SAMPLE PAPER 1
CHEMISTRY THEORY (043)

MM:70 **Time: 3 Hours**

General Instructions:

Read the following instructions carefully.

a) There are 33 questions in this question paper. All questions are compulsory.

b) Section A: Q. No. 1 to 16 are objective type questions. Q. No. 1 and 2 are passage based questions carrying 4 marks each while Q. No. 3 to 16 carry 1 mark each.

c) Section B: Q. No. 17 to 25 are short answer questions and carry 2 marks each.

d) Section C: Q. No. 26 to 30 are short answer questions and carry 3 marks each.

e) Section D: Q. No. 31 to 33 are long answer questions carrying 5 marks each.

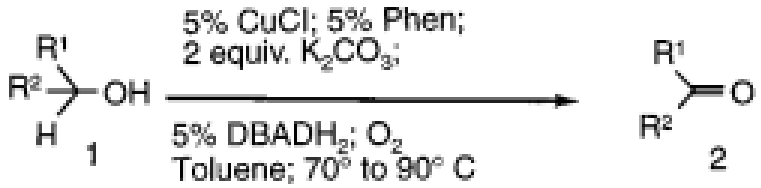
f) There is no overall choice. However, internal choices have been provided.

g) Use of calculators and log tables is not permitted.

SECTION A (OBJECTIVE TYPE)

1. Read the passage given below and answer the following questions: **(1x4=4)**

An efficient, aerobic catalytic system for the transformation of alcohols into carbonyl compounds under mild conditions, copper-based catalyst has been discovered. This copper-based catalytic system utilizes oxygen or air as the ultimate, stoichiometric oxidant, producing water as the only by-product



A wide range of primary, secondary, allylic, and benzylic alcohols can be smoothly oxidized to the corresponding aldehydes or ketones in good to excellent yields. Air can be conveniently used instead of oxygen without affecting the efficiency of the process. However, the use of air requires slightly longer reaction times.

This process is not only economically viable and applicable to large-scale reactions, but it is also environmentally friendly.

(*Reference:Ohkuma, T., Ooka, H., Ikariya, T., & Noyori, R. (1995). Preferential hydrogenation of aldehydes and ketones. Journal of the American Chemical Society, 117(41), 10417-10418.)*

The following questions are multiple choice questions. Choose the most appropriate answer:

(i)The Copper based catalyst mention in the study above can be used to convert:

a) propanol to propanonic acid

b) propanone to propanoic acid

c) propanone to propan-2-ol

d) propan-2-ol to propanone

(ii)The carbonyl compound formed when ethanol gets oxidised using this copper-based catalyst can also be obtained by ozonolysis of:

a) But-1-ene

b) But-2-ene

c) Ethene

d) Pent-1-ene

OR

Which of the following is a secondary allylic alcohol?

a) But-3-en-2-ol

b) But-2-en-2-ol

c) Prop-2-enol

d) Butan-2-ol

(iii) Benzyl alcohol on treatment with this copper-based catalyst gives a compound 'A' which on reaction with KOH gives compounds 'B' and 'C'. Compound 'B' on oxidation with $KMnO_4$- KOH gives compound 'C'. Compounds 'A', 'B' and 'C' respectively are :

a) Benzaldehyde, Benzyl alcohol, potassium salt of Benzoic acid

b) Benzaldehyde, potassium salt of Benzoic acid, Benzyl alcohol

c) Benzaldehyde, Benzoic acid, Benzyl alcohol

d) Benzoic acid, Benzyl alcohol, Benzaldehyde

(iv) An organic compound 'X' with molecular formula C_3H_8O on reaction with this copper based catalyst gives compound 'Y' which reduces Tollen's reagent. 'X' on reaction with sodium metal gives 'Z' . What is the product of reaction of 'Z' with 2-chloro-2-methylpropane?

a) $CH_3CH_2CH_2OC(CH_3)_3$

b) $CH_3CH_2OC(CH_3)_3$

c) $CH_2=C(CH_3)_2$

d) $CH_3CH_2CH=C(CH_3)_2$

Read the passage given below and answer the following questions: (1x4=4)

The amount of moisture that leather adsorbs or loses is determined by temperature, relative humidity, degree of porosity, and the size of the pores. Moisture has great practical significance because its amount affects the durability of leather, and in articles such as shoes, gloves and other garments, the comfort of the wearer. High moisture content accelerates deterioration and promotes

mildew action. On the other hand, a minimum amount of moisture is required to keep leather properly lubricated and thus prevent cracking.

The study indicates that adsorption of moisture by leather is a multi-molecular process and is accompanied by low enthalpies of adsorption. Further at 75-percent relative humidity, the adsorption is a function of surface area alone.

Hide is tanned to harden leather. This process of tanning occurs due to mutual coagulation of positively charged hide with negatively charged tanning material. Untanned hide and chrome-tanned leathers have the largest surface areas. The leathers tanned with vegetable tanning materials have smaller surface areas since they are composed of less hide substance and the capillaries are reduced to smaller diameters, in some cases probably completely filled by tanning materials. The result of the study indicated that untanned hide and chrome-tanned leather adsorb the most water vapour.

(Source:Kanagy, J. R. (1947). Adsorption of water vapor by untanned hide and various leathers at 100 F. *Journal of Research of the National Bureau of Standards*, *38*(1), 119-128.)

2. In these questions (Q. No 5-8 , a statement of assertion followed by a statement of reason is given. Choose the correct answer out of the following choices.

a) Assertion and reason both are correct statements and reason is correct explanation for assertion.

b) Assertion and reason both are correct statements but reason is not correct explanation for assertion.

c) Assertion is correct statement but reason is wrong statement.

d) Assertion is wrong statement but reason is correct statement.

(i) Assertion: Vegetable tanned leather cannot adsorb a large amount of moisture.
Reason: Porous materials have higher surface area.

(ii) Assertion: Animal hide soaked in tannin results in hardening of leather.
Reason: Tanning occurs due to mutual coagulation.

(iii) Assertion: Adsorption of moisture by leather is physisorption.
Reason: It is a multimolecular process and is accompanied by low enthalpies of adsorption

(iv) Assertion: Leathers tanned with vegetable tanning materials have smaller surface areas
Reason: The capillaries present in leather are reduced to smaller diameters

OR

Assertion: Leather absorbs different amount of moisture.
Reason: Some moisture is necessary to prevent cracking of leather.

Following questions (No. 3 -11) are multiple choice questions carrying 1 mark each:

3 Which of the following option will be the limiting molar conductivity of CH_3COOH if the limiting molar conductivity of CH_3COONa is 91 Scm^2mol^{-1}? Limiting molar conductivity for individual ions are given in the following table.

S.No	Ions	limiting molar conductivity / Scm^2mol^{-1}
1	H+	349.6
2	Na+	50.1
3	K+	73.5
4	OH^-	199.1

a) 350 Scm^2mol^{-1}

b) 375.3 Scm^2mol^{-1}

c) 390.5 Scm^2mol^{-1}

d) 340.4 Scm^2mol^{-1}

4. Curdling of milk is an example of:

a) breaking of peptide linkage

b) hydrolysis of lactose

c) breaking of protein into amino acids

d) denauration of proetin

OR

Dissachrides that are reducing in nature are:

a) sucrose and lactose

b) sucrose and maltose

c) lactose and maltose

d) sucrose, lactose and maltose

5.When 1 mole of benzene is mixed with 1 mole of toluene The vapour will contain: (Given : vapour of benzene = 12.8kPa and vapour pressure of toluene = 3.85 kPa).

a) equal amount of benzene and toluene as it forms an ideal solution

b) unequal amount of benzene and toluene as it forms a non ideal solution

c) higher percentage of benzene

d) higher percentage of toluene

6.Which of the following is the reason for Zinc not exhibiting variable oxidation state

a) inert pair effect

b) completely filled 3d subshell

c) completely filled 4s subshell

d) common ion effect

OR

Which of the following is a diamagnetic ion: (Atomic numbers of Sc, V, Mn and Cu are 21, 23, 25 and 29 respectively)

a) V^{2+}

b) Sc^{3+}

c) Cu^{2+}

d) Mn^{3+}

7. Propanamide on reaction with bromine in aqueous NaOH gives:

a) Propanamine

b) Ethanamine

c) N-Methyl ethanamine

d) Propanenitrile

OR

IUPAC name of product formed by reaction of methyl amine with two moles of ethyl chloride

a) N,N-Dimethylethanamine

b) N,N-Diethylmethanamine

c) N-Methyl ethanamine

d) N-Ethyl - N-methylethanamine

8.Ambidentate ligands like NO_2^- and SCN^- are :

a) unidentate

b) didentate

c) polydentate

d) has variable denticity

OR

The formula of the coordination compound Tetraammineaquachloridocobalt(III) chloride is

a) $[Co(NH_3)_4(H_2O)Cl]Cl_2$

b) $[Co(NH_3)_4(H_2O)Cl]Cl_3$

c) $[Co(NH_3)_2(H_2O)Cl]Cl_2$

d) $[Co(NH_3)_4(H_2O)Cl]Cl$

9.Which set of ions exhibit specific colours? (Atomic number of Sc = 21, Ti = 22, V=23, Mn = 25, Fe = 26, Ni = 28 Cu = 29 and Zn =30)

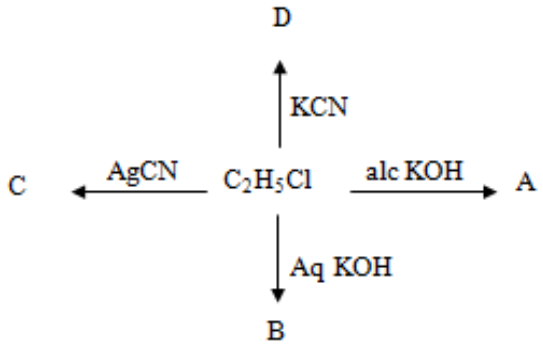
a) Sc^{3+}, Ti^{4+}, Mn^{3+}

b) Sc^{3+}, Zn^{2+}, Ni^{2+}

c) V^{3+}, V^{2+}, Fe^{3+}

d) Ti^{3+}, Ti^{4+}, Ni^{2+}

10. Identify A,B,C and D:



a) A = C_2H_4, B= C_2H_5OH, C= C_2H_5NC, D= C_2H_5CN

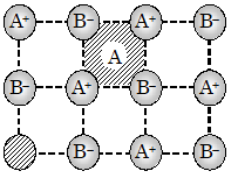
b) A= C_2H_5OH, B= C_2H_4, C = C_2H_5CN, D=C_2H_5NC

c) A = C_2H_4, B= C_2H_5OH, C= C_2H_5CN, D= C_2H_5NC

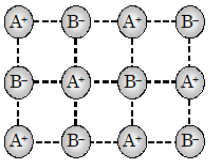
d) A= C_2H_5OH, B= C_2H_4, C= C_2H_5NC, D= C_2H_5CN

11.The crystal showing Frenkel defect is :

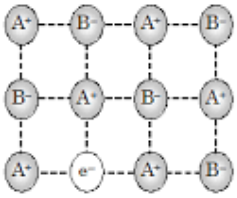
a)



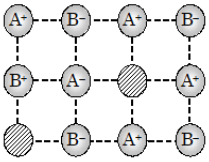
b)



c)



d)



In the following questions (Q. No. 12 - 16) a statement of assertion followed by a statement of reason is given. Choose the correct answer out of the following choices.

a) Assertion and reason both are correct statements and reason is correct explanation for assertion.
b) Assertion and reason both are correct statements but reason is not correct explanation for assertion.
c) Assertion is correct statement but reason is wrong statement.
d) Assertion is wrong statement but reason is correct statement.

12.Assertion: The two strands of DNA are complementary to each other
Reason: The hydrogen bonds are formed between specific pairs of bases.

13.Assertion: Ozone is thermodynamically stable with respect to oxygen.
Reason:Decomposition of ozone into oxygen results in the liberation of heat

14.Assertion: Aquatic species are more comfortable in cold waters rather than in warm waters.
Reason:Different gases have different K_H values at the same temperature

OR

Assertion: Nitric acid and water form maximum boiling azeotrope.
Reason: Azeotropes are binary mixtures having the same composition in liquid and vapour phase.

15. Assertion: Carboxylic acids are more acidic than phenols.
Reason: Phenols are ortho and para directing.

16.Assertion: Methoxy ethane reacts with HI to give ethanol and iodomethane
Reason: Reaction of ether with HI follows S_N2 mechanism

SECTION B

The following questions, Q.No 17 – 25 are short answer type and carry 2 marks each.

17. With the help of resonating structures explain the effect of presence of nitro group at ortho position in chlorobenzene.

OR

Carry out the following conversions in not more than 2 steps:

(i)Aniline to chlorobenzene

(ii)2-bromopropane to 1- bromopropane

18. A glucose solution which boils at 101.04°C at 1 atm. What will be relative lowering of vapour pressure of an aqueous solution of urea which is equimolal to given glucose solution? (Given: K_b for water is 0.52 K kg mol^{-1})

19. (i) Using crystal field theory, write the electronic configuration of iron ion in the following complex ion. Also predict its magnetic behaviour :

$[Fe(H_2O)_6]^{2+}$

(ii)Write the IUPAC name of the coordination complex: $[CoCl_2(en)_2]NO_3$

OR

(i)Predict the geometry of $[Ni(CN)_4]^{2-}$

(ii)Calculate the spin only magnetic moment of $[Cu(NH_3)_4]^{2+}$ ion.

20. For a reaction the rate law expression is represented as follows:

$$Rate = k [A][B]^{1/2}$$

i. Interpret whether the reaction is elementary or complex. Give reason to support your answer.

ii. Write the units of rate constant for this reaction if concentration of A and B is expressed in moles/L.

OR

The following results have been obtained during the kinetic studies of the reaction:

$P + 2Q \rightarrow R + 2S$

Exp.	**Initial P(mol/L)**	**Initial Q (mol/L)**	**Init. Rate of Formation of R (M min^{-1})**
1	0.10	0.10	3.0×10^{-4}
2	0.30	0.30	9.0×10^{-4}
3	0.10	0.30	3.0×10^{-4}
4	0.20	0.40	6.0×10^{-4}

Determine the rate law expression for the reaction.

21. The C-14 content of an ancient piece of wood was found to have three tenths of that in living trees. How old is that piece of wood? (log 3= 0.4771, log 7 = 0.8540 , Half-life of C-14 = 5730 years)

22. When 3-methylbutan-2-ol is treated with HBr, the following reaction takes place:

Give a mechanism for this reaction.

23. Give the formula and describe the structure of a noble gas species which is isostructural with IF_6^-.

24. The following haloalkanes are hydrolysed in presence of aq KOH.

(i) 2- Chlorobutane (ii) 2-chloro-2-methylpropane

Which of the above is most likely to give a racemic mixture? Justify your answer.

25.Atoms of element P form *ccp* lattice and those of the element Q occupy 1/3rd of tetrahedral voids and all octahedral voids. What is the formula of the compound formed by the elements P and Q?

SECTION C

Q.No 26 -30 are Short Answer Type II carrying 3 mark each.

26. Give reasons for the following:

i. Transition elements act as catalysts

ii. It is difficult to obtain oxidation state greater than two for Copper.

iii. $Cr_2O_7^{2-}$ is a strong oxidising agent in acidic medium whereas WO_3 and MoO_3 are not.

OR

Observed and calculated values for the standard electrode potentials of elements from Ti to Zn in the first reactivity series are depicted in figure (1):

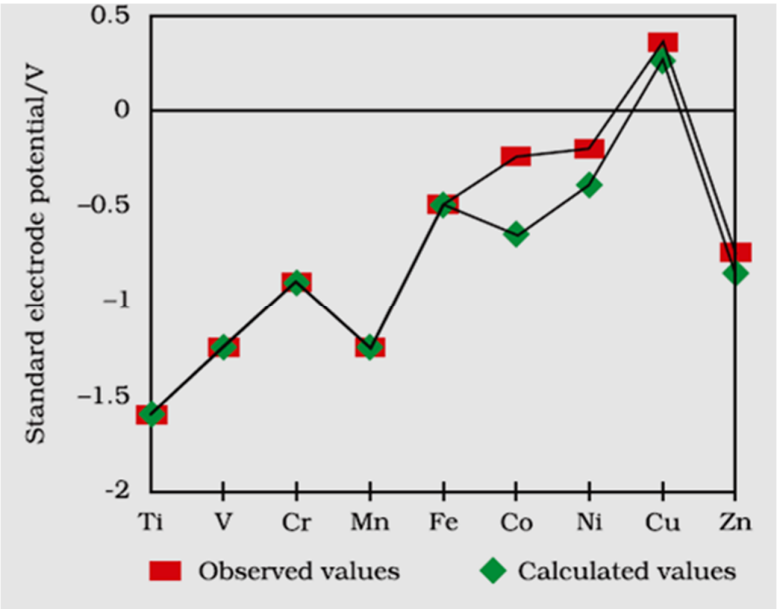


FIGURE 1 (source NCERT)

Explain the following observations:

i. The general trend towards less negative E^o values across the series

ii. The unique behaviour of Copper

iii. More negative E^o values of Mn and Zn

27. Arrange the following in increasing order of property specified:

i. Aniline, ethanamine, 2-ethylethanamine (solubility in water)

ii. Ethanoic acid, ethanamine, ethanol (boiling point)

iii. Methanamine, N, N- dimethylmethanamine and N- methylmethanamine (basic strength in aqueous phase)

OR

i. Give a chemical test to distinguish between N-methylethanamine and N,N-dimethyl ethanamine.

ii. Write the reaction for catalytic reduction of nitrobenzene followed by reaction of product so formed with bromine water.

iii. Out of butan-1-ol and butan-1-amine, which will be more soluble in water and why?

28. A metal crystallizes into two cubic system-face centred cubic (fcc) and body centred cubic (bcc) whose unit cell lengths are 3.5 and 3.0Å respectively. Calculate the ratio of densities of fcc and bcc.

29. Three amino acids are given below:

Alanine $CH_3CH(COOH)(NH_2)$ Aspartic acid $HOOC\text{-}CH_2CH(COOH)(NH_2)$ and Lysine $H_2N\text{-}(CH_2)_4\text{-}CH(COOH)(NH_2)$

i. Make two tripeptides using these amino acids and mark the peptide linkage in both cases.

ii. Represent Alanine in the zwitter ionic form.

30. i. Arrange the following in decreasing order of bond dissociation enthalpy

F_2 , Cl_2 , Br_2 , I_2

ii. Bi does not form pπ-pπ bonds. Give reason for the observation.

iii. Electron gain enthalpy of oxygen is less negative than sulphur. Justify

SECTION D

Q.No 31 to 33 are long answer type carrying 5 marks each.

31. (i) Answer the following questions: **(2+3)**

a) Write the balanced chemical reaction for reaction of Cu with dilute HNO_3.

b) Draw the shape of ClF_3

(ii)'X' has a boiling point of 4.2K, lowest for any known substance. It is used as a diluent for oxygen in modern diving apparatus. Identify the gas 'X'. Which property of this gas makes it usable as diluent? Why is the boiling point of the gas 'X' so low?

OR

(i) Answer the following questions: **(2+3)**

a) Arrange the following in the increasing order of thermal stability:

H_2O, H_2S, H_2Se, H_2Te

b) Give the formula of the brown ring formed at the interface during the ring test for nitrate.

(ii) A greenish yellow gas 'A' with pungent and suffocating odour, is a powerful bleaching agent. 'A' on treatment with dry slaked lime it gives bleaching powder. Identify 'A' and explain the reason for its bleaching action. Write the balanced chemical equation for the reaction of 'A' with hot and concentrated NaOH.

32. An organic compound 'A' C_8H_6 on treatment with dilute H_2SO_4 containing mercuric sulphate gives compound 'B'. This compound 'B' can also be obtained from a reaction of benzene with acetyl chloride in presence of anhy $AlCl_3$. 'B' on treatment with I_2 in aq. KOH gives 'C' and a yellow compound 'D'. Identify A, B, C and D. Give the chemical reactions involved. **(5)**

OR

(i) Write the reaction for cross aldol condensation of acetone and ethanal.

(ii) How will you carry out the following conversions:

a) Benzyl alcohol to phenyl ethanoic acid

b) Propanone to propene

c) Benzene to *m*-Nitroacetophenone

33. (i) State Kohlrausch law. **(1+4)**

(ii) Calculate the emf of the following cell at 298 K:

$Al(s)/Al^{3+}(0.15M)//Cu^{2+}(0.025M)/Cu(s)$

(Given $E^o(Al^{3+}/Al) = -1.66$ V, $E^o(Cu^{2+}/Cu) = 0.34$V, log 0.15 = -0.8239, log 0.025 = -1.6020)

OR

(i) On the basis of E^o values identify which amongst the following is the strongest oxidising agent **(1+4)**

$Cl_2(g) + 2\ e^- \rightarrow 2Cl^-$ $E^o = +1.36$ V,

$MnO_4^- + 8H^+ + 5e^- \rightarrow Mn^{2+} + 4H_2O$ $E^o = +1.51$ V

$Cr_2O_7^{2-} + 14H^+ + 6e^- \rightarrow 2Cr^{3+} + 7H_2O$ $E^o = +1.33$ V

(ii) The following figure 2, represents variation of (Λ_m) vs $\sqrt{c}$ for an electrolyte. Here Λ_m is the molar conductivity and c is the concentration of the electrolyte.

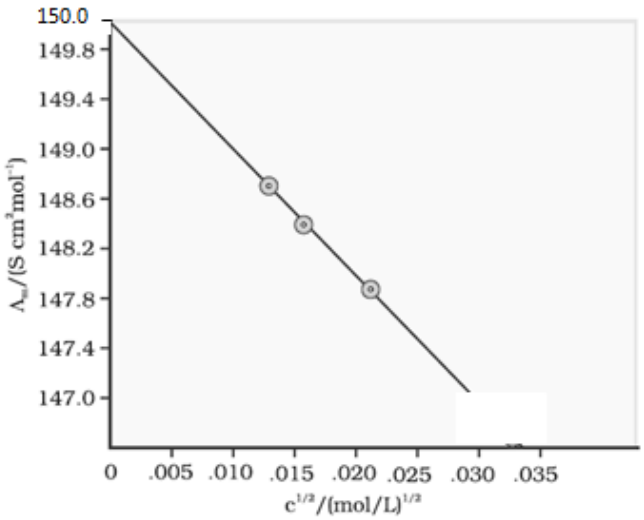


Figure 2

a) Define molar conductivity
b) Identify the nature of electrolyte on the basis of the above plot. Justify your answer.
c) Determine the value of Λ_m^o for the electrolyte.
d) Show how to calculate the value of A for the electrolyte using the above graph.

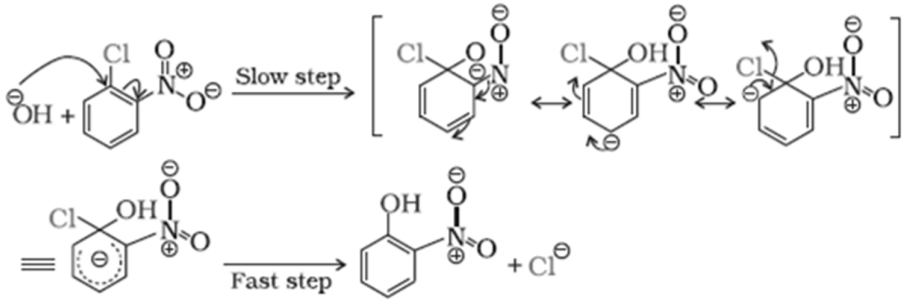
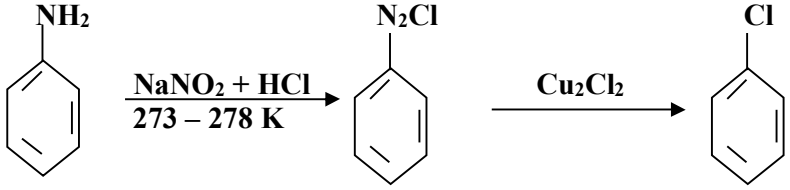
MARKING SCHEME

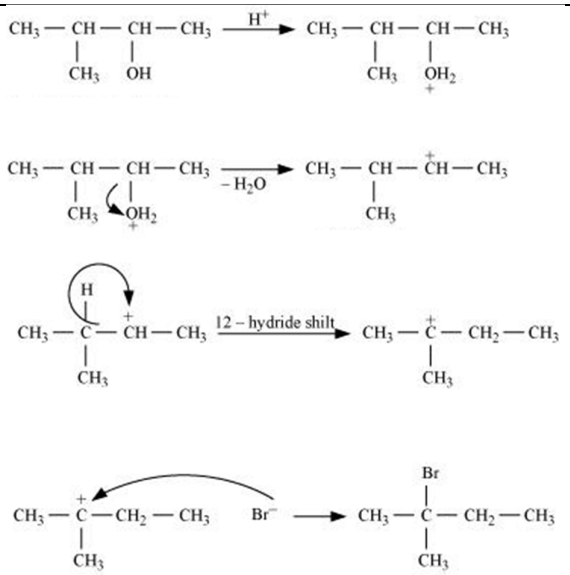
SAMPLE PAPER 1

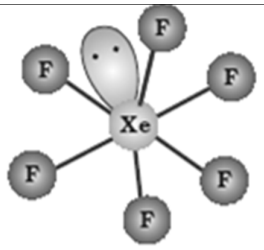
SECTION A

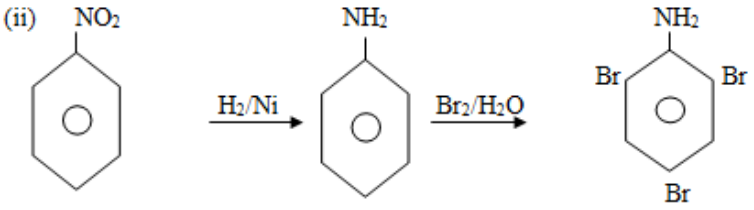
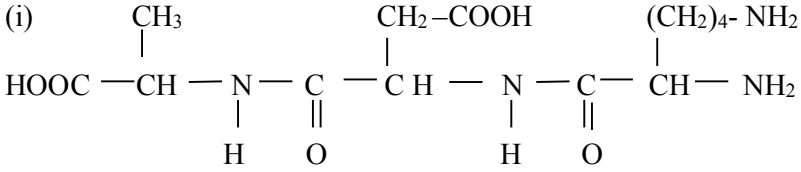
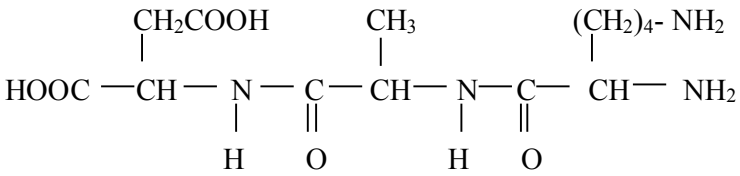
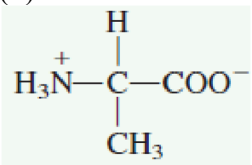
Q.No.	Value Point	Marks
1(i)	D	1
(ii)	B OR A	1
(iii)	A	1
(iv)	C	1
2(i)	B	1
(ii)	A	1
(iii)	A	1
(iv)	A OR B	1
3	C	1
4	D OR C	1
5	C	1
6	B OR B	1
7	B OR D	1
8	A OR A	1
9	C	1
10	A	1
11	A	1
12	A	1
13	D	1
14	B OR B	1
15	B	1
16	A	1

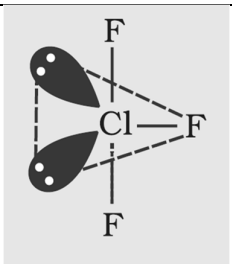
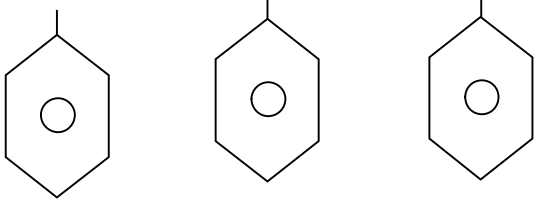
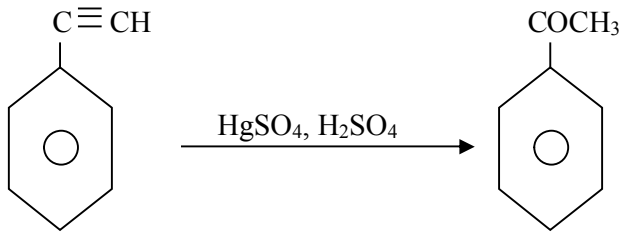
SECTION B, C, D

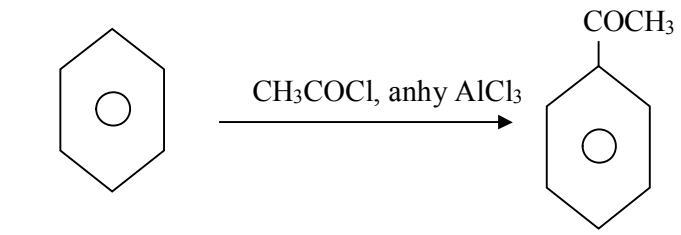
Q.No.	VALUE POINTS	MARKS
	SECTION B	
17	Nitro group at ortho position withdraws the electron density from the benzene ring and thus facilitates the attack of the nucleophile on haloarene.  **OR** **(i)**  **(ii)** $CH_3CH(Br)CH_3$ alc KOH $CH_3CH{=}CH_2$ HBr, organic peroxide $CH_3CH_2CH_2Br$	2 1 1
18	$\Delta Tb = K_b\, m$ $\Delta Tb = 101.04\text{-}100 = 1.04\ ^oC$ or $m = 1.04/0.52 = 2$ m 2 m solution means 2 moles of solute in 1 kg of solvent. 2 m aq solution of urea means 2 moles of urea in 1kg of water. No. of moles of water = 1000/18 = 55.5 Relative lowering of VP = x_2 (where x_2 is mole fraction of solute) Relative lowering of VP = $n_2/n_1{+}n_2$ (n_2 is no. of moles of solute , n_1 is no. of moles of solvent) = 2/ 2+55.5 = 2/57.5 = 0.034	1 1/2 1/2
19	(i)$t_{2g}^4e_g^2$ Paramagentic (ii)Dichloridobis(ethane-1,2-diamine)cobalt(III)nitrate OR (i)Square planar (ii)$Cu^{2+} = 3d^9$ 1 unpaired electron so $\sqrt{1(3)} = 1.73$BM	½, ½ 1 1 1
20	Reaction is a complex reaction. Order of reaction is 1.5. Molecularity cannot be 1.5, it has no meaning for this reaction. The reaction occurs in steps, so it is a complex reaction. (ii)units of k are $mol^{-1/2}L^{1/2}s^{-1}$	1/2 1/2 1

	OR Ans : let the rate law expression be Rate = k $[P]^x[Q]^y$ from the table we know that Rate 1 = $3.0 \times 10^{-4} = k\,(0.10)^x\,(0.10)^y$ Rate 2 = $9.0 \times 10^{-4} = k\,(0.30)^x\,(0.30)^y$ Rate 3 = $3.0 \times 10^{-4} = k\,(0.10)^x\,(0.30)^y$ Rate 1/ Rate 3 = $(1/3)^y$ or $1 = (1/3)^y$ So y = 0 Rate 2/ Rate 3 = $(3)^x$ or $3 = (3)^x$ So x = 1 Rate = k [P]	 ½ ½ 1
21	$k = 0.693/t_{1/2}$ $k = 0.693/5730$ years^{-1} $t = \frac{2.303}{k} \log \frac{Co}{Ct}$ let Co = 1 Ct = 3/10 so Co/Ct = 1/ (3/10) = 10/3 $t = \frac{2.303}{0.693} \times 5730 \log \frac{10}{3}$ t = 19042 x (1-0.4771) = 9957 years	 ½ ½ ½ ½
22		½ ½ ½ ½
23	XeF_6 Central atom Xe has 8 valence electrons, it forms 6 bonds with F and has 1 lone pair. According to VSEPR theory, presence of 6 bp and 1 lp results in distorted octahedral geometry	1 1

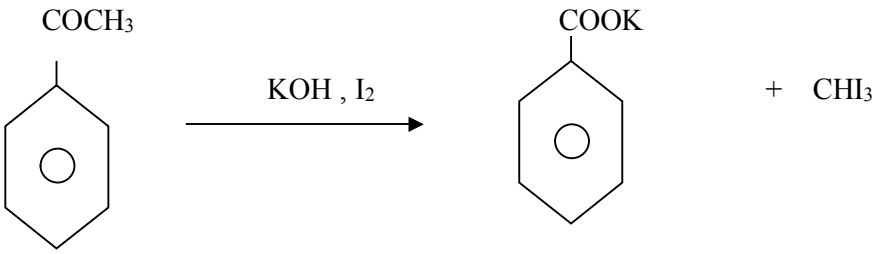
		
24.	Racemic mixture will be given by 2 chlorobutane as it is an optically active compound. When 2 chlorobutane undergoes S_N1 reaction, both front and rear attack are possible, resulting in a racemic mixture	1 1
25	Let no. of Atoms of element P be x No. of tetrahedral voids = 2x No. Of octahedral voids = x Atoms of Q = 1/3 (2x) + x = 5x/3 $P_xQ_{5x/3}$ P_3Q_5	1/2 ½ 1
	SECTION C	
26	(i)Due to large surface area and ability to show variable oxidation states (ii)Due to high value of third ionisation enthalpy (iii) Mo(VI) and W(VI) are more stable than Cr(VI). **OR** (i) The general trend towards less negative E^o V values across the series is related to the general increase in the sum of the first and second ionisation enthalpies. (ii) The high energy to transform Cu(s) to Cu^{2+} (aq) is not balanced by its hydration enthalpy. (iii) The stability of the half-filled *d* sub-shell in Mn^{2+} and the completely filled d^{10} configuration in Zn^{2+} are related to their more negative E^o V values	1 1 1 1 1 1
27	(i) Aniline, *N*-ethylethanamine, Etanamine (ii)Ethanamine, ethanol, ethanoic acid (iii) N, N dimethylmethanamine, methanamine, N-methylmethanamine **OR** (i) N-methyletahnamine is a secondary amine. When it reacts with benzenesulphonyl chloride, it forms N- Ethyl -N methyl sulphonamide while and	1 1 1 1

	N,N-dimethyl etahnanmine is a tertiary amine it does not react with benzenesulphonyl chloride. (ii)  (iii)Butan-1-ol Alcohol forms stronger hydrogen bonds with water than formed by amine due to higher electronegativity of O in alcohol than N in amine	1 ½ ½
28	We know that $d = zM/ N_a a^3$ For fcc, z=4 therefore $d = 4 \times M / Na (3.5 \times 10^{-8})^3$ g/cm^3 For bcc, z=2 therefore $d' = 2 \times M / Na (3.0 \times 10^{-8})^3$ g/cm^3 $d/d' = 4/(3.5 \times 10^{-8})^3 / 2/(3.0 \times 10^{-8})^3 = 1.26:1$	1/2 1 1 1/2
29	(i)   (ii) 	1 1 1
30	i. Arrange the following in decreasing order of bond dissociation enthalpy $Cl_2 > Br_2 > F_2 > I_2$ ii. Bi does not form pπ-pπ bonds as its atomic orbitals are large and diffuse so effective overlapping is not possible iii.Due to small size of oxygen, it has greater elecrton electron repulsions	1 1 1
	SECTION D	
31.	(i) (a) $3Cu + 8 HNO_3(dilute) \rightarrow 3Cu(NO_3)_2 + 2NO + 4H_2O$ (b)	1

	 (ii)'X' is Helium It is used as a diluent for oxygen in modern diving apparatus because of its very low solubility in blood. It monoatomic having no interatomic forces except weak dispersion forces and has second lowest mass therefore bp is lowest. OR (a) H_2Te, H_2Se, H_2S, H_2O (b) $[Fe(H_2O)_5(NO)]^{2+}$ (ii) A is chlorine gas Its bleaching action is due to oxidation. $Cl_2 + H_2O \rightarrow 2HCl + O$, Coloured substance + O → Colourless substance $6\,NaOH + 3Cl_2 \rightarrow 5NaCl + NaClO_3 + 3H_2O$	1 1 1 1 1 1 1 1 1
32	A: C≡CH B: $COCH_3$ C: COOK D: CHI_3  	½ each 1 1



1



OR

(i) $CH_3COCH_3 + CH_3CHO$ (dil NaOH)

1

$(CH_3)_2C(OH)CH_2CHO + CH_3CH(OH)CH_2COCH_3$

(Heat)

$(CH_3)_2C=CHCHO + CH_3CH=CHCOCH_3$

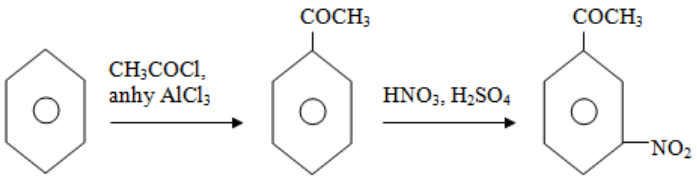
1

(ii) (a) $CH_2OH \xrightarrow{SOCl_2} CH_2Cl \xrightarrow{KCN} CH_2CN \xrightarrow{H^+/H_2O} CH_2COOH$

1

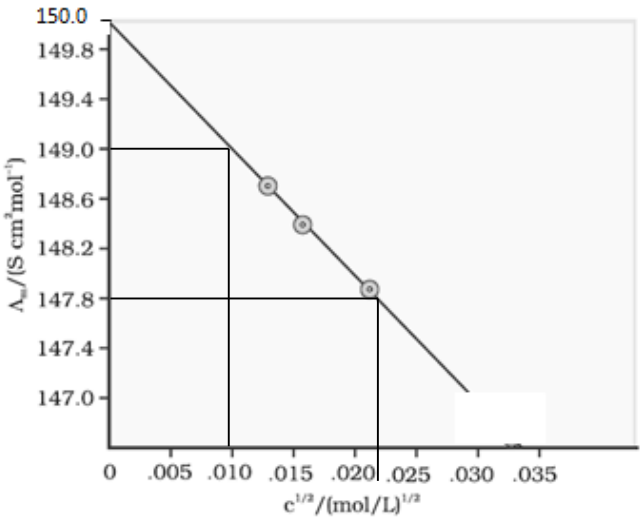
(b) $CH_3COCH_3 \xrightarrow{H_2, Pd} CH_3CH(OH)CH_3 \xrightarrow{H_2SO_4} CH_3CH=CH_2$

1

(c) 

1

33	(i) limiting molar conductivity of an electrolyte can be represented as the sum of the individual contributions of the anion and cation of the electrolyte. (ii) $E^o_{cell} = E^o_{cathode} - E^o_{anode} = 0.34-(-1.66) = 2.00$ V $E_{cell} = E^o_{cell} - \frac{0.059}{} \log [Al^{3+}]^2$	1 1/2

	n $[Cu^{2+}]^3$ Here n = 6 Ecell = $2 - \frac{0.059}{6} \log \frac{[0.15]^2}{[0.025]^3}$ $= 2 - 0.059/6\ (2\log 0.15 - 3 \log 0.025)$ $= 2 - 0.059/6\ (-1.6478 + 4.8062) = 2 - 0.0311 = 1.9689$V **OR** (i) MnO_4^- (ii)(a) Molar conductivity of a solution at a given concentration is the conductance of the volume V of solution containing one mole of electrolyte kept between two electrodes with area of cross section A and distance of unit length. (b)Strong electrolyte, For strong electrolytes, Λm increases slowly with dilution (c) $\Lambda m = \Lambda m° - A\ c$ ½ Therefore $\Lambda m° = 150$ S cm^2 mol^{-1} (d)  A = – slope = - (149 – 147.8/ 0.010-0.022) = 100 S cm^2 mol^{-1}/(mol/L^{-1})$^{1/2}$.	1 ½ 1 1 1 1 1 1 1