



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. What volume of hydrogen gas at STP would be liberated by action of 50 mL of H_2SO_4 of 50% purity (density = 1.3 g mL^{-1}) on 20 g of zinc?

Given : Molar mass of H, O, S, Zn are 1, 16, 32, 65 g mol^{-1} respectively.

- (A) 5.824 L
- (B) 7.428 L
- (C) 6.892 L

(D) 8.375 L

2. Which of the following statement(s) is/are true?

- A. If two orbitals have the same value of $(n + l)$, the orbital with lower value of n will have lower energy.
- B. Energies of the orbitals in the same subshell increase with increase in atomic number.
- C. The size of $2p_x$ orbital is less than the size of $3p_x$ orbital.
- D. Among $5f$, $6s$, $4d$, $5p$ and $5d$ orbitals, none of the orbitals have 2 radial nodes.

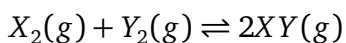
Choose the correct answer from the options given below :

- (A) A, B and C only
- (B) A and C only
- (C) C and D only
- (D) A only
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3. The covalent radii of atoms A and B are r_A and r_B , respectively. The covalent bond length and total length of AB molecule are respectively :

- (A) $(r_A + r_B), 2(r_A + r_B)$
- (B) $\frac{1}{2}(r_A + r_B), (r_A + r_B)$
- (C) $(r_A + r_B), (r_A + r_B)$
- (D) $2(r_A + r_B), \frac{1}{2}(r_A + r_B)$
-

4. Consider the following data for the reaction



at 600 K. The $\Delta_r G^\ominus$ (in kJ mol^{-1}) for the reaction is :

Compound	$\Delta_f H_{600K}^\ominus (\text{kJ mol}^{-1})$	$S_{600K}^\ominus (\text{J mol}^{-1} \text{K}^{-1})$
$XY(g)$	42	200
$X_2(g)$	8	140
$Y_2(g)$	80	250

- (A) -21000
- (B) -10
-

- (C) -1000
(D) -9.012
-

5. The correct order of molar heat capacities measured at 298 K and 1 bar is :

- (A) Copper(s) > Bromine(l) > Helium(g)
(B) Bromine(l) > Copper(s) > Helium(g)
(C) Helium(g) > Bromine(l) > Copper(s)
(D) Helium(g) > Bromine(l) = Copper(s)
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6. The reaction $A(g) \rightleftharpoons B(g) + C(g)$ was initiated with the amount 'a' of $A(g)$. At equilibrium it is found that the amount of $A(g)$ remaining is $(a - x)$ at a total pressure of p .

The equilibrium constant K_p of the reaction can be calculated from the expression :

- (A) $\frac{x^2}{a^2 + x^2} \times p$
(B) $\frac{x^2}{a^2 - x^2} \times p$
(C) $\frac{a + x^2}{x^2} \times p$
(D) $\frac{a^2 - x^2}{x^2} \times p$
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7. One half cell in a voltaic cell is constructed by dipping silver rod in $AgNO_3$ solution of unknown concentration, other half cell is Zn rod dipped in 1 molar solution of $ZnSO_4$.

A voltage of 1.60 V is measured at 298 K for this cell. What is the concentration of Ag^+ ions used in terms of $\log x$ ($x = [Ag^+]$)?

$$E_{Zn^{2+}/Zn}^{\ominus} = -0.76V, E_{Ag^+/Ag}^{\ominus} = +0.80V, \frac{2.303RT}{F} = 0.059V$$

- (A) $\frac{2}{3.9}$
(B) $\frac{4}{5.9}$
(C) $\frac{2.9}{2}$
(D) $\frac{5.9}{4}$
-

8. Given below are two statements :

Statement I : The number of pairs among $[Al_2O_3, Cr_2O_3]$, $[Cl_2O_7, Mn_2O_7]$, $[Na_2O, V_2O_5]$ and $[CO, N_2O]$ that contain oxides of same nature (acidic, basic, neutral or amphoteric) is 4.

Statement II : Among Na_2O, Al_2O_3, CO and Cl_2O_7 , the most basic and acidic oxides are Na_2O and Cl_2O_7 , respectively.

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
-

9. Given below are two statements :

Statement I : Aluminium upon reaction with NaOH forms $[Al(OH)_6]^{3-}$ ion.

Statement II : The geometry of ICl_4^- , ClO_3^- and IBr_2^- is square planar, pyramidal and linear respectively.

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. Given below are two statements :

Statement I : Presence of large number of unpaired electrons in transition metal atoms results in higher enthalpies of their atomisation.

Statement II : $d_{xy} = d_{xz} = d_{yz} < d_{x^2-y^2} = d_{z^2}$ and $d_{x^2-y^2} = d_{z^2} = d_{xy} < d_{xz} = d_{yz}$ are the d-orbital splittings in $[Fe(H_2O)_6]^{3+}$ and $[Ni(Cl)_4]^{2-}$ complex ions respectively.

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

- (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

11. Identify the correct statements from the following

- A. $[Fe(C_2O_4)_3]^{3-}$ is the most stable complex among $[Fe(OH)_6]^{3-}$, $[Fe(C_2O_4)_3]^{3-}$ and $[Fe(SCN)_6]^{3-}$
- B. The stability of $[Cu(NH_3)_4]^{2+}$ is greater than that of $[Cu(en)_2]^{2+}$
- C. The hybridization of Fe in $K_4[Fe(CN)_6]$ is d^2sp^3
- D. $[Fe(NO_2)_3Cl_3]^{3-}$ exhibits linkage isomerism
- E. NO_2^- and SCN^- ligands are NOT ambidentate ligands

Choose the correct answer from the options given below :

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

12. Match List - I with List - II.

List - I	List - II
Purification technique	Used to separate
A. Simple distillation	I. Steam volatile compound
B. Fractional distillation	II. Two liquids with large difference in boiling points
C. Steam distillation	III. Liquid decomposing at its boiling point
D. Distillation under reduced pressure	IV. Two liquids with close boiling points

Choose the correct answer from the options given below :

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

13. IUPAC name of the some alkenes are given below. Find out the correct stability order.

- A. 2-Methylbut-2-ene
- B. cis-But-2-ene
- C. 2,3-Dimethylbut-2-ene
- D. Prop-1-ene

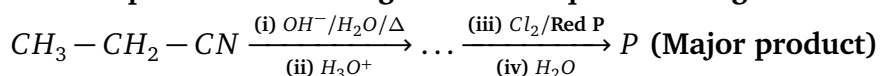
Choose the correct answer from the options given below :

- (A) $C > A > B > D$
 - (B) $C > A > D > B$
 - (C) $B > D > A > C$
 - (D) $A > B > C > D$
-

14. Identify the correct IUPAC name of hydrocarbon (x) containing three primary carbon atoms and with molar mass 72 g mol^{-1} .

- (A) 1, 1 - Dimethylcyclopropane
 - (B) 2, 2 - Dimethylpropane
 - (C) 2 - Methylbutane
 - (D) n-pentane
-

15. Complete the following reaction sequence and give the name of major product 'P'.



- (A) 2-Chloropropanoic acid
 - (B) 3-Chloropropanoic acid
 - (C) 1-Chloropropane
 - (D) 2-Chloropropane
-

16. Given below are two statements :

Statement I : The condensation reaction between $\text{CH}_3 - \text{CH} = \text{O}$ and $\text{H}_2\text{N} - \text{N}(\text{H}) - \text{CONH}_2$ under optimum pH will produce $\text{CH}_3 - \text{CH} = \text{N} - \text{NH} - \text{CONH}_2$.

Statement II : The molecule, $\text{Ph} - \text{CH}(\text{OH}) - \text{OCH}_3$ will generate $\text{Ph} - \text{CH} = \text{O}$ in the presence of dilute acid.

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. Given below are two statements :

Statement I : Heating benzamide with bromine in an ethanolic solution of sodium hydroxide will give benzylamine.

Statement II : Nitration of aniline with $\text{HNO}_3/\text{H}_2\text{SO}_4$ at 288 K produces m-nitroaniline in higher amount than o-nitroaniline (pH adjusted).

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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18. Identify the incorrect statement about tertiary structure of proteins.

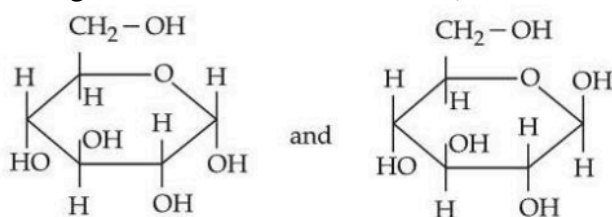
- (A) They can be fibrous or globular in structure
(B) The main forces that stabilize the structure are hydrogen bonding, disulphide links, van der Waals and electrostatic forces of attraction
(C) The structure remains intact when exposed to pH changes
(D) A linear polypeptide chain will convert to a secondary structure and then further folding of the secondary structure will convert to tertiary structure
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19. Given below are two statements :

Statement I : α and β D-(+)-glucose are two anomers of D-(+)-glucose.

Statement II : The open chain forms of D-glucose and D-fructose contain three similar chiral carbons at C_3 , C_4 and C_5 .

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
-

20. A paper dipped in a dil. H_2SO_4 solution of 'X' upon treatment with SO_2 gas turns into green. The compound 'X' is :

- (A) KI-starch
(B) $KMnO_4$
(C) $Pb(CH_3COO)_2$
(D) $K_2Cr_2O_7$
-

21. The total number of unpaired electrons present in the d^3 , d^4 (low spin), d^5 (high spin), d^6 (high spin) and d^7 (low spin) octahedral complex systems is _____.

22. $RMgI$ when treated with ice cold water liberated a gas which occupied $1.4 \text{ dm}^3/\text{g}$ at STP. The gas produced is further reacted with iodine in presence of HIO_3 to give compound (X). Compound (X) in presence of Na and dry ether produced compound (Y). Molar mass of compound (Y) is _____ g mol^{-1} . (Nearest integer)

23. 20 g hemoglobin in a 1 L aqueous solution (A) at 300 K is separated from pure water by semi permeable membrane. At equilibrium the height of solution in a tube dipped in a solution (A) is found to be 80.0 mm higher than the tube dipped in water. The molar mass of hemoglobin is _____ kg mol^{-1} . (Nearest integer)
(Given : $g = 10 \text{ m s}^{-2}$, $R = 8.3 \text{ kPa dm}^3 \text{ K}^{-1} \text{ mol}^{-1}$, density of solution = 1000 kg m^{-3})

24. At 298 K, the molar conductivity of $x\%$ (w/w) MX solution (aqueous) is $123.5 \text{ S cm}^2 \text{ mol}^{-1}$. The conductance of same solution is $1.9 \times 10^{-3} \text{ S}$. The value of x is $\text{_____} \times 10^{-2}$.
(Given : cell constant = 1.3 cm^{-1} ; molar mass of MX is 75 g mol^{-1} , density of aqueous solution of MX at 298 K is 1.0 g mL^{-1})

25. For a reaction $A \rightarrow P$ at $T \text{ K}$, the half life ($t_{1/2}$) is plotted as a function of initial concentration $[A]_0$ of A as given below. The value of x in the given figure is _____ s (Nearest integer)

