

PART - C (CHEMISTRY)

SECTION - A

(One Options Correct Type)

This section contains **20 multiple choice questions**. Each question has **four choices** (1), (2), (3) and (4), out of which **ONLY ONE** option is correct.

- *61. Given below are two statements: One is labeled as Assertion A and the other is labeled as Reason R.
 Assertion A: The first ionization enthalpy decreases across a period
 Reason R : The increasing nuclear charge outweighs the shielding across the period.
 In the light of the above statements, choose the most appropriate from the options given below:
 (1) A is false but R is true
 (2) A is true but R is false
 (3) Both A and R are true and R is the correct explanation of A
 (4) Both A and R are true but R is NOT the correct explanation of A

Ans. (1)

Sol. Assertion (A) is false

The first ionization enthalpy increases across a period.

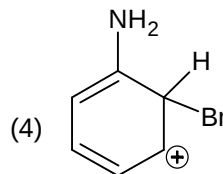
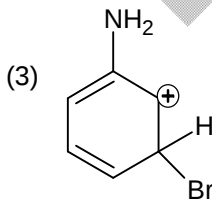
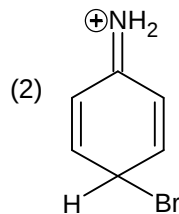
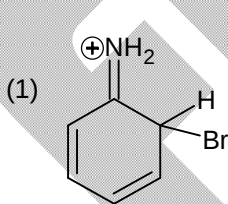
Reason is correct.

- *62. The difference in energy between the actual structure and the lowest energy resonance structure for the given compound is
 (1) electromeric energy (2) ionization energy
 (3) hyperconjugation energy (4) resonance energy

Ans. (4)

Sol. Resonance Energy: A compound with delocalized electron is more stable than if it would be if all its electron were localized. The extra stability of compound gains from having delocalized electrons is called Resonance Energy.

- *63. The arenium ion which is not involved in the bromination of Aniline is _____.



Ans. (3)

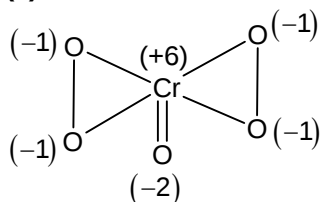
Sol. NH₂ group being ortho and para directing. Bromination is not possible at meta position.

64. In chromyl chloride test for confirmation of Cl^- ion, a yellow solution is obtained. Acidification of the solution and addition of amyl alcohol and 10% H_2O_2 turns organic layer blue indicating formation of chromium pentoxide. The oxidation state of chromium in that is

- (1) +5 (2) +3
(3) +10 (4) +6

Ans. (4)

Sol.



65. Match List I with List II

LIST I (Substances)		LIST II (Element Present)	
A.	Ziegler catalyst	I.	Rhodium
B.	Blood Pigment	II.	Cobalt
C.	Wilkinson catalyst	III.	Iron
D.	Vitamin B ₁₂	IV.	Titanium

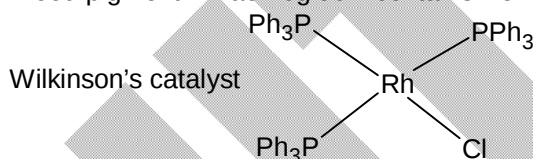
Choose the correct answer from the options given below

- (1) A-II, B-IV, C-I, D-III (2) A-IV, B-III, C-I, D-II
(3) A-II, B-III, C-IV, D-I (4) A-III, B-II, C-IV, D-I

Ans. (2)

Sol. Ziegler catalyst - $\text{TiCl}_4 + \text{Al}(\text{C}_2\text{H}_5)_3$

Blood pigment – Haemoglobin contains Fe^{2+}



Vitamin B₁₂ – contain Co^{2+}

66. Type of amino acids obtained by hydrolysis of proteins is :

- (1) γ (2) δ
(3) β (4) α

Ans. (4)

Sol. Proteins $\xrightarrow{\text{Hydrolysis}}$ Peptides $\xrightarrow{\text{Hydrolysis}}$ α – amino acids

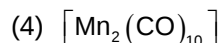
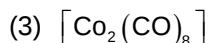
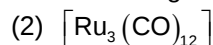
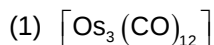
- *67. The interaction between π bond and lone pair of electrons present on an adjacent atom is responsible for

- (1) Resonance effect (2) Electromeric effect
(3) Inductive effect (4) Hyperconjugation

Ans. (1)

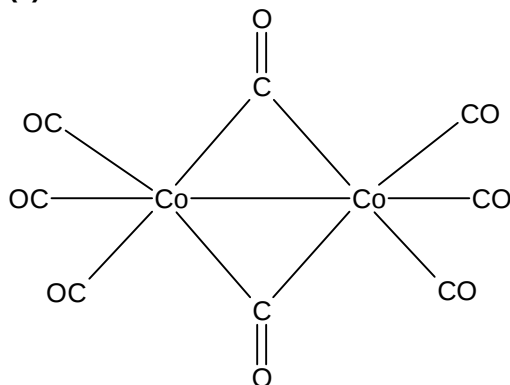
Sol. Resonance – The delocalization of electrons is known as resonance. For a compound to show resonance, compound with unsaturated system would be in conjugation with π – bond, –ve charge, positive charge, lone pair or odd electron.

68. In which one of the following metal carbonyls, CO forms a bridge between metal atoms?



Ans. (3)

Sol.



69. Given below are two statements: One is labelled as **Assertion A** and the other is labelled as **Reason R**.

Assertion A: Aryl halides cannot be prepared by replacement of hydroxyl group of phenol by halogen atom.

Reason R : Phenols react with halogen acids violently.

In the light of the above statements, choose the most appropriate 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 but R is NOT the correct explanation of A

Ans. (3)

Sol. Aryl halides cannot be prepared by replacement of hydroxyl group of phenol by halogen atom.

*70. The correct set of four quantum numbers for the valence electron of rubidium atom ($Z = 37$) is:

(1) $5, 1, 0, +\frac{1}{2}$

(2) $5, 1, 1, +\frac{1}{2}$

(3) $5, 0, 1, +\frac{1}{2}$

(4) $5, 0, 0, +\frac{1}{2}$

Ans. (4)

Sol. Rubidium = $[\text{Kr}]5s^1$

[At. No. = 37]

$$n = 5, \ell = 0, m = 0, s = +\frac{1}{2}$$

71. Identify the incorrect pair from the following:

(1) Carnallite- $\text{KCl} \cdot \text{MgCl}_2 \cdot 6\text{H}_2\text{O}$

(2) Cryolite - Na_3AlF_6

(3) Fluoroapatite- $3 \text{Ca}_3(\text{PO}_4)_2 \cdot \text{CaF}_2$

(4) Fluorspar - BF_3

Ans. (4)

*72. Appearance of blood red colour, on treatment of the sodium fusion extract of an organic compound with FeSO_4 in presence of concentrated H_2SO_4 indicates the presence of element/s

(1) N and S

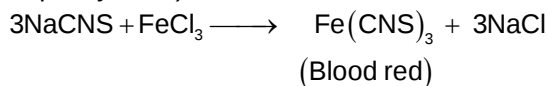
(2) N

(3) S

(4) Br

Ans. (1)

Sol. Lassaigne's filtrate (sodium extract) consist of NaCN and NaOH and when organic compound contains both 'N' and 'S'. Sodium thiocyanate is formed, which gives red coloration (of ferric sulphocyanide) with ferric ion.

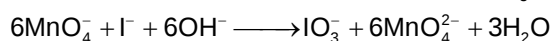


73. In alkaline medium, MnO_4^- oxidizes I^- to

- (1) IO^- (2) IO_4^-
(3) I_2 (4) IO_3^-

Ans. (4)

Sol. In alkaline medium KMnO_4 oxidises I^- to IO_3^-



*74. Which of the following is not correct?

- (1) ΔG is zero for a reversible reaction
(2) ΔG is negative for a spontaneous reaction
(3) ΔG is positive for a spontaneous reaction
(4) ΔG is positive for a non-spontaneous reaction

Ans. (3)

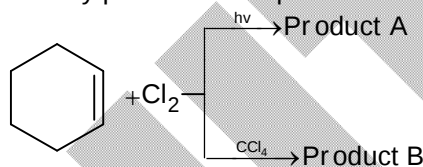
Sol. At constant temperature and pressure

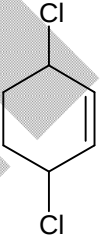
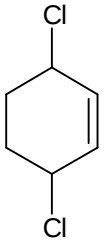
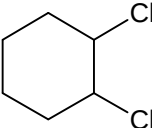
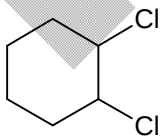
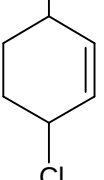
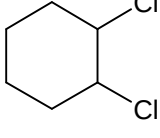
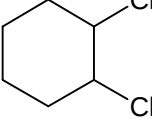
$\Delta G = -ve$ for spontaneous process

$\Delta G = 0$ for process at equilibrium

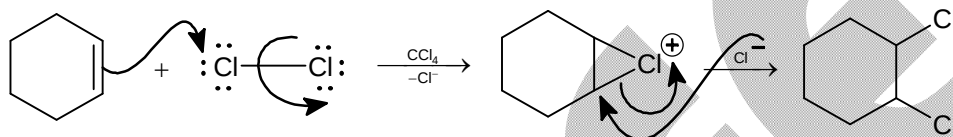
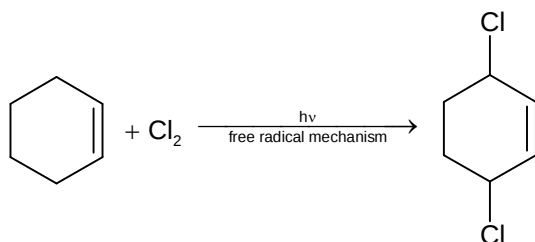
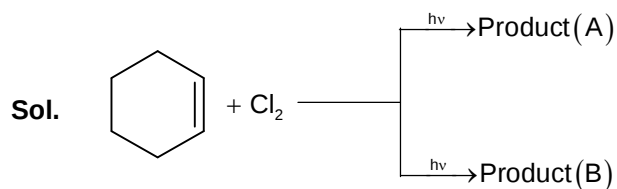
$\Delta G = +ve$ for non-spontaneous process.

*75. Identify product A and product B :

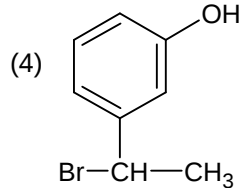
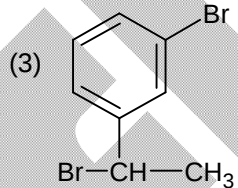
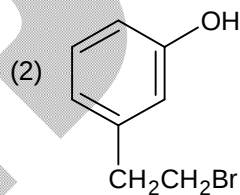
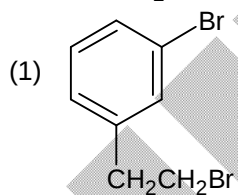
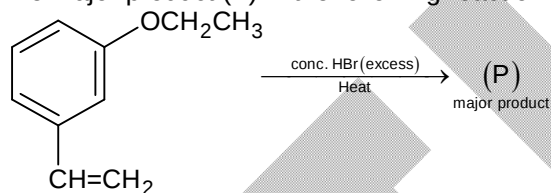


- (1) A:  B: 
- (2) A:  B: 
- (3) A:  B: 
- (4) A:  B: 

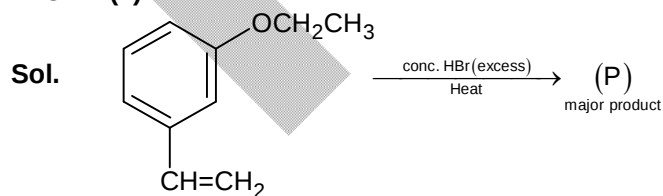
Ans. (2)

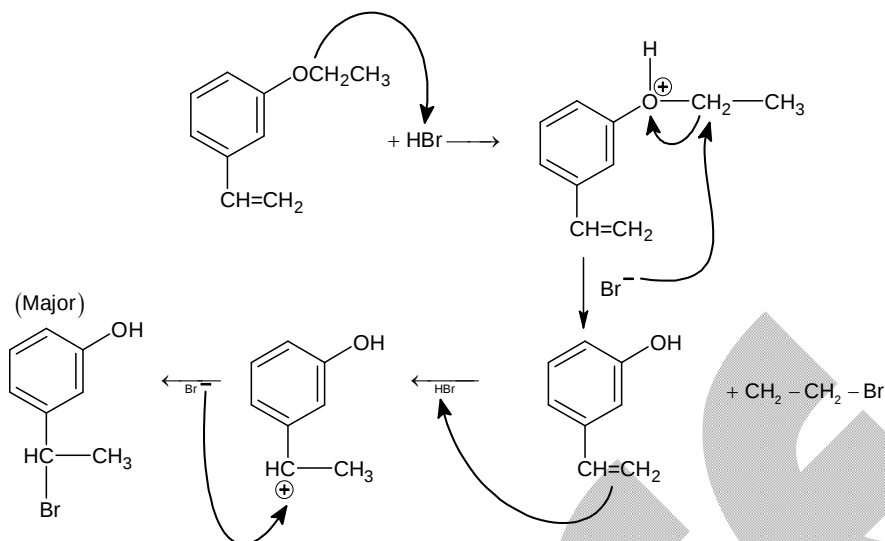


76. The major product (P) in the following reaction is

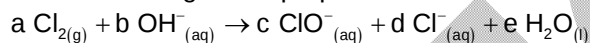


Ans. (4)





*77. Chlorine undergoes disproportionation in alkaline medium as shown below :



The values of a, b, c and d in a balanced redox reaction are respectively:

(1) 2, 2, 1 and 3

(2) 1, 2, 1 and 1

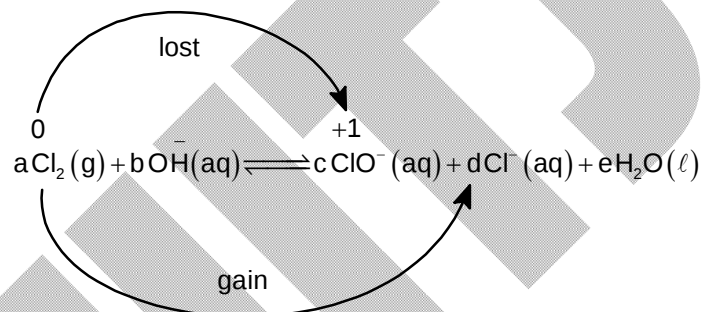
(3) 2, 4, 1 and 3

(4) 3, 4, 4 and 2

Ans.

(2)

Sol.



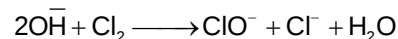
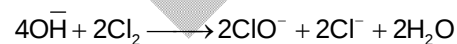
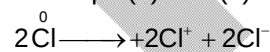
Lost part



Gain part

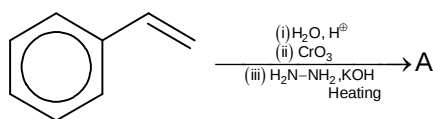


Add Eqn. (1) and (2)



Hence, a = 1, b = 2, c = 1, d = 1, e = 1

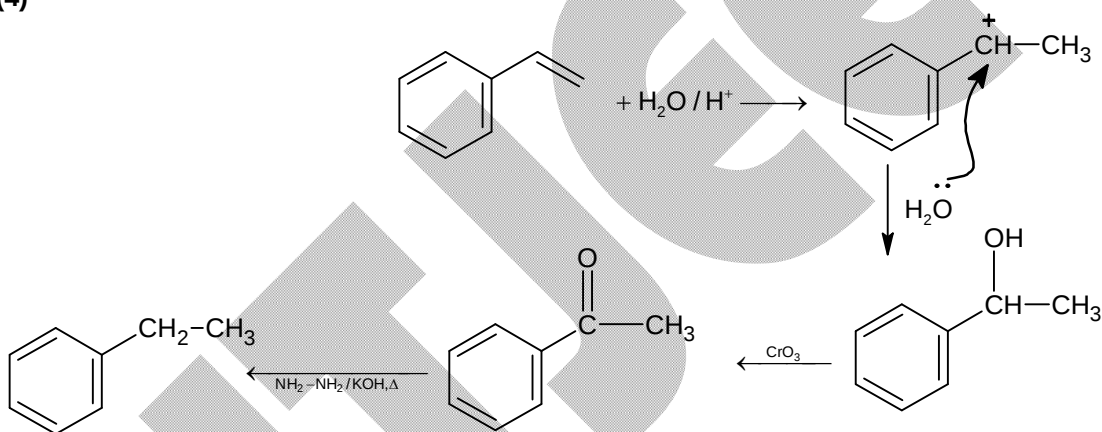
78. The final product A formed in the following multistep reaction sequence is



- (1)
- (2)
- (3)
- (4)

Ans. (4)

Sol.



*79. Given below are two statements:

Statement I: The electronegativity of group 14 elements from Si to Pb gradually decreases.

Statement II: Group 14 contains non-metallic, metallic, as well as metalloid elements.

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

- (1) Statement I is true but Statement II is false
 (2) Statement I is false but Statement II is true
 (3) Both Statement I and Statement II are false
 (4) Both Statement I and Statement II are true

Ans. (2)

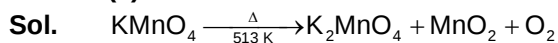
Sol. Order of E. N.



80. KMnO_4 decomposes on heating at 513 K to form O_2 along with

- (1) Mn & KO_2 (2) K_2MnO_4 & MnO_2
 (3) K_2MnO_4 & Mn (4) MnO_2 & K_2O_2

Ans. (2)

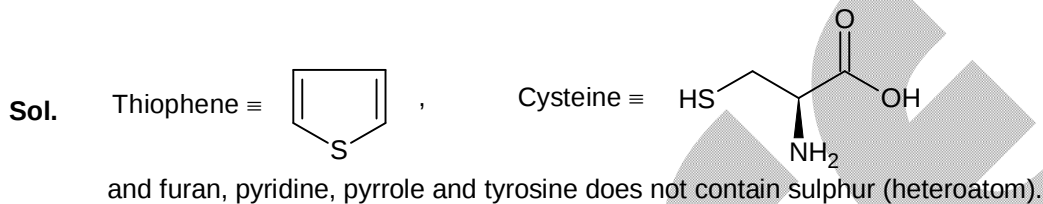


SECTION - B**(Numerical Answer Type)**

This section contains **10** Numerical based questions. The answer to each question is rounded off to the nearest integer value.

- *81. Number of compounds among the following which contains sulphur as heteroatom is _____.
Furan, Thiophene, Pyridine, Pyrrole, Cysteine, Tyrosine

Ans. 2



82. The osmotic pressure of a dilute solution is 7×10^5 Pa at 273 K. Osmotic pressure of the same solution at 283 K is _____ $\times 10^4$ Nm⁻²

Ans. 73

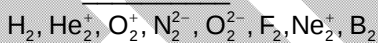
Sol. Osmotic pressure = 7×10^5 Pa, $T = 273$ K

$$\pi = CRT \Rightarrow \frac{\pi}{T} = CR = \text{constant}$$

$$\therefore \frac{7 \times 10^5}{273} = \frac{\pi_{\text{req}}}{283}$$

$$\pi_{\text{req}} = \frac{7 \times 10^5}{273} \times 283 = 72.56$$

- *83. The number of species from the following which are paramagnetic and with bond order equal to one is _____.



Ans. 1

Sol. $\text{H}_2 \equiv \sigma 1s^2$, Bond order = $\frac{2}{2} = 1$, M. B. = Diamagnetic

$$\text{He}_2^- \equiv \sigma 1s^2 \sigma^* 1s^2 \sigma 2s^1, \text{ Bond order} = \frac{1}{2}[3 - 2] = \frac{1}{2} = 0.5, \text{ M. B.} = \text{P. M.}$$

$$\text{O}_2^+ \Rightarrow \text{Bond order} = 2.5, \text{ M. B.} = \text{P. M.}$$

$$\text{N}_2^{2-} \Rightarrow \text{Bond order} = 2.0, \text{ M. B.} = \text{P. M.}$$

$$\text{Bond order} = \frac{1}{2}[10 - 6] = \frac{4}{2} = 2$$

$$\text{O}_2^{2-} \rightarrow \text{Bond order} = 1, \text{ M. B.} = \text{Diamagnetic}$$

$$\text{F}_2 \rightarrow \text{Bond order} = 1.0, \text{ M. B.} = \text{Diamagnetic}$$

$$\text{Ne}_2^+ \rightarrow \text{Bond order} = 0.5, \text{ M. B.} = \text{Paramagnetic}$$

$$\text{B}_2 \rightarrow \text{Bond order} = \frac{1}{2}[6 - 4] = \frac{2}{2} = 1, \text{ M. B.} = \text{P. M.}$$

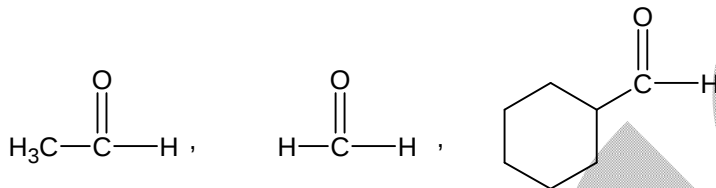
Hence, the number of species from the following which are paramagnetic and with bond order equal to one = 1.

84. From the compounds given below, number of compounds which give positive Fehling's test is _____.

Benzaldehyde, Acetaldehyde, Acetone, Acetophenone, Methanal, 4-nitrobenzaldehyde, cyclohexane carbaldehyde.

Ans. 3

Sol. Number of compound which gives Fehling test

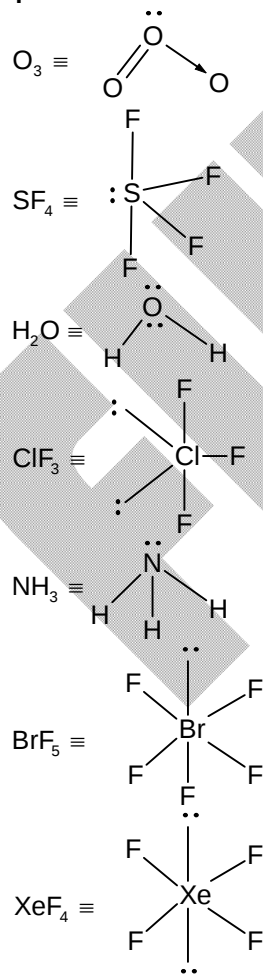


- *85. Number of compounds with one lone pair of electron on central atom amongst following is _____.

O_3 , H_2O , SF_4 , ClF_3 , NH_3 , BrF_5 , XeF_4

Ans. 4

Sol.



∴ Number of compound with one lone pair of electron on central atom = 4 (which are O₃, NH₃, BrF₅ and SF₄)

- *86. For the reaction $\text{N}_2\text{O}_{4(g)} \rightleftharpoons 2\text{NO}_{2(g)}$, $K_p = 0.492 \text{ atm}$ at 300 K. K_c for the reaction at same temperature is _____ $\times 10^{-2}$.
(Given : $R = 0.082 \text{ L atm mol}^{-1} \text{ K}^{-1}$)

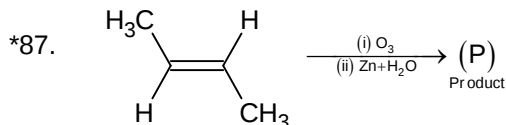
Ans. 2

Sol. $\text{N}_2\text{O}_4(g) \rightleftharpoons 2\text{NO}_2(g)$, $K_p = 0.492 \text{ atm}$, $T = 300 \text{ K}$

$$\Delta n_g = 2 - 1 = 1$$

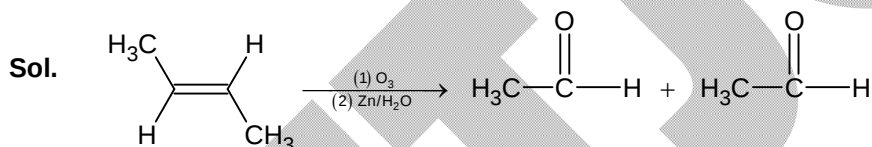
$$\therefore K_p = K_c \times (RT)^{\Delta n_g} \Rightarrow 0.492 = K_c \times (0.082 \times 300)^1$$

$$K_c = \frac{0.492}{300 \times 0.082} = \frac{0.492}{24.6} = 2 \times 10^{-2}$$



Consider the given reaction. The total number of oxygen atom/s present per molecule of the product (P) _____.

Ans. 1



- *88. A solution of H₂SO₄ is 31.4 % H₂SO₄ by mass and has a density of 1.25 g/mL. The molarity of the H₂SO₄ solution is _____ M (nearest integer)
[Given molar mass of H₂SO₄ = 98 g mol⁻¹]

Ans. 4

Sol. 31.4% by mass of H₂SO₄, $d_{\text{soln}} = 1.25 \text{ g/mL}$

$$[M]_{\text{H}_2\text{SO}_4} = ?$$

Let mass of solution = 100 g

Mass of H₂SO₄ = 31.4

$$\therefore V_{\text{soln}} = \frac{100}{1.25} = 80 \text{ mL}$$

$$(\text{mole})_{\text{H}_2\text{SO}_4} = \frac{31.4}{98} = 0.32$$

$$[M]_{\text{H}_2\text{SO}_4} = \frac{\text{mole}}{V_{\text{soln in mL}}} \times 1000 = 4$$

89. The mass of zinc produced by the electrolysis of zinc sulphate solution with a steady current of 0.015 A for 15 minutes is _____ $\times 10^{-4}$ g.
(Atomic mass of zinc = 65.4 amu)

Ans. 46

Sol. $\text{Zn}^{2+} + 2e^- \longrightarrow \text{Zn}$

$$W \propto Q$$

$$W = \text{zit}$$

$$= \frac{65.4}{2 \times 96500} \times 0.015 \times 15 \times 60 = \frac{882.9}{193000} = 45.75 \times 10^{-4} \text{ g}$$

*90. For a reaction taking place in three steps at same temperature, overall rate constant $K = \frac{K_1 K_2}{K_3}$. If

E_{a1} , E_{a2} and E_{a3} are 40, 50 and 60 kJ/mol respectively, the overall E_a is _____ kJ/mole

Ans. 30

Sol. $E_{a1} = 40$, $E_{a2} = 50$ and $E_{a3} = 60$

$$k_{\text{eff}} = \frac{k_1 k_2}{k_3}$$

$$*A_{\text{eff.}} e^{-\frac{E}{RT}} = \frac{A_1 \times e^{-\frac{E_1}{RT}} \times A_2 e^{-\frac{E_2}{RT}}}{A_3 \times e^{-\frac{E_3}{RT}}}$$

On differentiating w. r. t. to temperature,

$$E = E_{a1} + E_{a2} - E_{a3} \\ = 40 + 50 - 60 = 30$$