10⁻³ L
V₁ = 1.2 × 10⁻⁴ L
= 1.2 × 18⁻⁴ × 10³ mL
= 1.2 × 10⁻¹ ML
= 0.12 ML
V = 12 × 10⁻² mL

26. The correct answer is [360].

$$C_6H_{12}O_6(s) + 6O_2(g) \rightarrow 6CO_2(g) + 6H_2O(l)$$

The energy required to evaporate water

$$H_2O_{(I)} \rightarrow H_2O_{(g)}$$

energy utilized = $\frac{1800}{2}$ = 900kJ

Given enthalpy of evaporation of $H_2O = 45 \text{ kJ/mol}$

moles of
$$H_2O = \frac{900kJ}{45kJ/mol}$$

moles of $H_2O = 20$ mol

$$W_{H_2O} = 20 \text{ mol} \times 18 \frac{\text{gm}}{\text{mol}}$$

$$= 360 \text{ gm}$$

27. The correct answer is [4].

$$[NiCl_{_{4}}]^{_{2^{-}}} \ Ni^{_{2^{+}}} \colon 3d^{_{8}} \\ \boxed{1 \hspace{-0.5cm} |\hspace{-0.08cm} 1 \hspace{-0.08cm} |\hspace{-0.08cm} 1 \hspace{-0.08cm}$$

Cl is a weak ligand so e s remain unpaired ∴ it is paramagnetic in nature.

$$[Cu(NH_3)_4]^{2+} \ Cu^{2+}: \ 3d^9 \\ \hline \ 11 \ 11 \ 11 \ 11 \ 1$$

Here one unpaired e⁻ is a present

∴ it is paramagnetic in nature.

$$[Fe(CN)_{_{6}}]^{_{3-}} Fe^{_{3+}} : 3d^{_{5}}$$

Here one unpaired e^- is a present

: it is paramagnetic in nature.

$$[Fe(H_{2}O)_{6}]^{2+}\ Fe^{2+}: \ \ 3d^{6}$$

Here H_2O is a weak ligand so e^- remain unpaired

∴ it is paramagnetic in nature.

The other species do not contain unpaired e's

:. they are diamagnetic in nature.

28. The correct answer is [10].

Anode:
$${}^{1/2}H_{2(g)} \rightarrow H^{+}_{(aq)} + e^{-}$$

Cathode: $Fe^{3+}_{(aq)} + e^{-} \rightarrow Fe^{2+}_{(aq)} - \frac{1}{2}H_{2(g)} + Fe^{3+}_{(aq)} \rightarrow H^{+}_{(aq)} + Fe^{2+}_{(aq)}$
 $E_{cell} = E^{o}_{cell} - \frac{0.0591}{n} log \left[\frac{Fe^{2+}}{Fe^{3+}} \right] \times \frac{[H^{+}]}{(P_{H2})^{\frac{1}{2}}}$
Given $p = 1$, $F^{o}_{L} = 0.771$ V. $F_{L} : = 0.712$ V.

Given n = 1,
$$E_{cell}^{o}$$
 = 0.771 V E_{cell} = 0.712 V $[H^{+}]$ = 1 M P_{H2} = 1 atm
$$0.712 = 0.771 \cdot \frac{0.0591}{1} log \left[\frac{Fe^{2+}}{Fe^{3+}} \right] \times \frac{1M}{(1)^{\frac{1}{2}}}$$

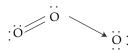
$$-0.059 = -0.0591 \log \left[\frac{Fe^{2+}}{Fe^{3+}} \right]$$

$$log \left[\frac{Fe^{2+}}{Fe^{3+}} \right] = 1$$

$$\operatorname{or}\left[\frac{\operatorname{Fe}^{2+}}{\operatorname{Fe}^{3+}}\right] = 10$$

29. The correct answer is [6].

The structure of ozone is



Thus there are 6 lone pairs of electrons on oxygen atoms of ozone.

30. The correct answer is [9079].

Given: No. of moles of $NH_3 = 0.1$

No. of moles of $NH_4Cl = 0.1$

Being acidic HCl reacts with NH₃ to form NH₄Cl

$$\begin{split} NH_3 + & HCI \rightarrow NH_4CI \\ 0.1 & 0.02 & 0.1 \\ -0.02 & -0.02 & +0.02 \\ 0.08 & 0.12 \\ here & pOH = pK_b + log \bigg[\frac{salt}{base} \bigg] \\ & pOH = 4.745 + log \frac{0.12}{0.08} \\ pOH & = 4.921 \\ & pH & = 14 - pOH \\ & = 14 - 4.921 \\ & pH & = 9.079 \\ & pH \approx 9079 \times 10^{-3} \end{split}$$