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Sample Paper

Class:12th **Subject: Chemistry**

Time: 3 hours **Maximum Marks: 70**

General Instructions:

i) All questions are compulsory.
ii) Question numbers 1 to 8 are very short answer questions and carry 1 mark each.
iii) Question numbers 9 to 18 are short answer questions and carry 2 marks each.
iv) Question numbers 19 to 27 are also short answer questions and carry 3 marks each.
v) Question numbers 28 to 30 are long answer questions and carry 5 marks each.
vi) Use log tables if necessary. Use of calculators is not allowed.

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1 Arrange the following compounds in order of increasing boiling points.
Chloropropane, Isopropyl chloride, 1-Chlorobutane

2 Give the IUPAC name of the following compound $(CH_3)_2C=CHCOOH$.

3 For the reaction: $N_2(g) + 3H_2(g) \longrightarrow 2NH_3(g)$
If $\Delta[NH_3]/\Delta t = 4 \times 10^{-8}$ mol $L^{-1}s^{-1}$, what is the value of $-\Delta[H_2]/\Delta t$?

4 Which of the following is the most effective electrolyte in the coagulation of $Fe_2O_3.H_2O/Fe^{3+}$ sol :- KCl, $AlCl_3$, $MgCl_2$, $K_4[Fe(CN)_6]$

5 Which nucleic acid is responsible for protein synthesis in the cell?

6 Which xenon compound is isostructural with ICl^-?

7 What happens to the colour of the coordination compound $[Ti(H_2O)_6]Cl_3$ when heated gradually?

8 Write the structure of phenyl isopentyl ether.

9 i) For a weak electrolyte, molar conductance in dilute solution increases sharply as its concentration in solution is decreased. Give reason.
ii) Write overall cell reaction for lead storage battery when the battery is being charged.

10 Sucrose decomposes in acid solution into glucose and fructose according to the first order rate law with $t_{1/2} = 3$ hours. Calculate the fraction of sucrose which remains after 8 hours.

OR

The rate constant of a reaction at 500 K and 700 K are 0.02 s^{-1} and 0.07 s^{-1} respectively. Calculate the value of activation energy for the reaction. [Given R = 8.31 $JK^{-1}mol^{-1}$]

11 What do you understand by order of the reaction? Identify the reaction order from each of the following units of reaction rate constant:

i)$L^{-1}mol\ s^{-1}$

ii)$L\ mol^{-1}s^{-1}$

12 i) Draw the structure of hypophosphorous acid.

ii) Write a chemical reaction for its use as a reducing reagent.

13 i) Suggest a quantitative method for estimation of the gas which protects us from UV rays of the sun.

ii) Nitrogen oxides emitted from the exhaust system of supersonic jet aeroplanes slowly deplete the concentration of ozone layer in the upper atmosphere. Comment.

14 i) Give the electronic configuration of the d-orbitals of Ti in $[Ti(H_2O)_6]^{3+}$ ion and explain why this complex is coloured? [At. No. of Ti = 22]

ii) Write IUPAC name of $[Cr(NH_3)_3(H_2O)_3]Cl_3$.

15 Describe a chemical test in each case to distinguish between the following pairs of compounds.

i) Aniline and N-Ethyl aniline.

ii) N-Methyl propan-2-amine and N-Ethyl-N-methyl ethanamine.

16 Write a chemical equation each to represent

i) Gattermann reaction.

ii) Hoffmann bromamide reaction.

17 Aluminium crystallizes in an fcc unit cell. Atomic radius of the metal is 125pm. What is the length of the side of the unit cell of the metal?

18 i) Why does the presence of excess of lithium makes LiCl crystals pink?

ii) What type of semiconductor is obtained when a) B is doped with Ge ii) P is doped with Si

19 i) Calculate the charge in coulombs required for oxidation of 2 moles of water to oxygen.

ii) Zn/Ag oxide cell is used in hearing aids and electric watches. The following reactions occur:

$Zn\ (s) \longrightarrow Zn^{2+} + 2e^-$ $\quad E°_{Zn2+/Zn} = -0.76V$

$Ag_2O + H_2O + 2e^- \longrightarrow 2Ag + 2OH^-$ $\quad E°_{Ag+/Ag} = 0.344V$

Calculate: i) standard potential of the cell.

ii) standard Gibbs energy.

20 Give reasons for the following observations:

i) Colloids stabilize due to Brownian movement.

ii) Cottrell's smoke precipitator is fitted at the mouth of chimney used in factories.

iii) Colloidal gold is used for intramuscular injection.

21 i) Extraction of Au by leaching with NaCN involves both oxidation and reduction. Justify by giving equations for the reactions involved.

ii) Why is the froath floatation method selected for the concentration of sulphide ores?

OR

i) Name the method used for refining of copper metal.

ii) Name the principal ore of aluminium. Explain the significance of leaching in the extraction of aluminium.

22 Write balanced chemical equations for the reactions:

a)Thermal decomposition of ammonium dichromate.

b)Reaction of Cl_2 with cold and dilute NaOH.

c)When phosphine is passed through mercuric chloride solution.

23 Account for the following:

a)C-X bond length in halobenzene is smaller than C-X bond length in CH_3-X

b)Chloroform should be stored in dark coloured bottles and these bottles should be stored in dark coloured bottles should be completely filled.

c)Benzylic halides show high reactivity towards S_N1 reaction.

24 a) Give one reaction of D-glucose which cannot be explained by its open chain structure.

b)Give one example each for essential and non-essential amino acids.

c)Differentiate between keratin and insulin.

25 a) Identify aliphatic biodegradable polyester which is used in packaging and orthopaedic devices.

i)Write its full form.

ii) Give the structures of monomers from which it is formed.

iii)Show the formation of polymer.

b)Write the name and structure of the monomer of Nylon-6.

26 Mr Paul was diabetic. He used to take milk or tea without sugar.But he did not find it tasty. He told it to Mr. Seth. Mr. Seth suggested him to use some artificial sweetners like sugarfree tablets available in the market. Mr.Seth told him that he can enjoy the taste of sweetness without any harmful side effects. Moreover it will also reduce his calorie intake. Mr. Paul tried it and he found it very good.

After reading above passage answer the following:

a) Why Mr. Paul avoided taking sugar?

b) Why artificial sweetness do not cause any harm to a diabetic patients?

c) Identify some values that your find in the above context.

27 a) Give chemical tests to distinguish between:

i)Isopropyl alcohol and n-propylalcohol.

ii)Phenol and alcohol

iii)Methylethanoate and Ethylethanoate

28 a)A 6.2% solution of menthol in cyclohexane freezes at -1.95°C. Determine the molecular mass of menthol. The freezing point and molal depression constant of cyclohexane are 6.5°C and 20.2 Km^{-1},respectively.

b)State Henry's Law and mention its two important applications.

c) Which of the following has higher boiling point and why: 0.1 M NaCl or 0.1 M Glucose.

OR

a) Explain the following:

i) Raoult's Law

ii) Boiling point elevation constant for a solvent.

b)A solution of glycerol ($C_3H_8O_3$) in water ws prepared by dissolving some glycerol in 500 g of water. This solution has a boiling point of 100.42°C. What mass of glycerol was dissolved

S.No.	Unit	VSA (1 mark)	SA I (2 marks)	SA II (3 marks)	LA (5 marks)	Total

to make this solution? (K_b for water = 0.512 K kg mol^{-1}).

29 a) i) Which is stronger reducing agent Cr^{2+} or Fe^{2+} and why?

ii)Explain why Cu^{+} ion is not stable in aqueous solutions.

iii)Explain why Ce^{4+} is a strong oxidizing agent.

b)Describe the oxidizing property of $KMnO_4$ in neutral or weakly alkaline medium for its reaction with iodide ions and thiosulphate ions.

OR

a)Account for the following:

i)Oxidizing power in the series $VO^{2+} < Cr_2O_7^{2-} < MnO_4^-$

ii)In the first transition series, only copper has positive electrode potential.

iii)Oxoanions of a metal show higher oxidation state.

iv) Transition metals exhibit variable oxidation states.

v) Actinoids exhibit a greater range of oxidation states than the lanthanoids.

30 a) An organic compound (A) which has a characteristic odour, on treatment with NaOH, it forms two compounds (B) and (C). Compound (B) has molecular formula C_7H_8O which on oxidation gives back (A).The compound (C) is a sodium salt of an acid. When (C) is treated with soda lime, it yields an aromatic hydrocarbon (D). Deduce the structures of (A), (B), (C) and (D). Write the sequence of reactions involved.

b)Arrange the following in the increasing order of the property indicated:

i) Benzoic acid, 4-Nitro benzoic acid, 3,5-Dinitrobenzoic acid, 4-Methoxybenzoic acid (Acid strength)

ii) Acetaldehyde, Acetone, Di-tertbutylketone, Methyltert-butyl ketone (Reactivity towards HCN).

OR

a)Complete each synthesis by filling the missing starting materials, reagents or products

i) $C_6H_5CHO + CH_3CH_2CHO \xrightarrow{NaOH(dil)} X$

ii) $CH_3CH_2CH_2CH_2OH \xrightarrow{Y} CH_3CH_2CH_2COOH$

iii) $CH_3(CH_2)_9COOC_2H_5 \xrightarrow{Z} CH_3(CH_2)_9CHO$

b) How will you bring about the following conversions in not more than two steps?

i)Toulene to benzaldehyde

ii)Ethylcyanide to 1-Phenylpropanone.

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1	Solid State		4(2)			4(2)
2	Solutions				5(1)	5(1)
3	Electrochemistry		2(1)	3(1)		5(2)
4	Chemical Kinetics	1(1)	4(2)			5(3)
5	Surface Chemistry	1(1)		3(1)		4(2)
6	General Principles and Processes of Isolation of Elements			3(1)		3(1)
7	p-Block elements	1(1)	4(2)	3(1)		8(4)
8	d and f-Block elements				5(1)	5(1)
9	Coordination Compounds	1(1)	2(1)			3(2)
10	Haloalkanes and Haloarenes	1(1)		3(1)		4(2)
11	Alcohols, Phenols and Ethers	1(1)		3(1)		4(2)
12	Aldehydes, ketones and Carboxylic acids	1(1)			5(1)	6(2)
13	Organic Compounds Containing Nitrogen		4(2)			4(2)
14	Biomolecules	1(1)		3(1)		4(2)
15	Polymers			3(1)		3(1)
16	Chemistry in Everyday Life			3(1)		3(1)
	Total	8(8)	20(10)	27(9)	15(3)	70(30)

Answer Key(CHEMISTRY-12)

1) Isopropyl chloride < Chloropropane < 1-Chlorobutane (1mark)

2) 3-Methyl but-2-en-1-oic acid (1mark)

3) Rate = $-1/3(\Delta[H_2]/\Delta t) = 1/2(\Delta[NH_3]/\Delta t)$

$\Rightarrow -(\Delta[H_2]/\Delta t) = 3/2(\Delta[NH_3]/\Delta t)$

$= 3/2 \times 4 \times 10^{-8}$ mol L^{-1} s^{-1} $= 6 \times 10^{-8}$ mol L^{-1} s^{-1} (1mark)

4) $K_4[Fe(CN)_6]$ (1mark)

5) RNA (1mark)

6) XeF_4 (1mark)

7) Its colour becomes lighter on heating (1mark)

8) C_6H_5-O-CH_2-CH_2-$CH(CH_3)_2$ (1mark)

9) i) Correct reason (1mark)

ii) $2PbSO_4\ (s) + 2H_2O\ (l) \longrightarrow Pb\ (s) + PbO_2\ (s) + 4H^+\ (aq) + 2SO_4^{2-}\ (aq)$ (1mark)

10) i) $k = 0.693/t_{1/2}$ (0.5mark)

$k = 0.693/3h = 0.231\ h^{-1}$ (0.5mark)

$0.231\ h^{-1} = 2.303/8h \log [R]_\circ/[R]$ (0.5mark)

$\Rightarrow \log [R]_\circ/[R] = 0.231 \times 8/2.303 = 0.8024$

$\Rightarrow [R]_\circ/[R] = 1/6.345 = 0.158$ (0.5mark)

OR

$\log k_2/k_1 = E_a/2.303R\ [T_2 - T_1/\ T_1 - T_2]$ (0.5mark)

$\log 0.07/0.02 = E_a/2.303 \times 8.314\ J\ K^{-1}\ mol^{-1}\ [200/700 \times 500\ K^{-1}]$ (0.5mark)

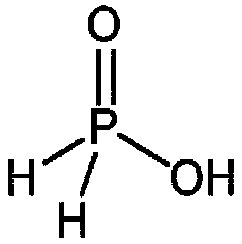
$0.5441 = E_a/2.303 \times 8.314\ J\ K^{-1}\ mol^{-1}\ [200/700 \times 500\ K^{-1}]$ (0.5mark)

$E_a = 18231\ J\ mol^{-1} = 18.231\ kJ\ mol^{-1}$ (0.5mark)

11) Sum of powers of the concentration of the reactants in the rate law expression (1 mark)

i) Zero order (0.5mark) ii)second order (0.5mark)

12) i)



(1 mark)

ii) $H_3PO_2 + 4AgNO_3 + 2H_2O \longrightarrow 4Ag + 4HNO_3 + H_3PO_4$ (1 mark)

13) i) $O_3 + 2I^- + H_2O \longrightarrow O_2 + I_2 + 2OH^-$ (1 mark)

I_2 liberated is then titrated against sodium thiosulphate solution and amount of O_3 can be estimated.

ii) $NO\ (g) + O_3\ (g) \longrightarrow NO_2\ (g) + O_2\ (g)$ (1 mark)

NO combines rapidly with O_3 forming oxygen and thus is slowly depleting the concentration of the ozone.

14) i) $Ti^{3+} = [Ar]3d^1\ 4s^0$

Due to d-d transition, complex is coloured. (1 mark)

ii) Triamminetriaquachromium (III) chloride. (1 mark)

15) i)Carbylamine test- Aniline gives this test while N-Ethyl aniline does not (write the rxn) (1 mark)

ii) Hinsberg test - N-Methyl propan-2-amine gives this test while N-Ethyl-N-methyl ethanamine does not (write the rxn) (1 mark)

16) i) $ArN_2^+X^- \xrightarrow{Cu/\ HCl} ArCl + N_2 + CuX$ (1 mark)

ii) $Ar/RCONH_2 + Br_2 + KOH\ (alc.) \longrightarrow Ar/R\text{-}NH_2 + 3KBr + K2CO3 + 3H_2O$ (1 mark)

17) $r = a/2\sqrt{2}$ (0.5 mark)

Or $a = 2r \times \sqrt{2}$ (0.5 mark)

$= 2 \times 125pm \times 1.414$ (0.5 mark)

$= 353.5$ pm (0.5 mark)

18) i) Due to creation of F-centre or anionic vacancies filled by electrons. (1 mark)

ii) n-type and p-type semiconductors (0.5 marks each)

19) i) $2H_2O \longrightarrow 4H^+ + O_2 + 4e^-$

$\Rightarrow Q = nF = 4 \times 96500 = 38600\ C\ mol^{-1}$ (1 mark)

ii) $E°_{cell} = E°_{Ag+/Ag} - E°_{Zn2+/Zn} = [0.344 – (0.76)]\ V = 1.104\ V$ (1 mark)

$\Delta G° = -nFE°_{cell} = -2 \times 96500\ C\ mol^{-1} \times 1.10\ V = -2.13 \times 10^5\ J\ mol^{-1}$ (1 mark)

20) i) Brownian movement is the zig-zag motion of the colloidal particles in a colloidal solution which is due to unequal bombardement of colloidal particles by dispersion medium which does not allow the particles to settle and thus provide stability to colloids. (1 mark)

ii) The precipitator containing plates having a charge opposite to that carried by smoke particles which lose their charge and get precipitated and thus free from carbon and dust particles after passing through chimney. (1 mark)

iii) Because of larger area of colloidal gold and easy assimilation with the blood which is coloidal(1 mark)

21) i) Oxidation of Au to $[Au(CN)_2]^-$

$Au + 8CN + 2H_2O + O_2 \longrightarrow 4[Au(CN)_2]^- + 4OH^-$ (1 mark)

Reduction of Au^+ to Au

$2[Au(CN)_4]^- + Zn \longrightarrow [Zn(CN)_4]^{2-} + 2Au$ (1 mark)

ii) because sulphide ores are preferentially wetted by oil and impurities by water. (1 mark)

OR

a) Electrolytic refining (1 mark)

b) Bauxite/ $Al_2O_3.2H_2O$. The significance of leaching is to prepare pure Alumina from the bauxite ore or reaction involved. (2 mark)

22) a) $(NH_4)_2Cr_2O_7 \xrightarrow{\Delta} N_2 + Cr_2O_3 + 4H_2O$ (1 mark)

b) $2NaOH + Cl_2 \longrightarrow NaCl + NaClO + H_2O$ (1 mark)

c) $3HgCl_2 + 2PH_3 \longrightarrow HgP_2 + 6HCl$ (1 mark)

23) a) Due to resonance in halobenzene (1 mark)

b) in presence of air it is oxidized to produce phosgene, a poisonous gas (1 mark)

c)Due to high stability of benzyl carbocation through resonance. (1 mark)

24) a) does not form hydrogen sulphite addition product with $NaHSO_3$. (1 mark)

b) Essential AA – Valine, Non-essential AA – Glycine (1 mark)

c) Keratin is a fibrous protein whereas insulin is a globular protein. (1 mark)

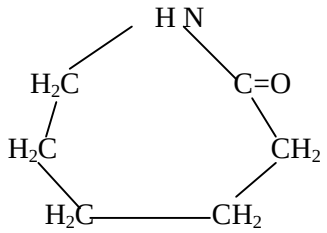
25) a) i) PHBV – Poly-β-hydroxybutyrate-co-β-hydroxyvalerate (1 mark)

ii) $CH_3CH(OH)CH_2COOH$ and $CH_3CH_2CH(OH)CH_2COOH$ (0.5 mark)

iii) $CH_3CH(OH)CH_2COOH + CH_3CH_2CH(OH)CH_2COOH \longrightarrow$

$[-OCH(CH_3)CH_2COOCH(C_2H_5)CH_2CO-]_n$ (0.5 mark)

b) Nylon-6 – Caprolactam (1 mark)



26) a) i)As Mr Paul was diabetic direct intake of sugar could cause him a lot of health problems due to deficiency of enzyme insulin in the body. To make himself free from such risks, Mr. Paul avoided taking sugar. (1 mark)

ii)Artificial sweetners only provide sweet tasteto the food material without adding any calorific values. (1 mark)

iii)Concern for health and at the same time enjoyment of the food in a proper way on scientific basis, friendly advise to a needy person are some of the values associated with the passage. (1 mark)

27) i) Iodoform test (1 mark)

ii) Ferric chloride test (1 mark)

iii) Hydrolysis followed by iodoform test (1 mark)

28) a) $\Delta T_f = K_f m = K_f W_B/M_B \times 1000/W_A$ (0.5 mark)

$8.45 = 20.2 \times 6.2/M_B \times 1000/93.8$ (0.5 mark)

$M_B = 158\ g\ mol^{-1}$ (1 mark)

b)The solubility of a gas in a liquid is directly proportional to the pressure of the gas.

Applications:

1) Solubility of CO2 is increased at high pressure.
2) Mixture of He and O2 are used by sea divers as He is less soluble than nitrogen. (1 + 0.5 + 0.5 mark)

c) 0.1 M NaCl and because NaCl gets dissociated into 2 ions. (0.5 + 0.5 mark)

OR

a) i) It states that for a solution of volatile solute the partial pressure of each component is directly proportional to its mole fraction. (1 mark)
ii)the elevation in boiling point when one mole of a non volatile solute is dissolved in 1 kg of solvent (1 mark)

b) $\Delta T_b = 100.42°C - 100°C = 0.42°C$ or 0.42 K (1 mark)
⇨ $W_B = M_B \times \Delta T_b \times W_A/K_b \times 1000$ (1 mark)
⇨ $W_B = 92 \times 0.42 \times 500/0.512 \times 1000 = 37.73\ g$ (1 mark)

29) a) i) $d^4 \longrightarrow d^6$ occurs in case of Cr^{2+} to Cr^{3+} and $d^6 \longrightarrow d^5$ in case of Fe^{2+} to Fe^{3+}. In a medium like water d^3 is more stable than d^5.

ii) because Cu^+ in aqueous solution undergoes disproportionation to more stable and Cu^{2+} and Cu.

iii) because Ce is more stable in +3 oxidation state. (1 + 1 + 1 marks)

b) In neutral medium MnO_4^- oxidizes I^- to IO_3^-

$MnO_4^- + H_2O \longrightarrow 2MnO_2 + IO_3^- + 2OH^-$
In basic medium MnO_4^- oxidizes $S_2O_3^{2-}$ to SO_4^{2-}
$8MnO_4^- + 3S_2O_3^{2-} + H_2O \longrightarrow 8MnO_2 + 6SO_4^{2-} + OH^-$ (1+ 1 mark)

OR

a) i)This is due to the increasing stability of lower species to which they are reduced. (1 mark)
ii) Cu has high ionization enthalpy for transforming Cu(s) to Cu^{2+} (aq) and this is not balanced by its hydration enthalpy. (1 mark)
iii)Due to high electronegativity and multiple bond formation with metal by oxygen (1 mark)

iv) due to participation of ns and (n-1)d electrons in bonding. (1 mark)

v) Due to comparable energies of 5f, 6d and 7s orbitalsof actinoids. (1 mark)

30) a) $C_6H_5CHO \xrightarrow{NaOH} C_6H_5CH_2OH + C_6H_5COONa \xrightarrow{NaOH/CaO} C_6H_6$ (1 mark)

(A) Benzaldehyde - C_6H_5CHO

(B) Benzylalcohol - $C_6H_5CH_2OH$

(C) Sodium benzoate- C_6H_5COONa

(D) Benzene- C_6H_6 (0.5 + 0.5 + 0.5 + 0.5 mark)

b) i) 4-Methoxybenzoic acid < Benzoic acid < 4-Nitro benzoic acid < 3,5-Dinitrobenzoic acid

ii) Di-tertbutylketone < Methyltert-butyl ketone < Acetone < Acetaldehyde (1 + 1 mark)

OR

a) i) $C_6H_5CH(OH)CH(CH_3)CHO$
ii) $KMnO_4/OH^-$, H_3O^+
iii) DIBAL-H/H_2O (1+1 +1 mark)

b) i) Etard reaction
ii) Reaction with phenyl magnesiumbromide followed by acid hydrolysis. (1 + 1 mark)