



General Instructions

- (i) **Duration:** The total duration of the examination is 1 hours (60 minutes).
- (ii) **Total Marks:** The complete Chemistry paper carries a maximum of 100 marks.
- (iii) **Structure:** The paper consists of two sections:
 - **Section A:** 20 Multiple Choice Questions (MCQs).
 - **Section B:** 5 Numerical Value Type Questions.
- (iv) **Compulsory Questions:** All 25 questions are compulsory.
- (v) Each question has four options. Only **one** option is correct.
- (vi) **Correct Answer:** +4 marks.
- (vii) **Incorrect Answer:** -1 mark (Negative marking).
- (viii) **Unanswered/Marked for Review:** 0 marks.

Chemistry Section - A

1. Which of the following contain the same number of atoms ?

(Given : Molar mass in g mol^{-1} of H, He, O and S are 1, 4, 16 and 32 respectively)

- A. 2 g of O_2 gas
- B. 4 g of SO_2 gas
- C. 1400 mL of O_2 at STP
- D. 0.05 L of He at STP
- E. 0.0625 mol of H_2 gas

Choose the correct answer from the options given below :

- (A) A and B only
 - (B) B and C only
 - (C) C and D only
 - (D) A, C and E only
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2. The Bohr radius of a hydrogen like species is 70.53 pm. The species and the stationary state (n) are respectively

(Given : Hydrogen atom Bohr radius is 52.9 pm)

- (A) Li^{2+} , 3
 - (B) He^+ , 3
 - (C) He^+ , 2
 - (D) Li^{2+} , 2
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3. Given below are two statements :

Statement I : The number of compounds among SO_2 , SO_3 , SF_4 , SF_6 and H_2S in which sulphur does not obey the Octet rule is 3.

Statement II : Among $[\text{H}_2\text{O}, \text{ClF}_3, \text{SF}_4]$, $[\text{NH}_3, \text{BrF}_5, \text{SF}_4]$, $[\text{BrF}_5, \text{ClF}_3, \text{XeF}_4]$ and $[\text{XeF}_4, \text{ClF}_3, \text{H}_2\text{O}]$, the number of sets in which all the molecules have one lone pair of electrons on the central atom is 1.

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
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4. Match List - I with List - II.

List - I (Isothermal process)	List - II (Expression)
A. Reversible expansion	I. $q = 0$
B. Free expansion	II. $q = nRT \ln \frac{V_2}{V_1}$
C. Irreversible Compression	III. $w = -P_{\text{ext}}(V_1 - V_2)$
D. Cyclic reversible	IV. $\frac{q_{\text{rev}}}{T} = 0$

Choose the correct answer from the options given below :

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

5. Given below are two statements :

Chamber 1	Semi-permeable membrane	Chamber 2
18 g glucose in 100 mL aqueous solution		30 g glucose in 250 mL aqueous solution

Statement I : H_2O molecules move from the chamber 1 to chamber 2.

Statement II : The osmotic pressure of a solution prepared by dissolving 50 mg of potassium sulphate (molar mass = 174 g/mol) in 2 L of water (at 27°C) is 0.0107 bar.

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

6. Given is a concentrated solution of a weak electrolyte A_xB_y of concentration 'c' and dissoci-

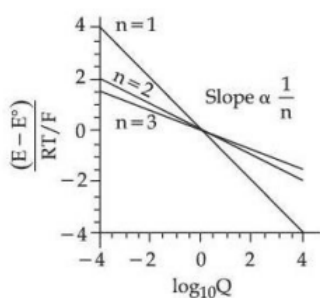
ation constant 'K'. The degree of dissociation is given by :

- (A) $[K \times c^{x+y-1} x^x y^y]^{\frac{1}{x+y}}$
(B) $\left[\frac{K}{c^{x+y-1} x^x y^y} \right]^{\frac{1}{x+y}}$
(C) $\left[\frac{c^{x+y-1} x^x y^y}{K} \right]^{\frac{1}{x+y}}$
(D) $\left[\frac{K}{c^{x+y-1} x^x y^y} \right]^{x+y}$
-

7. Which of the following statement is incorrect ?

(Graph of $(E - E^0)/(RT/F)$ vs $\log_{10} Q$ for redox reaction)

- (A) The overall reaction can be written as $n_2 \text{Red}_1 + n_1 \text{Ox}_2 = n_2 \text{Ox}_1^{n_1+} + n_1 \text{Red}_2^{n_2-}$
(B) The electrons do not appear in the overall reaction because they are consumed at the cathode.



- (C) Here n is the number of electrons transferred in redox reaction.
(D) If the reaction is carried out reversibly, the electrical work done is equal to the ratio of charge and potential difference.
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8. In a period, the first ionisation enthalpy of the element at extreme left and the negative electron gain enthalpy of the extreme right element, except noble gases, are respectively.

- (A) lowest and lowest
(B) highest and lowest
(C) lowest and highest
(D) highest and highest
-

9. Given below are two statements :

Statement I : $\text{F}_2\text{O} < \text{H}_2\text{O} < \text{Cl}_2\text{O}$ is the correct trend in terms of bond angle.

Statement II : SiF_4 , SnF_4 and PbF_4 are ionic in nature.

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

10. The correct order of first ($\Delta_i H_1$) and second ($\Delta_i H_2$) ionisation enthalpy values of Cr and Mn are :

- A. $\Delta_i H_1$: Cr > Mn
- B. $\Delta_i H_2$: Cr > Mn
- C. $\Delta_i H_1$: Mn > Cr
- D. $\Delta_i H_2$: Mn > Cr

Choose the correct answer from the options given below :

- (A) A and B only
- (B) B and C only
- (C) A and D only
- (D) C and D only

11. Which of the following sequences of hybridisation, geometry and magnetic nature are correct for the given coordination compounds ?

- A. $[\text{NiCl}_4]^{2-} - sp^3$, tetrahedral, paramagnetic
- B. $[\text{Ni}(\text{NH}_3)_6]^{2+} - sp^3d^2$, octahedral, paramagnetic
- C. $[\text{Ni}(\text{CO})_4] - sp^3$, tetrahedral, paramagnetic
- D. $[\text{Ni}(\text{CN})_4]^{2-} - dsp^2$, square planar, diamagnetic

Choose the correct answer from the options given below :

- (A) A, B, C and D
(B) B, C and D only
(C) A, C and D only
(D) A, B and D only
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12. Given below are two statements :

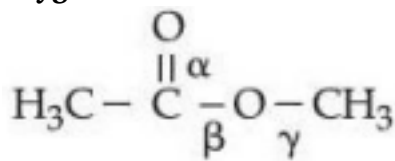
Statement I : A mixture of $C_{12}H_{22}O_{11}$ (sugar) and NaCl can be separated by dissolving sugar in alcohol, due to differential solubility.

Statement II : Rose essence from rose petals is separated by steam distillation due to its high volatility and insolubility in H_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 Statement II are false
(C) Statement I is true but Statement II is false
(D) Statement I is false but Statement II is true
-

13. Shown below is the structure of methyl acetate with three different α , β and γ carbon - oxygen bonds.



The correct order of bond lengths of these bonds is :

- (A) $\alpha > \beta > \gamma$
(B) $\alpha < \beta < \gamma$
(C) $\alpha = \beta = \gamma$
(D) $\alpha < \beta = \gamma$
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14. 'x' is the product which is obtained by the hydrolysis of prop-1-yne in the presence of mer-

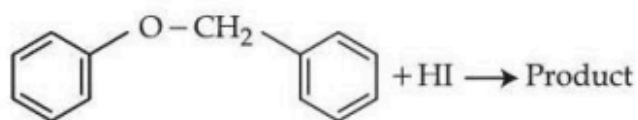
curic sulphate under dilute acidic medium at 333 K. 'y' is the product which is obtained by the reaction of ethane nitrile with methyl magnesium bromide in dry ether followed by hydrolysis. IUPAC name of product obtained from 'x' and 'y' in the presence of barium hydroxide followed by heating is :

- (A) 2-Methylpent-4-en-3-one
- (B) 4-Methylpent-3-en-2-one
- (C) 4-Methylpent-1-ene
- (D) 2-Methylpent-3-one

15. An optically active alkyl bromide C_4H_9Br , reacts with ethanolic KOH to form major compound [A] which reacts with bromine to give compound [B]. Compound [B] reacts with ethanolic KOH and sodamide to give compound [C]. One molecule of water adds to compound [C] on warming with mercuric sulphate and dilute sulphuric acid at 333 K to form compound [D]. The functional group in compound D will be confirmed by :

- (A) Haloform test
- (B) Lucas test
- (C) Silver mirror test
- (D) Benedict test

16. Consider the following reaction.



Statement I : In the above reaction, product formed will be a mixture of benzyl alcohol and iodobenzene.

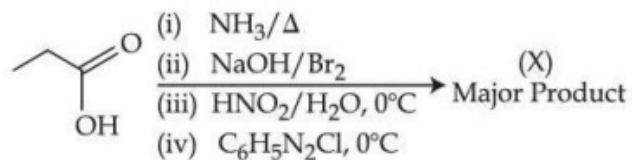
Statement II : In the above reaction, the $-O-CH_2-$ bond is cleaved to give the product.

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

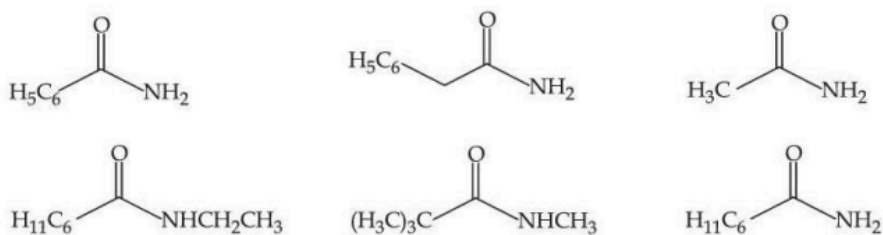
17. Consider the following organic reaction sequence. Choose the final product (X) from the following (consider the major product in all intermediate reactions)



- (i) NH_3/Δ
 (ii) $\text{NaOH}/\text{Br}_2 \rightarrow (\text{X})$
 (iii) $\text{HNO}_2/\text{H}_2\text{O}, 0^\circ\text{C}$
 (iv) $\text{C}_6\text{H}_5\text{N}_2\text{Cl}, 0^\circ\text{C}$

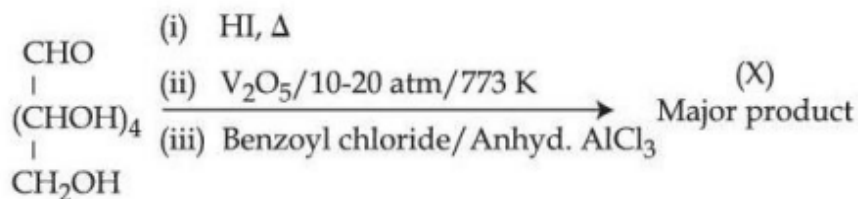
- (A) Benzene
 (B) Phenol
 (C) Propanol
 (D) Chlorobenzene

18. The number of compounds from the following which can undergo reaction with Br_2/KOH (alcoholic) to give respective products and these respective products can also be obtained separately by Gabriel phthalimide reaction is :



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

19. Consider the following reactions. Total number of electrons in the π bonds and lone pair of electrons in the product (X) is :



- (A) 12
(B) 16
(C) 14
(D) 18

20. Treatment of a gas 'X' with a freshly prepared ferrous sulphate solution gives a compound 'Y' as a brown ring. The compounds X and Y are.

- (A) NO and $[\text{Fe}(\text{NO})]\text{SO}_4$
(B) NO_2 and $[\text{Fe}(\text{NO}_2)]\text{SO}_4$
(C) N_2O and $[\text{Fe}(\text{N}_2\text{O})]\text{SO}_4$
(D) N_2O_4 and $[\text{Fe}(\text{N}_2\text{O}_4)]\text{SO}_4$

Chemistry Section -B

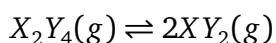
21. An excess of AgNO_3 is added to 100 mL of a 0.05 M solution of tetraquadichloridochromium (III) chloride. The number of moles of AgCl precipitated will be _____ $\times 10^{-3}$. (Nearest integer)

22. An alkane (Y) requires 8 moles of oxygen for complete combustion and on chlorination with $\text{Cl}_2/h\nu$, (Y) gives only one monochlorinated product (Z). The total number of primary

carbon atoms in (Y) is _____ .

23. 500 mL of 0.2 M MnO_4^- solution in basic medium when mixed with 500 mL of 1.5 M KI solution, oxidises iodide ions to liberate molecular iodine. This liberated iodine is then titrated with a standard x M thiosulphate solution in presence of starch till the end point. If 300 mL of thiosulphate was consumed, then the value of x is _____ .

24. In a closed flask at 600 K, one mole of $X_2Y_4(g)$ attains equilibrium as given below :



At equilibrium, 75% $X_2Y_4(g)$ was dissociated and the total pressure is 1 atm. The magnitude of $\Delta_r G^\ominus$ (in kJ mol^{-1}) at this temperature is _____. (Nearest Integer)

(Given : $R = 8.3 \text{ J mol}^{-1} \text{ K}^{-1}$; $\ln 10 = 2.3$, $\log 2 = 0.3$, $\log 3 = 0.48$, $\log 5 = 0.69$, $\log 7 = 0.84$)

25. Decomposition of a hydrocarbon follows the equation $k = (5.5 \times 10^{11} \text{ s}^{-1})e^{\frac{-28000\text{K}}{T}}$. The activation energy of reaction is _____ kJ mol^{-1} . (Nearest Integer)

Given : $R = 8.3 \text{ J K}^{-1} \text{ mol}^{-1}$
