

23.12.2024 Chemistry Sample Question Paper-1

Q. nos. 1 to 7 are MCQs carrying 1 mark each.

Q 1. Which of the following statements about the reaction below are incorrect? (1)



- (a) Lead is getting reduced  
(b) Carbon di oxide is getting oxidised  
(c) Carbon is getting oxidised  
(d) Lead oxide is getting reduced

- (i) (a) & (b) (ii) (a) & (c)  
(iii) (a), (b) & (c) (iv) all the above

Q 2. The colour of the solution observed after 30 minutes of placing Zn metal to Copper sulphate solution is (1)

- (a) blue (b) colourless (c) Dirty green (d) Reddish brown

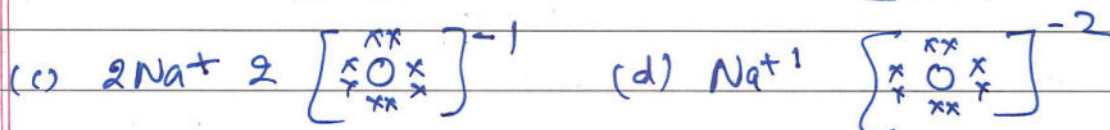
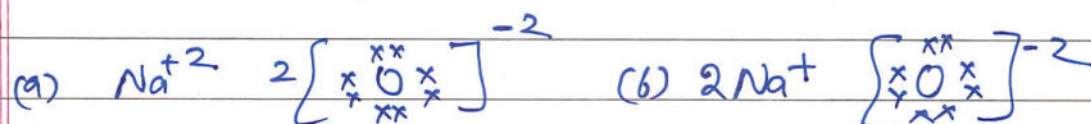
Q 3. Mild non-corrosive basic salt is (1)

- (a)  $\text{Ca}(\text{OH})_2$  (b)  $\text{NaCl}$  (c)  $\text{NaOH}$  (d)  $\text{NaHCO}_3$

Q 4. On adding dilute Sulphuric acid to a test tube containing a metal 'X', a colourless gas is produced when a burning match stick is brought near it. Which of the following correctly represent metal 'X'? (1)

(a) Sodium (b) Sulphur (c) Copper (d) Silver

Q 5. Which of the following correctly represents Sodium oxide? ①



Q 6. An element with atomic number \_\_\_\_\_ will form a basic oxide. ①

(a) 7 (2, 5) (b) 17 (2, 8, 7) (c) 14 (2, 8, 4)  
(d) 11 (2, 8, 1)

Q 7. An element 'M' has 50% of the electrons filled in the 3<sup>rd</sup> shell as in the 2<sup>nd</sup> shell. The atomic number of 'M' is ①

(a) 10 (b) 12 (c) 14 (d) 18

Q. no 8 consists of 2 statements - Assertion (A) and Reason (R). Answer these questions selecting the appropriate option given below:

- (a) Both A & R are true, and R is the correct explanation of A  
(b) Both A & R are true, and R is not the correct explanation of A  
(c) A is true but R is false  
(d) A is false but R is true

Q 8. Assertion : Rusting of Iron is endothermic in nature. (1)

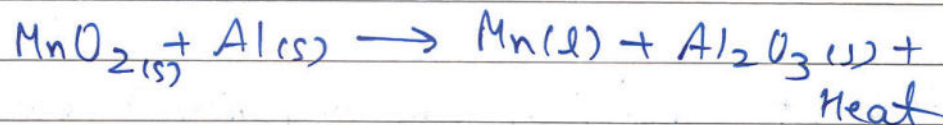
Reason : As the reaction is slow, the release of heat is barely evident.

Q. no 9 is very short answer type question carrying 2 marks.

Q.9 Dilute HCl is added to Zn granules. 'How will you prove that chemical change has taken place here?'. Support your response with two arguments. (2)

Q nos. 10 & 11 are short answer type questions carrying 3 marks each.

Q 10. The given reaction shows one of the processes to extract the metals like Iron and Manganese. (3)



(a) Give reason why the above reaction is known as a 'thermite reaction'.

(b) Identify the substance oxidised and reduced in the above reaction.

(c) Give a reason why Aluminium is preferably used in thermite reactions.

Q 11. An element 'M' with electronic configuration 2, 8, 3 combines separately with  $\text{Cl}^-$ ,  $\text{SO}_4^{2-}$  anions. Write the chemical formulae of the (3)

compounds formed. Predict the suitable reason the nature of bond formed by element 'M' in general. How will the electrical conductivity of the compounds formed vary with respect to 'M'?

OR

A reddish-brown metal 'X' when heated in air, gives a black compound 'Y', which when heated in presence of  $H_2$  gas gives 'X' back. 'X' is refined by the process of electrolysis; this refined form of 'X' is used in electrical wiring. Identify 'X' and 'Y'. Draw a well labelled diagram to represent the process of refining 'X'. (3)

Q no. 12 is long answer type question carrying 5 marks.

Q 12(a) Rehmat classified the reaction between methane and Chlorine in presence of sunlight as a substitution reaction. Support Rehmat's view with suitable justification and illustrate the reaction with the help of a balanced chemical equation. (5)

(b) Chlorine gas was prepared using electrolysis of brine solution. Write the chemical equation to represent the change. Identify the other products formed in the process and give one application of each.

OR

Raina while doing certain reactions observed that heating of substance 'X' with vinegar like smell with a substance 'Y' (which is used as industrial solvent) in presence of conc. Sulphuric acid on a water bath gives a sweet smelling liquid 'Z' having molecular formula  $C_4H_8O_2$ . When heated with caustic soda (NaOH) 'Z' gives back the sodium salt of ~~acid~~ 'X' and the compound 'Y'.

(5)

Identify 'X', 'Y' and 'Z'. Illustrate the changes with the help of suitable chemical equations.

Q no. 13 is Case-based / Data-based question with 2 to 3 short sub parts. Internal choice is provided in one of these sub parts

Q 13. The table below shows the hints given by the quiz master in a quiz.

(4)

S.Nos.	HINT
(i)	Substance 'C' is used as preservative.
(ii)	'C' has two carbon atoms. 'C' is obtained by the reaction of 'A' in presence of alkaline potassium permanganate followed by acidification.
(iii)	Misuse of 'A' in industry is prevented by adding Methanol, Benzene & Pyridine to 'A'.
(iv)	'F' is formed by heating 'A' in

- (v) presence of conc. Sulphuric acid  
'F' reacts with Hydrogen gas in presence of Nickel and Palladium catalyst

Based on above hints answer the following questions

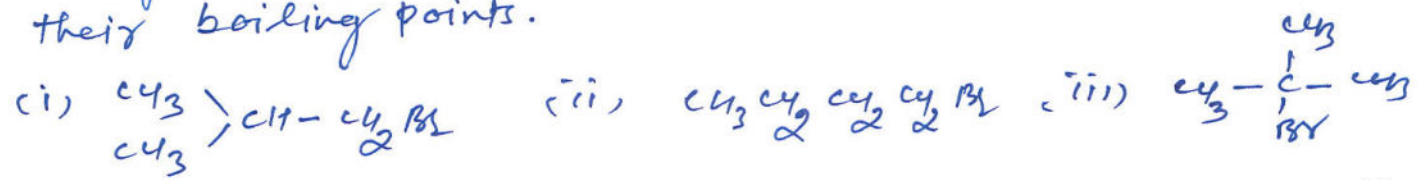
- (a) Give IUPAC names of A and F.  
(b) Illustrate with the help of chemical equations the change taking place  
 $A \rightarrow C$  and  $A \rightarrow F$

OR

Name the chemical reactions which occur in steps 2 and 5. Identify the compounds formed in these steps if 'A' is replaced with its next homologue.

① The gas evolved when methylamine reacts with nitrous acid is: (1)  
 (A)  $\text{NH}_3$  (B)  $\text{N}_2$  (C)  $\text{H}_2$  (D)  $\text{C}_2\text{H}_6$

② Arrange the following compounds in increasing order of their boiling points.

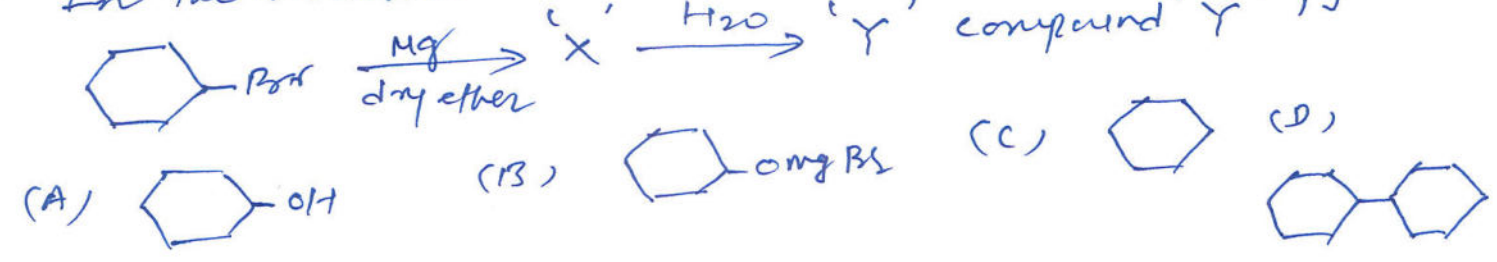


- (A) (iii) < (ii) < (i) (B) (i) < (ii) < (iii) (C) (iii) < (i) < (ii)  
 (D) (iii) < (i) < (ii)

③ Which of the following statement is not correct?

- (A) La is actually transition element.  
 (B) In Lanthanide series, ionic radii decreases from  $\text{La}^{+3}$  to  $\text{Lu}^{+3}$   
 (C)  $\text{La}(\text{OH})_3$  is less basic than  $\text{Lu}(\text{OH})_3$   
 (D) Ionic radii of Zr and Hf are almost similar due to Lanthanide contraction.

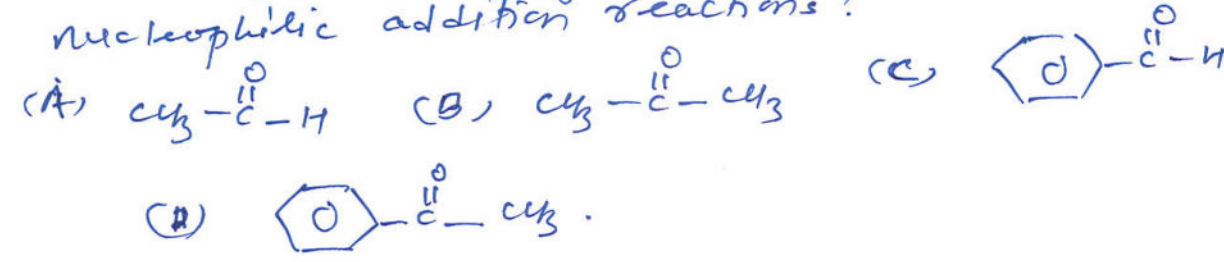
④ In the reaction



⑤ For a zero order reaction, the slope in the plot of  $[\text{R}]$  vs. time is

- (A)  $-\frac{k}{2.303}$  (B)  $-k$  (C)  $+\frac{k}{2.303}$  (D)  $+k$

⑥ Which of the following compound is most reactive towards nucleophilic addition reactions?



7) The formula of the complex <sup>(2)</sup>triamminetri(nitrito-o) cobalt (III) is

- (A)  $[Co(OONO)_3(NH_3)_3]$  (B)  $[Co(NO_2)_3(NH_3)_3]$   
(C)  $[Co(OONO)_3(NH_3)_3]$  (D)  $[Co(NO_2)(NH_3)_3]$

8) The term anomers of glucose refers to isomers of glucose that differ in configuration at:


- (A) C-1 (B) C-2 (C) C-3 (D) C-4

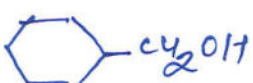


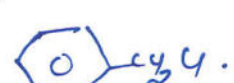
9) KMnO<sub>4</sub> is coloured due to:

- (A) d-d transition (B) charge transfer from ligand to metal  
(C) charge transfer from metal to ligand (D) unpaired electron in d-orbital of Mn.

10) The rate of a gaseous reaction is given by the expression, rate =  $k[A]^x[B]^y$ . If the volume of the reaction vessel is suddenly reduced to 1/4 of the initial volume, the reaction rate related to original rate will be

- (A) 1/16 (B) 1/8 (C) 8 (D) 16

11)  on heating with  $CCl_4$  and alcoholic KOH gives foul smell of

- (A)  (B)  (C)  (D) 

12) The reagent which does not react with both, acetone and benzaldehyde is

- (A) sodium hydrogen sulphite (B) phenyl hydrazine  
(C) Fehling solution (D) Grignard reagent

13) Assertion (A): Zn, Cd and Hg cannot be regarded as transition elements.

Reason (R): These elements do not belong to the d-block of Periodic Table



(14) Assertion (A): current stops flowing when  $E_{\text{cell}} = 0$   
Reason (R): Equilibrium of the cell reaction is attained.

(15) Assertion (A): D(+) - Glucose is dextrorotatory in nature  
Reason (R): 'D' represents its dextrorotatory nature

(16) Assertion (A): Cu is less reactive than hydrogen  
Reason (R):  $E_{\text{Cu}^{2+}/\text{Cu}}^{\circ}$  is negative.

### SECTION B

This section contains 5 questions with internal choice in one question. The following questions are very short answer type and carry 2 marks each.

(17) Give reasons for the following  
(a) when 2 g of benzoic acid is dissolved in 25 g of benzene, the experimentally determined molar mass is always greater than true value.

(b) The preservation of fruits by adding concentrated sugar solution protects them against bacterial action  
OR

~~Exe~~

(a) Mixture of ethanol and acetone shows positive deviation from Raoult's law

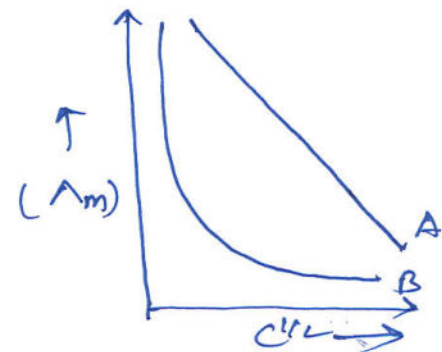
(b) Aquatic species are more comfortable in cold water than warm water.

(18) What is the effect of synergic bonding interactions in a metal carbonyl complex?

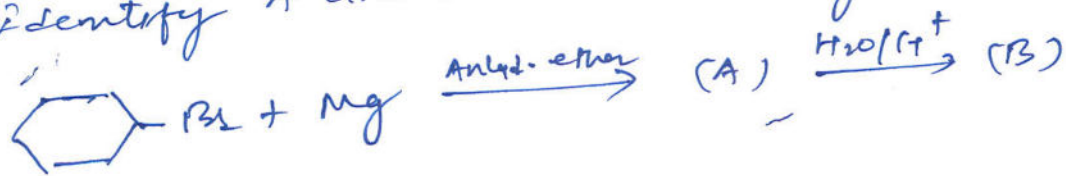
(19) In the plot of molar conductivity ( $\Lambda_m$ ) vs square root of concentration ( $C^{1/2}$ ), following curves are obtained for two electrolytes A and B. Answer the following

(i) Predict the nature of electrolyte A and B

(ii) What happens on extrapolation of  $\Lambda_m$  to concentration approaching zero for ~~each~~ electrolytes A and B?



20) Identify A and B in the following reaction:



21) The presence of carbonyl group in glucose is confirmed by its reaction with hydroxylamine. Identify the type of carbonyl group present and its position. Give a chemical reaction to support your answer.

### SECTION C

This section contains 7 questions with internal choice in one question. The following questions are short answer type and carry 3 marks each.

22) (a) Write Nernst equation for the reaction at 25°C:  
 $2\text{Al(s)} + 3\text{Cu}^{2+}(\text{aq}) \longrightarrow 2\text{Al}^{3+}(\text{aq}) + 3\text{Cu(s)}$

(b) Predict the electrolysis of an aqueous solution of  $\text{CuCl}_2$  with platinum electrodes.  
 (Given:  $E_{\text{Cu}^{2+}/\text{Cu}}^\circ = +0.34$ ,  $E_{\text{H}^+/\text{H}_2}^\circ = +1.36$ ,  $E_{\text{H}^+/\text{H}_2}^\circ = 0.00$ ,  $E_{\text{O}_2/\text{H}_2\text{O}}^\circ = +1.23$ )

(c) Name the cell which is used in hearing aids?

23) The elements of 3d transition series are given as:  
 Sc Ti V Cr Mn Fe Co Ni Cu Zn

Answer the following

- which element has the highest m.p. and why?
- which element is strong oxidising agent in its oxidation state and why?
- which element is soft and why?

24) Complete the following reactions:



OR

Write chemical equations for the following reactions:

- (i) Propanone is treated with dilute  $\text{Ba(OH)}_2$
- (ii) Acetophenone is treated with  $\text{Zn(Hg)/con. HCl}$
- (iii) Benzoyl chloride is hydrogenated in presence of  $\text{Pd/BaSO}_4$ .

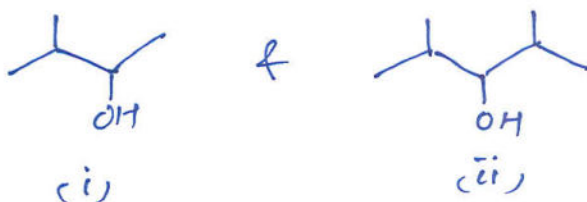
25) Define the following with a suitable example in each:

- (i) oligosaccharides
- (ii) Fibrous protein
- (iii) Vitamins

26) Give reasons of the following

- (i) Phenol is more acidic than methanol
- (ii) The C-O-H bond angle in alcohols is slightly less than the tetrahedral angle ( $109^\circ 28'$ )
- (iii)  $(\text{CH}_3)_3\text{C}-\text{O}-\text{CH}_3$  on reaction with HI gives  $(\text{CH}_3)_3\text{C}-\text{I}$  and  $\text{CH}_3-\text{OH}$  as the main products and not  $(\text{CH}_3)_3\text{C}-\text{OH}$  and  $\text{CH}_3-\text{I}$

27) (a) Identify the chiral molecule in the following pair:



(b) Write the structure of the product when chlorobenzene is treated with methyl chloride in the presence of sodium metal and dry ether.

(c) Write the structure of the alkene formed by dehydrohalogenation of 1-bromo-1-methylcyclohexane with alcoholic  $\text{KOH}$ .

28

consider the following reaction:



- (i) Depict the galvanic cell in which the given reaction takes place
- (ii) Give the direction of flow of current.
- (iii) Write the half-cell reactions taking place at cathode and anode.

**Section D**

The following questions are case-based questions.

Each question has an internal choice and carries 4 (2+1+1) marks each.

Read the passage carefully and answer the questions that follow:

29. Rahul set-up an experiment to find resistance of aqueous *KCl* solution for different concentrations at 298 K using a conductivity cell connected to a wheat stone bridge. He fed the wheat stone bridge with a.c. power in the audio frequency range 440 to 5000 cycle per seconds. Once the resistance was calculated from null point he also calculated the conductivity  $k$  and molar conductivity  $\Lambda_m$  and recorded his readings in tabular form.

S.No.	CONC. (M)	$Kscm^{-1}$	$\Lambda_M scm^{-2}mn^{-1}$
1.	1.00	$111.3 \times 10^{-3}$	111.3
2.	0.10	$12.9 \times 10^{-3}$	1129.0
3.	0.01	$1.41 \times 10^{-3}$	141.0

- (i) If Rahul had used *HCl* instead to *KCl* then would you expect the  $\Lambda_M$  values to be more or less than those per *KCl* for a given concentration. Justify. (2)

**OR**

Amit a classmate of Rahul repeats the same experiment with *CH<sub>3</sub>COOH* solution instead of *KCl* solution. Give **one** point that would be similar and one that would be different in his observations as compared to Rahul.

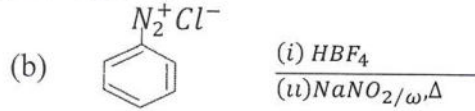
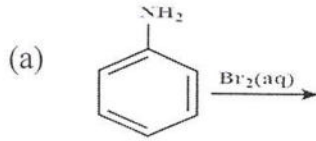
- (ii) Why does conductivity decreases with dilution? (1)
- (iii) If  $\Lambda_m^0$  of *KCl* is  $150.05cm^2mol^{-1}$ , calculate the degree of disassociation of .01M*KCl*. (1)

30. Amines are usually formed from nitro compounds, halides, amides, imides etc. They exhibit hydrogen bonding which influences their physical properties. In alkyl amines, a combination of electron releasing, steric and hydrogen bonding factors influence the stability of the substituted ammonium cations in protic polar solvents and thus affect the basic nature of amines. In aromatic amines, electron releasing and withdrawing groups, respectively increase and decrease their basic character. Influence of the number of hydrogen atoms at nitrogen atom on the type of reactions and nature of products is responsible for identification and distinction between primary, secondary and tertiary amines. Presence of amino group in aromatic ring enhances reactivity of the aromatic amines. Aryl diazonium salts provide advantageous methods for producing aryl halides, cyanides,, phenols and arenes by reductive removal of the diazo group.

- (i) An aromatic compound 'A' of molecular formula  $C_7H_6O_2$  on treatment with aqueous ammonia and heating form compound 'B' on heating with  $Br_2$  and aqueous KOH gives a compound 'C' of molecular formula  $C_6H_7N$ . Write the structures of A, B and C. (2)

OR

Complete the following reactions giving main products:



- (ii) Arrange the following in the increasing order of their  $pK_b$  values in aqueous solution:  
 $C_2H_5NH_2$ ,  $(C_2H_5)_2NH$ ,  $(C_2H_5)_3N$  (1)
- (iii) Aniline on nitration gives a substantial amount of *m*-nitroaniline, though amino group *o/p* directing. Why? (1)

### SECTION E

The following questions are long answer types and carry 5 marks each. All questions have an internal choice.

- 31 (a) A metal ion  $M^{n+}$  having  $d^4$  valence electronic configuration combines with three bidentate ligands to form a complex compound. Assuming  $\Delta_0 > P$ .

- (i) write the electronic configuration of  $d^4$  ion.  
 (ii) what type of hybridisation will  $M^{n+}$  ion have?  
 (iii) Name the type of isomerism exhibited by this complex

(b) Using IUPAC norms, write the formula for the following complexes:

- (i) Tetraaminediaquacobalt(II) chloride  
 (ii) Dibromido bis(ethane-1,2-diamine)platinum(IV) nitrate.

OR

- (a) (i) For the complex  $[Fe(H_2O)_6]^{3+}$ , write the hybridization, magnetic character and spin of the complex. (A.O.F Fe = 26)  
 (ii) Draw one of the geometrical isomers of the complex  $[Pt(en)_2Cl_2]^{2+}$  which is optically inactive.

(b) (i) using crystal field theory, write the electronic configuration of iron ion in the following complex ion. Also predict its magnetic behaviour:  $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$

(ii) write the IUPAC name of the coordination complex:  $[\text{Co}_2(\text{en})_2]^{2+}$

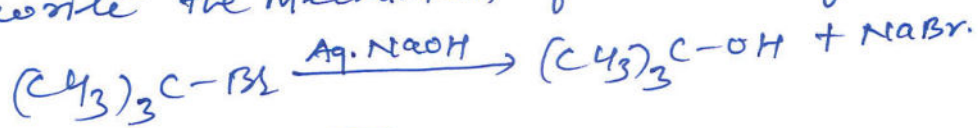
(32) (a) How can you convert the following?

(i) Phenol to o-hydroxybenzaldehyde

(ii) Methanol to ethanol

(iii) Phenol to phenyl ethanoate.

(b) write the mechanism of the following  $\text{S}_\text{N}1$  reaction:



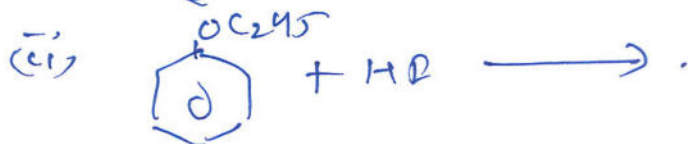
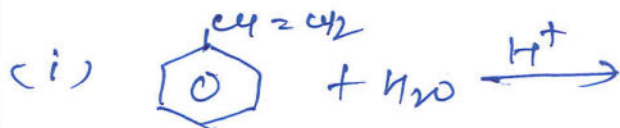
[OR]

(a) (i) How can you obtain phenol from cumene.

(ii) write the reaction involved in Kolbe's reaction.

(iii) How will you distinguish between butan-1-ol and butan-2-ol.

(b) write the structures of the main products in the following reactions:



(33) (a) when 2.56 g of sulphur, was dissolved in 100 g of  $\text{CS}_2$ , the freezing point is lowered by 0.383 K. calculate the formula of sulphur ( $\text{S}_x$ ) ( $K_f$  for  $\text{CS}_2 = 3.83 \text{ K kg mol}^{-1}$ ,  $Z$  of sulphur = 32  $\text{g mol}^{-1}$ )

(b) Define the following terms:

(i) colligative properties.

(ii) Molality (M).

OR

(i) A 10% solution (by mass) of sucrose in water has a freezing point of  $269.15\text{ K}$ . Calculate the freezing point of 10% glucose in water if the freezing point of pure water is  $273.15\text{ K}$   
[Given, molar mass of sucrose =  $342\text{ g mol}^{-1}$ ,  
molar mass of glucose =  $180\text{ g mol}^{-1}$ ]

(ii) Define following terms

- (a) Abnormal molar mass
- (b) Van't Hoff factor.

————— X —————

# SAMPLE QUESTION PAPER

SUB: CHEMISTRY

BLOCK PRINT

SNO	Chapter	MCQ 01 MARK	SA-I 02 MARKS	SA-II 03 MARKS	CBQ 04 MARKS	LA 05 MARKS	TOTAL
01	SOLUTION	-	2(1)			5(1)	07
02	ELECTROCHEMISTRY	1(2)		3(1)	4(1)		09
03	CHEMICAL KINETICS	1(2)	2(1)	3(1)			07
04	THE d and f block ELEMENTS	1(2)				5(1)	07
05	CO-ORDINATION COMPOUNDS			3(1)	4(1)		07
06	HALO ALKANES & HALO ARENES	1(1)	2(1)	3(1)			06
07	ALCOHOL, PHENOL AND ETHER	4(3)		3(1)			06
08	ALDEHYDE KETONES AND ACIDS	1(3)	2(1)	3(1)			08
09	AMINES	4(1)				5(1)	06
10	BIOMOLECULES	1(2)	2(1)	3(1)			07
		1(16)	2(5)	3(7)	4(2)	5(3)	70
	Total	16	10	21	08	15	



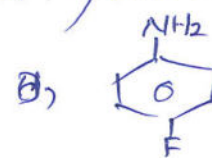
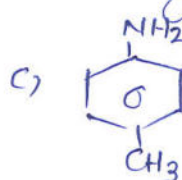
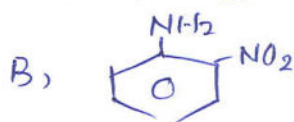
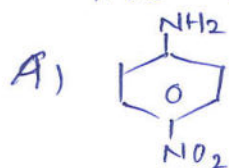
GENERAL INSTRUCTIONS:

- i) This question paper contains 33 questions. All questions are compulsory.
- ii) Question paper divided in to five sections: Section A, B, C, D and E.
- iii) Section A - question number 1-16 are multiple choice type questions. Each carries one mark.
- iv) Section B- question number 17-22 are very short answer type questions. Each carries two marks.
- v) Section C- question number 22-28 are short answer type questions. Each carries three marks.
- vi) Section D- question no 29 and 30 are case based questions. Each carries four marks.
- vii) Section E- question no 31-33 are long answer type questions. Each carries five marks.
- viii) There is no over all choice given in the question paper. How ever, an internal choice has been provided in few questions in all sections except section A
- ix) Use of Calculators is not allowed

SECTION: A

Question No. 1 to 16 are multiple choice type questions carrying one mark each. (16x1=16)

1. The most basic amine among the following is



2. The rate of the reaction  $A+B+C \rightarrow P$  is given by

$$r = -\frac{d[A]}{dt} = k[A]^{1/2}[B]^3[C]^{1/4}$$

The order of the reaction is

- A) 1      B) 2      C)  $\frac{1}{2}$       D)  $\frac{5}{4}$

3. Which of the following ions are coloured?

1.  $Cu^+$     2.  $Ti^{4+}$     3.  $Co^{2+}$     4.  $Fe^{2+}$

- A) 1, 2, 3, 4    b) 3, 4    c) 2, 3    d) 1, 2

4. Friedel-Crafts acylation of benzene with benzoyl chloride gives

- a)  $C_6H_5COCH_3$     b)  $CH_3COCH_3$     c)  $C_6H_5COC_6H_5$     d) none of these

5. In the following sequence of reactions  
 $\text{Et}_3\text{CH}_2\text{CH}_2\text{Br} \xrightarrow{\text{KOH (alc)}} \text{A} \xrightarrow{\text{HBr}} \text{B} \xrightarrow{\text{KOH (aq)}} \text{C}$

The major product C is

a) Propene b) Propyne c) propan-1-ol d) Propan-2-ol

6. The term anomers of glucose refers to  
 a) Isomers of glucose that differ in configurations at carbons one and four ( $\text{C}_1$  and  $\text{C}_4$ )

b) a mixture of (D)-glucose and (L)-glucose.

c) enantiomers of glucose

d) isomers of glucose that differ in configuration at carbon one ( $\text{C}_1$ )

7. Aldehydes, other than formaldehyde react with Grignard's reagent to give addition products which on hydrolysis give

a) tertiary alcohol b) secondary alcohol

c) primary alcohol d) Carboxylic acid.

8.  $\Lambda^\circ(\text{ClCH}_2\text{COONa}) = 224 \text{ ohm}^{-1} \text{ cm}^2 \text{ mol}^{-1}$ ,  $\Lambda^\circ(\text{NaCl}) = 38.2 \text{ ohm}^{-1} \text{ cm}^2 \text{ mol}^{-1}$ ,  $\Lambda^\circ(\text{HCl}) = 203 \text{ ohm}^{-1} \text{ cm}^2 \text{ mol}^{-1}$ . What is the value of  $\Lambda^\circ(\text{ClCH}_2\text{COOH})$ ?

a)  $288.5 \text{ ohm}^{-1} \text{ cm}^2 \text{ mol}^{-1}$  b)  $289.5 \text{ ohm}^{-1} \text{ cm}^2 \text{ mol}^{-1}$

c)  $388.8 \text{ ohm}^{-1} \text{ cm}^2 \text{ mol}^{-1}$  d)  $59.5 \text{ ohm}^{-1} \text{ cm}^2 \text{ mol}^{-1}$

9. The following sequence of reactions



The compound Q formed will be

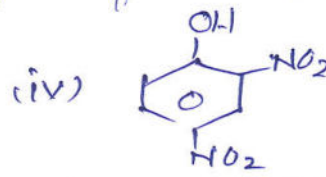
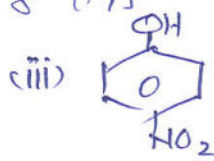
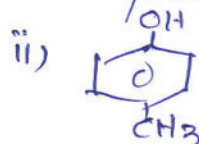
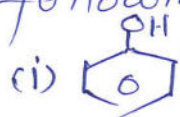
a) Aniline b) phenol c) benzaldehyde d) benzene Sulphonic acid.

10. General electronic configuration of lanthanoids is

a)  $(n-2)f^{0-14} (n-1)d^{0-1} ns^2$  b)  $(n-2)f^{0-14} (n-1)d^{0-1} ns^2$

c)  $(n-2)f^{0-14} (n-1)d^{10} ns^2$  d)  $(n-2)f^{0-14} (n-1)d^{0-1} ns^2$

11. The correct order of strength of acidity of the following compounds is



a) (ii) > (i) > (iii) > (iv) b) (i) > (ii) > (iii) > (iv) c) (iv) > (iii) > (ii) > (i)

d) (iv) > (iii) > (i) > (ii)

12. The rate of gaseous reaction is given by the expression  $k[\text{A}]^2[\text{B}]^3$ . The volume of the reaction

Vessel is reduced to one half of the initial volume. What will be the reaction rate as compare to the original rate?

- a)  $\frac{1}{8} a$       b)  $\frac{1}{2} a$       c)  $2a$       d)  $32a$

For question number 13-16, two statements are given one labelled as Assertion (A) and the other labelled as Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below.

- a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A)
- b) Both Assertion (A) and Reason (R) are true and Reason (R) is not the correct explanation of the Assertion (A)
- c) Assertion (A) is true, but Reason (R) is false
- d) Assertion (A) is false, but Reason (R) is true.

13. Assertion (A):  $\Lambda_m$  for weak electrolyte show a sharp increase when electrolytic solution is diluted.  
Reason (R): For weak electrolyte degree of dissociation increase with dilution.

14. Assertion (A): D-Glucose is dextro rotatory whereas L-Glucose is laevo-rotatory.  
Reason (R): D-compound is always dextro and L-compounds are <sup>always</sup> laevo rotatory.

15. Assertion (A): Carbonyl compounds have substantial dipole moments and polar than ethers.  
Reason (R): The high polarity of the carbonyl group is explained on the basis of resonance involving neutral and dipolar structures  

$$\text{>C=O} \leftrightarrow \text{>C}^{\oplus} - \text{O}^{\ominus}$$

16. Assertion (A): Reimer-Tiemann reaction is used to prepare salicylaldehyde from phenol.  
Reason (R): Reimer-Tiemann reaction involves nucleophilic substitution reaction.

SECTION - B

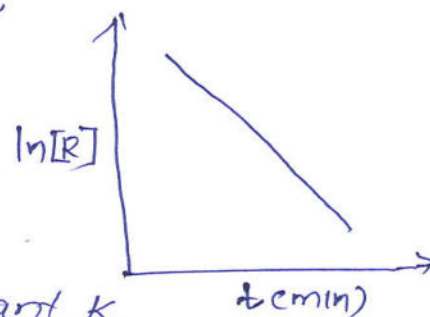
17. Calculate molarity and molality of a 13% solution (by mass) of sulphuric acid. Its density is  $1.02 \text{ g/cm}^3$  (Molar mass of  $\text{H}_2\text{SO}_4 = 98$ )

18. a) Amino acids show amphoteric behaviour. Why  
b) write one difference between  $\alpha$ -helix structures and  $\beta$ -pleated structures of protein

19. Haloalkanes undergo nucleophilic substitution reaction where as haloarenes undergo electrophilic substitution

reaction. Explain.

20. For a certain chemical reaction, variation in the concentration,  $\ln[R]$  vs time (min) plot is shown below.



For this reaction

- What is the order of reaction?
- What are the units of rate constant  $k$  for this reaction?
- Give the relationship between  $k$  and  $t_{1/2}$  of this reaction.
- If the initial concentration for this reaction becomes half, how will  $t_{1/2}$  vary?

21. (i) When propanone is subjected to Wolf-Kishner reduction, what product will be obtained? Write chemical equation.

(ii) How will you convert acetaldehyde to acetone?

OR

(i) Suggest reagents to obtain the following product



(ii) Write the chemical equations involved in Fard reaction.

### SECTION - C

22. (a) What is the basic structural difference between starch and cellulose?

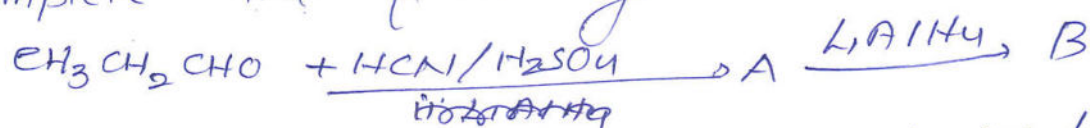
(b) Differentiate Denaturation of protein with an example.

(c) Why cannot vitamin C be stored in our body?

23. (a) Why phenol is more acidic than hexanol?

(b) What is the product formed when propanal react with 2-methylpropanal in the presence of  $\text{NaOH}$ ? Write the name of the reaction.

24. (a) Complete the following reaction.



(b) An aliphatic compound A with molecular formula  $\text{C}_3\text{H}_6\text{O}$  with phenyl hydrazine gives a compound B. Compound A gives ~~positive~~ yellow precipitate with  $\text{I}_2$  in alkaline medium. Identify A and B.

25. (a) Give reasons.

- a) Ethyl Iodide undergoes  $S_N2$  reaction faster than ethyl bromide
- b) Which will have higher boiling point?  
1- chloro ethane or 2-methyl-2-chloro butane
- c) Out of chlorobenzene and benzyl chloride which one gets easily hydrolysed by aqueous NaOH and why?

26. For the reaction  
 $2AgCl(s) + H_2(g, 1\text{ atm}) \rightarrow 2Ag(s) + 2H^+(0.1M) + 2Cl^-(0.1M)$   
 $\Delta G^\circ = -43600\text{ J at } 25^\circ\text{C}$ . Calculate the e.m.f of the cell.

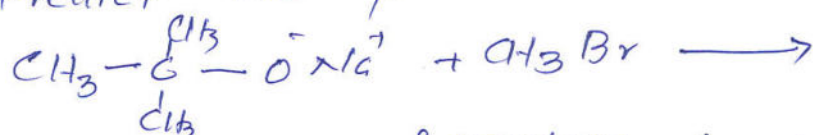
27. Give reasons for the following observations

a)  $[Cr(NH_3)_6]^{3+}$  is paramagnetic while  $[Ni(CN)_6]^{2-}$  is diamagnetic

b) A solution of  $[Ni(H_2O)_6]^{2+}$  is green but  $[Ni(CN)_4]^{2-}$  is colourless.

c) Write the IUPAC name of  $[Co(NH_3)_5(CO_3)]Cl$ .

28. a) Predict the product.



b) Write the ~~name of~~ reaction for the preparation of ethoxybenzene by Williamson Synthesis

c) How will you distinguish ethanol and propan-2-ol

OR

a) Out of o-nitro phenol and p-nitrophenol which one is steam volatile and why? (1)

b) Write mechanism of acid catalysed dehydration of alcohol. (2)

### SECTION: D

The following questions are case based questions. Read the case carefully and answer the questions that follow:

29. For understanding the structure and bonding in transition metal complexes, the magnetic properties are very useful. Low spin complexes are generally diamagnetic because of pairing of electrons, whereas high spin complexes are usually paramagnetic because of the presence of unpaired electrons. Larger the unpaired electrons, stronger will be the paramagnetism

However the magnetic behaviour of a complex can be confirmed from the magnetic moment measurement. magnetic moment  $\mu = \sqrt{n(n+2)}$  BM. where  $n$  = number of unpaired electrons. Greater the number of unpaired electrons more will be the magnetic moment.

Answer the following questions:

- What is the geometry of the compound  $[Pt(CNH_3)_2Cl_2]$ ?
- $[Fe(CN)_6]^{4-}$  and  $[FeCl_6]^{2-}$  are of different colours in dilute solutions. Why?
- $[CoF_6]^{3-}$  is paramagnetic but  $[Co(CNH_3)_6]^{3+}$  is diamagnetic complex. Why?

What are <sup>OR</sup>  $t_{2g}$  and  $e_g$  orbitals in octahedral complex and  $t_2$  and  $e$  in tetrahedral complex.

30. The potential of each electrode is known as electrode potential. Standard electrode potential is the potential when concentration of each species taking part in electrode reaction is unity and the reaction taking place at 298K. By convention, the standard electrode potential of hydrogen electrode is 0.0V. The electrode potential value for each electrode process is a measure of relative tendency of each species in the process to remain in oxidised/reduced form. The negative electrode potential means that the redox couple is stronger reducing agent than  $H^+/H_2$  couple. The positive electrode potential means that the redox couple is a weaker reducing agent than the  $H^+/H_2$  couple. Metals which have higher positive value of standard reduction potential form the oxides of greater thermal stability.

Answer the following questions:

- What is standard electrode potential?
- Lithium metal is the strongest reducing agent. Why?
- Following two reactions can occur at cathode in electrolysis of aqueous sodium chloride  
 $Na^+ + e^- \rightarrow Na(s)$ ,  $E_{red}^0 = -2.71V$   
 $2H_2O(l) + 2e^- \rightarrow H_2(g) + 2OH^-(aq)$ ,  $E_{red}^0 = -0.83V$   
 Which reaction takes place preferentially and why?

OR

Given the standard electrode potentials  
 $K^+/K = -2.93\text{ V}$ ,  $Ag^+/Ag = 0.80\text{ V}$ ,  $Hg^{2+}/Hg = 0.79\text{ V}$ ,  $Mg^{2+}/Mg = -2.37\text{ V}$   
 $Cr^{3+}/Cr = -0.74\text{ V}$ .

Arrange these metals in their increasing order of reducing power.

### Section: E

31. Attempt any five of the following

- The enthalpy of atomisation of transition elements are high. Give reason.
- Draw the structure of chromate and dichromate ions.
- Give two reasons in which potassium dichromate act as oxidising agent.
- Which transition metal of 3d series exhibits the large number of oxidation states and why?
- Scandium ( $Z=21$ ) does not exhibit variable oxidation state and yet it is regarded as transition elements. Explain.
- Orange solution potassium dichromate turns yellow on adding sodium hydroxide to it. Give reason.
- Name the lanthanoids which show abnormally low value of third ionisation enthalpy.

32. a) When is the value of van't Hoff factor more than one?

b) An aqueous solution of glucose is made by dissolving 10g of glucose ( $C_6H_{12}O_6$ ) in 90g of water at 303K. If the vapour pressure of pure water at 303K be 32.8mm Hg, what would be the vapour pressure of the solution?

c) How many gram of KCl should be required to be added to 1kg of water to lower the freezing point to  $-8^\circ\text{C}$ .  $K_f(\text{H}_2\text{O}) = 1.86\text{ K kg mol}^{-1}$ ,  $\Delta_{\text{mass}}K = 39$ ,  $\Delta_{\text{mass}}Cl = 35.5$

OR

a) What weight of the non-volatile urea ( $\text{NH}_2\text{CO-NH}_2$ ) needs to be dissolved in 100g of water in order to decrease the vapour pressure of water by 25%. What will be molality of the solution?

b) 4% NaOH solution (m/v) and 6% urea solution (mass/volume) are equimolar but not isotonic. Why?

33. Write one chemical reaction each to illustrate the following.

- (i) Hoffmann's bromamide reaction
- (ii) Gabriel phthalimide synthesis
- (iii) Before reaction aniline with  $\text{HNO}_3$  for nitration it is converted to acetanide. Why is this done and how is nitroaniline obtained subsequently?

OR

a) (i) Give one test to distinguish between  $\text{CH}_3\text{CH}_2\text{NH}_2$  and  $\text{CH}_3\text{-NH-CH}_3$ .

(ii) Write the chemical reaction for the reduction of nitroethane by  $\text{LiAlH}_4$ .

b) Write the chemical equation stating the reaction condition, require for each of the following conversions.

(i) Methyl bromide to ethylamine

(ii) Aniline to phenol

4-methyl aniline.



General Instructions:

- Read the following instructions carefully and follow them.
1. There are 33 questions in this question paper with internal choice.
  2. SECTION-A consists of 16 multiple-choice questions carrying 1 mark each.
  3. SECTION-B consists of 5 short answer questions carrying 2 marks each.
  4. SECTION-C consists of 7 short answer questions carrying 3 marks each.
  5. SECTION-D consists of 2 case-based questions carrying 4 marks each.
  6. SECTION-E consists of 3 long answer questions carrying 5 marks each.
  7. All questions are compulsory.
  8. Use of log tables and calculator is not allowed.

The following questions are multiple-choice questions with one correct answer. Each question carries 1 mark. There is no internal choice.

Q1) Which of the following statements is not correct?

- (a) All aliphatic amines are more basic than ammonia.
- (b) Boiling point of 1° amine is lower than 2° and 3° amines.
- (c) Aliphatic amines are soluble in water.
- (d) Gabriel phthalimide synthesis cannot be used for the preparation of 2° and 3° amines.

Q2) Which one of the following has higher dipole moment?

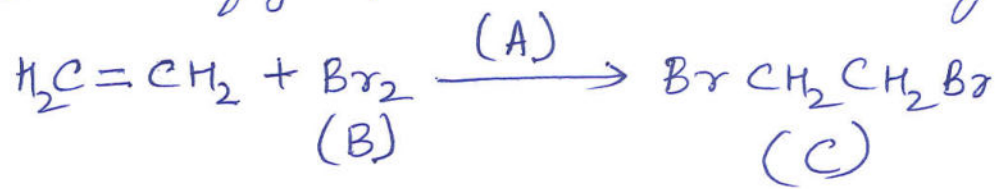
- (a)  $\text{CH}_3\text{F}$
- (b)  $\text{CH}_3\text{Cl}$
- (c)  $\text{CH}_3\text{I}$
- (d)  $\text{CH}_3\text{Br}$

Q3) Which of the following statements is not correct?

- I. Copper liberates hydrogen from acids
- II. In its lowest oxidation state, manganese forms stable compounds with oxygen and fluorine
- III.  $\text{Mn}^{3+}$  and  $\text{Co}^{3+}$  are oxidising agents in aqueous solutions.
- IV.  $\text{Ti}^{2+}$  and  $\text{Co}^{2+}$  are reducing agents in aq solutions

(a) I, II (b) II, III, IV (c) I, III (d) I, II, IV

Q4) Identify A, B and C in the given sequence.



Select the correct options.

- | <u>(A)</u>         | <u>(B)</u>    | <u>(C)</u>    |
|--------------------|---------------|---------------|
| (a) $\text{CCl}_4$ | Colourless    | Reddish-brown |
| (b) $\text{CCl}_4$ | Reddish-brown | colourless    |
| (c) $\text{CBr}_4$ | colourless    | Reddish-brown |
| (d) $\text{CBr}_4$ | Reddish-brown | colourless.   |

Q5) for a hypothetical reaction,  $\text{R} \rightarrow \text{P}$ ,

$$\text{Rate } -\frac{d[\text{R}]}{dt} = k[\text{R}] \quad \text{The negative sign}$$

used in the rate expression indicates

- (a) decrease in the concentration of reactant with time.
- (b) decrease in concentration of product with time.
- (c) reaction is reversible
- (d) decrease in the rate with time.

Q6. The name of the compound  $\text{CH}_3\text{CH}_2\text{COOC}_2\text{H}_5$  is:

- (a) Propyl ethanoate
- (b) Ethyl propanoate
- (c) Ethyl ethanoate
- (d) Ethoxy propane

(Q7) A coordination compound ~~pentaamminebromide~~ pentaamminebromidocobalt(III) sulphate is dissolved in water.

When a few drops of chemical 'X' is added to the solution, it gives white precipitate. The chemical 'X' is

- (a)  $\text{AgNO}_3$
- (b)  $\text{BaCl}_2$
- (c)  $\text{BaSO}_4$
- (d)  $\text{NaCl}$

Q8) Which of the following is an example of denaturation of protein:

- (a) Clotting of blood
- (b) Coagulation of egg white.
- (c) Curdling of milk
- (d) Both (b) and (c)

(Q9) The 'spin-only' magnetic moment (in units of B.M.) of  $\text{Ni}^{2+}$  in aqueous solution would be (At. No. of Ni = 28)

- (a) 2.83
- (b) 4.90
- (c) 0
- (d) 1.73

Q10) For the reaction,  $A + 2B \rightarrow C$ ,  $\text{Rate} = k[A][B]$

If the concentration of the reactant B is doubled, keeping the concentration of ~~A~~ A constant, the value of rate of reaction will be

- (a) decreased by two times (b) increased by four times  
(c) increased by two times (d) remains same

Q11) Secondary amines can be prepared by

- (a) reduction of nitro compounds  
(b) oxidation of N-substituted amides  
(c) reduction of isonitriles  
(d) reduction of nitriles

Q12) The major product of oxidation of secondary alcohol is

- (a) aldehyde (b) ketone (c) carboxylic acid  
(d) ether

### Assertion-Reason

In Question Nos. 13-16, ~~an~~ a statement, (Assertion) (A) followed by a Reason (R). Use the following key to choose the appropriate answer.

Q12) (a) Both (A) and (R) are true and (R) is the correct explanation of (A).

(b) Both (A) and (R) are true but (R) is not the correct explanation of (A)

(c) (A) is true but (R) is false

(d) (A) is false but (R) is true.

Q13) Assertion (A) In  $\text{Cr}_2\text{O}_7^{2-}$  ion, all the Cr-O bond lengths are equal.

Reason (R) In  $\text{Cr}_2\text{O}_7^{2-}$  ion, Cr-O-Cr bond angle is  $126^\circ$ .

Q14) Assertion (A) As a lead storage battery gets discharged, density of electrolyte present in it decreases.

Reason (R) Lead & lead dioxide both react with sulphuric acid to form lead sulphate

Q15) Assertion (A) All naturally occurring  $\alpha$ -amino acids except glycine are optically active.

Reason (R) Most naturally occurring amino acids have L-configuration.

7.

Q 16) Assertion (A) The units of rate constant of a zero order reaction and the rate of reaction are same.

Reason (R) In a zero order reaction, the rate of reaction is independent of the concentration of reactants.

### Section B

This section contains 5 questions with internal choice in one question. The following questions are very short questions and carry 2 marks each.

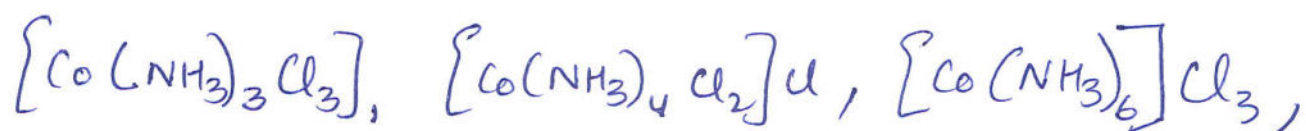
(Q 17) A solution containing 0.5 g of KCl dissolved in 100 g of water and freezes at  $-0.124^{\circ}\text{C}$ . Calculate degree of dissociation of the salt.  
( $K_f$  for water =  $1.86^{\circ}\text{C kg mol}^{-1}$ )  
(At weights of K = 39, Cl = 35.5)

OR

~~(Q 18)~~  
The osmotic pressure of a dilute solution of an ionic compound XY in water is 3 times that of a solution of  $0.01\text{M BaCl}_2$  in water

Assuming complete dissociation of the given ionic compound in water, calculate the concentration of XY (in moles/L) in the solution.

Q18) <sup>(a)</sup> Arrange the following complexes in increasing order of their conductivities. the conductivity of their solutions.



(b) Give IUPAC name:  $\text{K}_4[\text{Fe}(\text{CN})_6]$

Q19) Write the reactions taking place at anode and cathode of lead storage battery when current is drawn from it.

Q20) Explain (a) racemic mixture (b) Finkelstein reaction

Q21) What happens when (write chemical reactions)

(a) Glucose reacts with HCN

(b) Glucose reacts with conc  $\text{HNO}_3$



SECTION C

The section contains 7 questions with internal choice in one question. The following questions are short answer type and carry 3 marks each.

Q 22) (a). State Kohlrausch's law.

(b) What happens to conductivity of a solution on dilution? Give reason.

(c) Give products of electrolysis at anode and cathode when dilute solution of  $\text{AgNO}_3$  is electrolysed with inert electrodes.

Q 23) Give reasons:

(a) Zr and Hf have similar atomic radii.

(b) Zn, Cd and Hg are not considered transition elements.

(c) ~~the~~  $\text{Zn}^{2+}$  salts are white while  $\text{Ni}^{2+}$  salts are blue.

Q24) An organic compound A ( $C_4H_6O_3$ ) on treatment with ethyl alcohol gives a carboxylic acid B and compound C. Hydrolysis of C under acidified conditions gives B and D.

Identify A, B, C and D and write all the involved equations

OR

Convert: (a) Toluene to Benzaldehyde

(b) Ethanal to 3-Hydroxybutanal

(c) Benzene to Benzoic acid.

Q25) (a) Give 2 points of differences between DNA and RNA

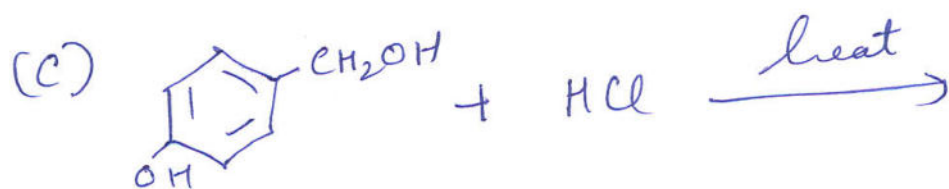
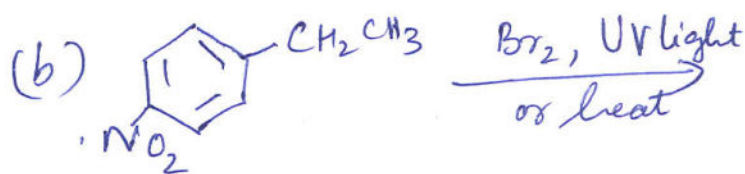
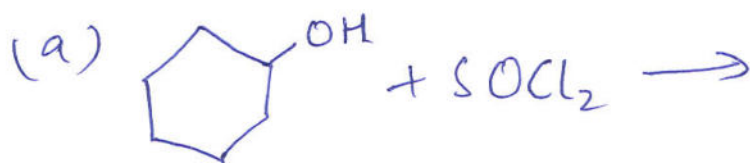
(b) Give the name of deficiency disease of vitamin C.

(c) Write the zwitterion structure of any  $\alpha$ -Amino acid.

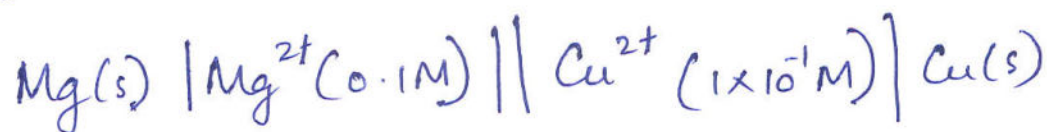
Q26) (a) Give mechanism of dehydration of alcohol to form alkene by using  $H_2SO_4$  at 443K. 11.

(b) Explain Reimer-Tiemann reaction and Kolbe's reaction.

(Q27) Draw the structures of major monohalo products in each of the following:



(Q28) (a) Calculate the emf of the cell at 298K



Given  $E^{\circ}_{Cu^{2+}/Cu} = 0.34V$

$$E^{\circ}_{Mg^{2+}/Mg} = -2.37V.$$

(b) State Faraday's 1st Law of electrolysis.

### Section D

The following questions are case-based questions. Each question has an internal choice and carries 4 (2+1+1) marks each. Read the passage carefully and answer the questions that follow.

Q29) The rate of a chemical reaction is influenced by temperature, a phenomenon that is crucial to industries and biological systems. Arrhenius equation gives the quantitative relationship between temperature and rate constant. Higher temperature provides more kinetic energy to colliding reactant molecules. This enhances the likelihood of overcoming the activation energy barrier, leading to a higher reaction rate.

Answer the following questions, which are based on the above paragraph.

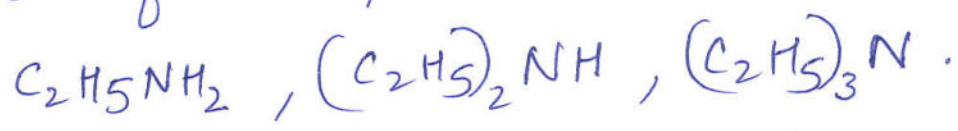
- (a) Calculate activation energy of a reaction whose rate doubles when temperature is increased from 298K to 308K.
- (b) Define activation energy.
- (c) Plot a graph between  $\ln k$  vs  $1/T$ .

Q 30) Amines are usually formed from nitro compounds, halides, amides etc. They exhibit hydrogen bonding which influences their physical properties. In alkyl amines, a combination of electron releasing, ~~and~~ steric and hydrogen bonding factors influence the stability of the substituted ammonium cations in protic polar solvents and thus affect the basic nature of amines.

Aryl diazonium salts provide advantageous methods for producing many aryl compounds.

Based on the above information, answer the following questions

(a) (i) Arrange the following in the decreasing order of their  $pK_b$  values in aqueous solutions.



(ii) How will you distinguish between ethanamine and diethylamine?

(b) Explain Hoffman bromamide reaction

(c) Convert Methanamine to ethanamine.

The following questions are long answer type and carry 5 marks each. All questions have an internal choice.

Q31) (a) For the complex,  $[\text{Fe}(\text{CN})_6]^{3-}$ , write the hybridisation type and magnetic character.

(At. no. of Fe = 26)

(b) (i) Draw one of the geometrical isomers of the complex  $[\text{Pt}(\text{en})_2\text{Cl}_2]^{2+}$  which is optically inactive.

(ii) Using IUPAC names, write the formula of hexaamminacobalt(III) sulphate.

(c)  $[\text{Ni}(\text{H}_2\text{O})_6]^{2+}(\text{aq})$  is green in colour, whereas  $[\text{Ni}(\text{H}_2\text{O})_4(\text{en})]^{2+}(\text{aq})$  is blue in colour, give reason in support of your answer.

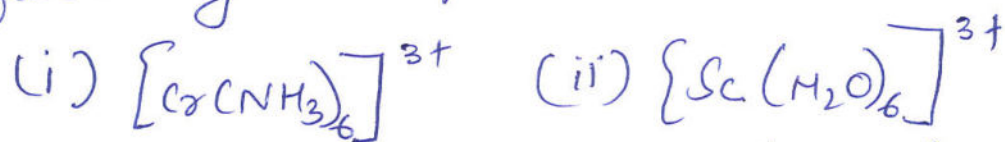
OR

(a) Explain the following by giving appropriate reason.

(i) Nickel does not form low spin octahedral complexes.

(ii) Write the IUPAC name of the complex  $[\text{Ag}(\text{H}_2\text{O})_2][\text{Ag}(\text{CN})_2]$

(b) Predict the number of unpaired electrons, the magnetic moments for each of the following complexes.



(c) Write the hybridisation of the complex  $[\text{Ni}(\text{CN})_4]^{2-}$  [At. No. of Ni = 28]

(Q 32) (a) Give any 2 limitations of Williamson's synthesis with examples.

(b) How will you distinguish between Pentan-2-ol and Pentan-3-ol.

(c) What happens when phenol reacts with Zn dust followed by reaction with  $\text{Br}_2$  in  $\text{CS}_2$ . Give equation.

(d) Convert (i) Phenol to picric acid  
(ii) Benzyl alcohol to 2-phenylacetic acid.

OR

(a) Write the mechanism of acidic hydration of ethene.

(b) Convert (i) Phenol to Aspirin  
(ii) Propene to Propanol.

(c) Explain ~~ii~~ alcohols are less acidic than Phenol

(d) Arrange in increasing order of their boiling points.

Pentan-1-ol, butan-1-ol, butan-2-ol, ethanol, propan-1-ol, methanol.

Q33) (a) Rahul's car radiator is filled with 1.0 kg of water. How many grams of ethylene glycol (M. Mass = 62 g/mole) must be added to get the freezing point of solution lowered to  $-2.8^{\circ}\text{C}$ .  $K_f$  of water is  $1.86 \text{ K kg/mole}$ .

(b) What type of deviation from Raoult's Law is shown by ethanol and acetone mixture? Give reason.

OR

(a) Boiling point of water at 750 mm Hg pressure is  $99.68^{\circ}\text{C}$ . How much sucrose (M. Mass = 342 g/mole) is to be added to 500 g of water such that it boils at  $100^{\circ}\text{C}$ ?

( $K_b$  for water =  $0.52 \text{ K kg mole}^{-1}$ ).



(b) State Hensey's Law and write any ~~two~~ one applications of the law.

— x —

# SAMPLE QUESTION PAPER

①

Sub: Chemistry  
Class: XII

MM: 70  
Time: 3hrs.

## General Instructions

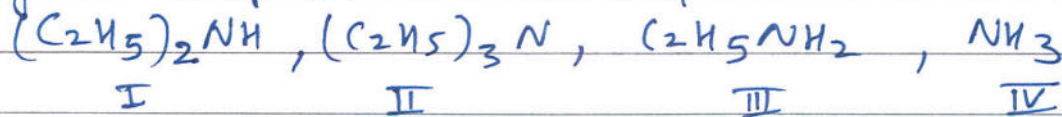
Read the following instructions carefully.

- There are 33 questions in this question paper with internal choice.
- SECTION A consists of 16 multiple-choice questions carrying 1 mark each.
- SECTION B consists of 5 short answer questions carrying 2 marks each.
- SECTION C consists of 7 short answer questions carrying 3 marks each.
- SECTION D consists of 2 case-based questions carrying 4 marks each.
- SECTION E consists of 3 long answer questions carrying 5 marks each.
- All questions are compulsory.
- Use of log tables and calculators is not allowed.

## SECTION A

The following questions are multiple-choice questions with one correct answer. Each question carries 1 mark. There is no internal choice in this section.

1. Arrange the following amines in increasing order of their  $pK_b$  value in aqueous medium. (1)



- (a)  $I < II < III < IV$  (b)  $IV < III < II < I$   
 (c)  $IV < III < I < II$  (d)  $IV < I < III < II$

2. When hydrochloric acid gas is treated with propene in the presence of benzoyl peroxide it gives (1)

- (a) 2-chloropropane (b) allyl chloride  
 (c) n-propyl chloride (d) iso-propyl chloride

3. Match the properties given in Column I with the metals given in Column II (1)

Column I

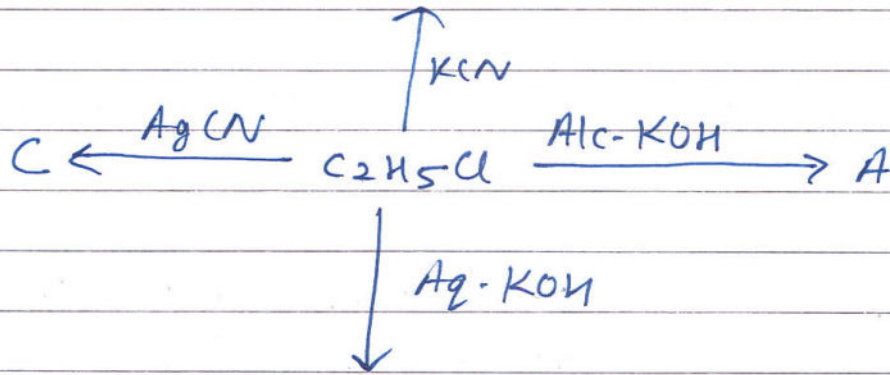
Column II

- |   |        |
|---|--------|
| (i) An element which has highest second ionization enthalpy | (b) Mn |
| (ii) 3d-block element that shows only +3 oxidation state    | (q) Zn |
| (iii) 3d-block element with lowest melting point            | (r) Sc |
| (iv) An element which can show +7 oxidation state           | (s) Cu |

Select the correct option

- (a) (i)  $\rightarrow$  p, (ii)  $\rightarrow$  s, (iii)  $\rightarrow$  r, (iv)  $\rightarrow$  q  
 (b) (i)  $\rightarrow$  s, (ii)  $\rightarrow$  q, (iii)  $\rightarrow$  r, (iv)  $\rightarrow$  p  
 (c) (i)  $\rightarrow$  s, (ii)  $\rightarrow$  r, (iii)  $\rightarrow$  q, (iv)  $\rightarrow$  p  
 (d) (i)  $\rightarrow$  r, (ii)  $\rightarrow$  s, (iii)  $\rightarrow$  p, (iv)  $\rightarrow$  q

4. Identify A, B, C and D



- (a)  $A = \text{C}_2\text{H}_4$ ,  $B = \text{C}_2\text{H}_5\text{OH}$ ,  $C = \text{C}_2\text{H}_5\text{NC}$ ,  $D = \text{C}_2\text{H}_5\text{CN}$   
 (b)  $A = \text{C}_2\text{H}_5\text{OH}$ ,  $B = \text{C}_2\text{H}_4$ ,  $C = \text{C}_2\text{H}_5\text{NC}$ ,  $D = \text{C}_2\text{H}_5\text{CN}$   
 (c)  $A = \text{C}_2\text{H}_4$ ,  $B = \text{C}_2\text{H}_5\text{OH}$ ,  $C = \text{C}_2\text{H}_5\text{NC}$ ,  $D = \text{C}_2\text{H}_5\text{NC}$   
 (d)  $A = \text{C}_2\text{H}_5\text{OH}$ ,  $B = \text{C}_2\text{H}_4$ ,  $C = \text{C}_2\text{H}_5\text{NC}$ ,  $D = \text{C}_2\text{H}_5\text{CN}$

5. How many times will the rate of the elementary reaction  $3X + Y \rightarrow X_2Y$  change if the concentration of the substance X is doubled and that of Y is halved?

- (a)  $r_2 = 4.5 r_1$ , (b)  $r_2 = 5 r_1$ , (c)  $r_2 = 2 r_1$ , (d)  $r_2 = 4 r_1$

6. A compound (A) with molecular formula  $\text{C}_5\text{H}_{10}\text{O}$  forms a phenyl hydrazone and gives negative Tollen's and iodoform tests. The compound on

reduction gives n-pentane. The compound (A) is

- (a) pentan-3-one (b) pentanal  
(c) pentanol (d) pentan-2-one

7. Match the following columns

(i)

Column I (Complex)

Column II (Structure & magnetic moment)

- A.  $[Ag(NH_3)_2]^+$   
B.  $[Co(NH_3)_6]^{3+}$   
C.  $[Fe(CN)_6]^{3-}$   
D.  $[CuCl_4]^{2-}$

1. Octahedral and 1.73BM  
2. Linear and zero  
3. Octahedral and zero  
4. Tetrahedral and 1.73BM

- (a) A-2, B-3, C-1, D-4  
(b) A-2, B-1, C-4, D-3  
(c) A-3, B-2, C-1, D-4  
(d) A-2, B-3, C-4, D-1

8. Disaccharides that are reducing in nature are

(i)

- (a) sucrose and lactose (b) sucrose and maltose  
(c) lactose and maltose (d) sucrose, lactose and maltose

9. Which of the following is a diamagnetic ion?  
(At. nos. of Sc, V, Mn and Cu are 21, 23, 25 & 29)

(i)

(a)  $V^{2+}$  (b)  $Sc^{3+}$  (c)  $Cu^{2+}$  (d)  $Mn^{3+}$

10. What is the half-life period for the decomposition of  $N_2O_5$  in seconds? (Given: Rate const. for the decomposition of  $N_2O_5$  is  $6 \times 10^{-4} s^{-1}$ ) (i)

(a) 11.55 (b) 115.5 (c) 1155 (d) 1.1.55

11. One of the following amides will not undergo Hofmann bromamide reaction: (i)

(a)  $CH_3CONHCH_3$  (b)  $CH_3CH_2CONH_2$  (c)  $CH_3CONH_2$   
(d)  $C_6H_5CONH_2$

12. Which of the following statement is not correct for carboxylic acids? (i)

- (a) Aromatic carboxylic acids undergo electrophilic substitution reaction
- (b) Carboxylic acids are stronger acids than alcohols
- (c) Carboxylic acids on heating with  $P_2O_5$  give corresponding acid chloride
- (d) Hell-Volhard-Zelinsky reaction is given by carboxylic acids.

Select the most appropriate answer from the options given below:

(a) Both A and B are true and B is the correct

explanation of A

- (b) Both A and R are true but R is not the correct explanation of A  
 (c) A is true but R is false  
 (d) A is false but R is true

13. A → Low spin tetrahedral complexes are rarely observed (1)

R → Crystal field splitting energy is less than pairing energy for tetrahedral complexes.

14. A → During electrolysis of aqueous copper sulphate solution using copper electrode, hydrogen gas is released at the cathode. (1)

R → The electrode potential of  $\text{Cu}^{2+}/\text{Cu}$  is greater than that of  $\text{H}^+/\text{H}_2$

15. A → Anomeric carbon in Fructose is C-2 (1)

R → Anomers are stereoisomers, which have same configuration of atoms

16. A → Molecularity has no meaning for a complex reaction. (1)

R → The overall molecularity of a complex reaction is equal to the molecularity of the slowest step

Date \_\_\_\_\_  
Page \_\_\_\_\_

## SECTION - B

This section contains 5 questions with internal choice in one question. The following questions are very short answer type and carry 2 marks each.

17. What happens when,

- (i) a pressure greater than osmotic pressure is applied on the solution side separated from solvent by a semipermeable membrane? (1)
- (ii) acetone is added to pure ethanol? (1)

OR

Determine the osmotic pressure of a solution prepared by dissolving  $2.32 \times 10^{-3}$  g  $K_2SO_4$  in 2 L of solution at  $25^\circ C$ , assuming that  $K_2SO_4$  is completely dissociated:  
( $R = 0.082$  L atm  $K^{-1}$  mol $^{-1}$ , Molar mass of  $K_2SO_4 = 174$  g/mol) (2)

18. (i) Write the IUPAC name of the given complex  $[Pt(NH_3)_2Cl_2]^{2+}$ . (1)
- (ii) Explain  $[Co(NH_3)_6]^{3+}$  is an inner orbital or outer orbital complex. (1)

19. There are four electrodes A, B, C and D.  $E^\circ$  values of these electrodes are as follows: (2)



Electrodes

$E^{\circ}$

A  $A/A^{-} = 0.96V$

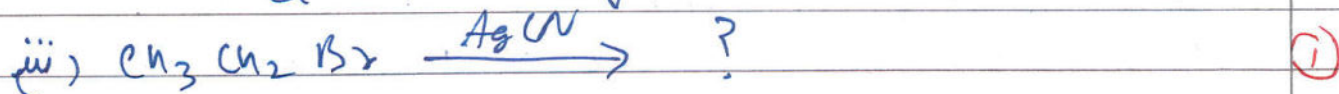
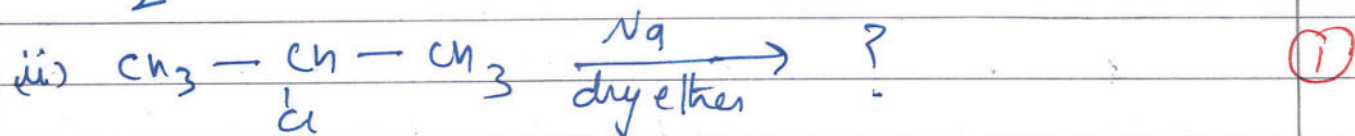
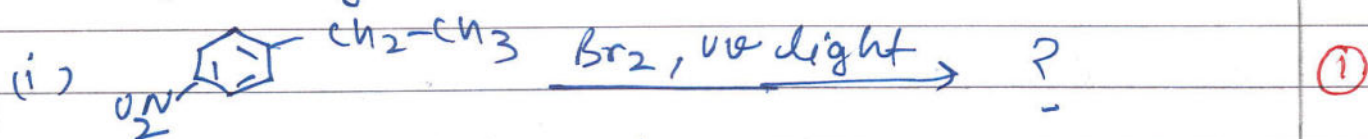
B  $B/B^{2-} = -0.12V$

C  $C^{+}/C = 0.18V$

D  $D^{2+}/D = -1.12V$

The combination of which of two electrodes will give the largest cell potential? Justify your answer. Also, find EMF of the cell.

20. Write the major product(s) in any two of the following reactions



21. (i) What happens when glucose reacts with  $Br_2$  water? (1)

(ii) Give any one property of glucose that cannot be explained by its open chain structure. (1)

- (ii) Metal-metal bonding in 4d and 5d series is more predominant than 3d series (1)
- (iii) In the series  $Ti^{4+}$ ,  $V^{2+}$ ,  $Mn^{3+}$ ,  $Cr^{3+}$   $Cr^{3+}$  is the most stable in aqueous solution. (1)

24. For each of the following combinations of reagents and conditions, suggest whether substitution or elimination will predominate. Justify your answer

- (i) Heating  $CH_3CH_2CH_2Br$  with aqueous  $NaOH$  (1)
- (ii) Heating  $(CH_3)_3CBr$  with  $NaOH$  in ethanol (1)
- (iii) Heating  $(CH_3)_2CHBr$  with  $(CH_3)_3CO^-K^+$  (1)

OR

OR

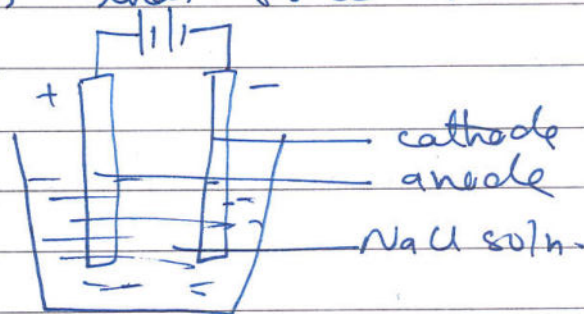
- (i) Ethyl iodide undergo  $SN_2$  reaction faster than ethyl bromide. Why (1)
- (ii) Haloarenes are insoluble in water but are soluble in benzene. Explain (1)
- (iii) Why Racemic mixture is optically inactive? (1)

25. (i) What do you mean by Glycosidic linkage? (1)
- (ii) Why the two strands of DNA are not (1)

## SECTION C

This section contains 7 questions with internal choice in one question. The following questions are short answer type questions and carry 3 marks each.

22. Look at the diagram and answer the questions that follow:



The electrodes used in the cell are made up of Platinum

- What are the products formed at cathode for the given setup? (1)
- Write the electrode reactions if the electrolyte is changed to molten NaCl. (1)
- What is the nature & function of the electrodes seen here? (1)

23. Give reasons:

- $\text{Cr}^{2+}$  ion is reducing agent while  $\text{Mn}^{3+}$  ion is an oxidising agent (1)

identical but are complementary?  
 (ii) Identify the products formed when lactose undergoes hydrolysis.

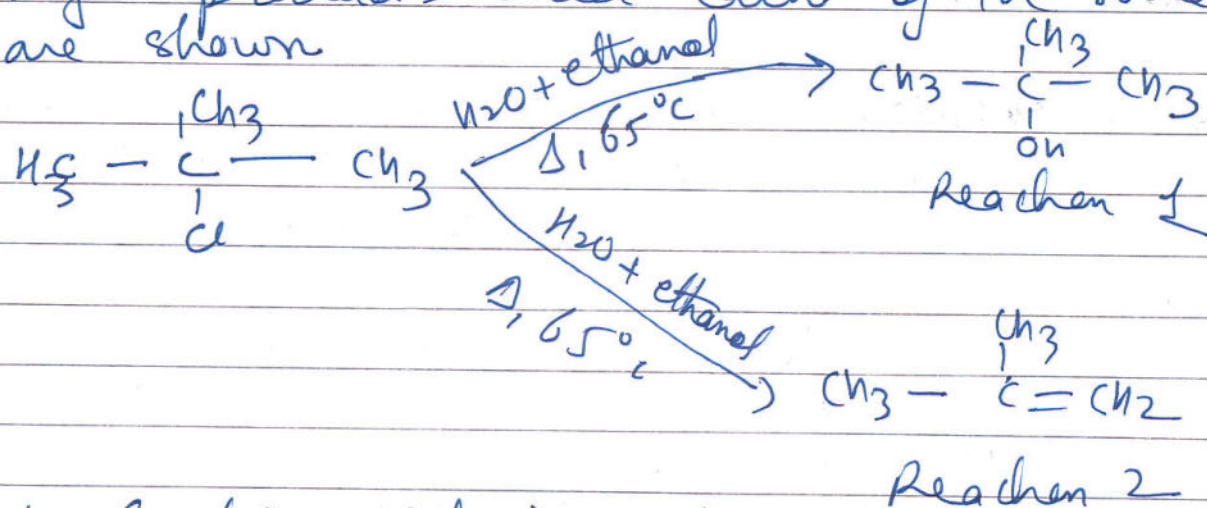
(1)

26. Identify suitable reagents for the following:

(3)

Exp.	Compound	Product
A	Propan-1-ol	Propanoic acid
B	Acetone	Propan-2-ol
C	Butan-2-ol	Butan-2-one
D	Ethanol	Acetaldehyde
E	Propan-2-ol	Propene
F	Phenol	Picric Acid

27. The image below shows two competing routes or reactions when a haloalkane reacts with water in the presence of alcohol. The major products under each of the route are shown.

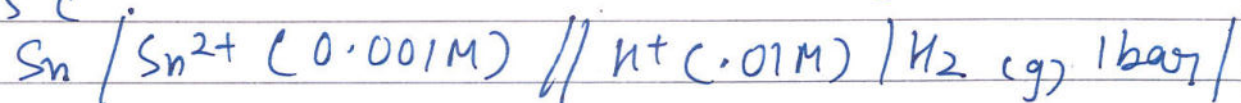


(i) Explain mechanism for both these reactions  
 (ii) Which out of the two reactions will

(1 1/2)  
(1 1/2)

predominate and why?

28. Calculate emf of the following cell at  $25^\circ\text{C}$  : (3)



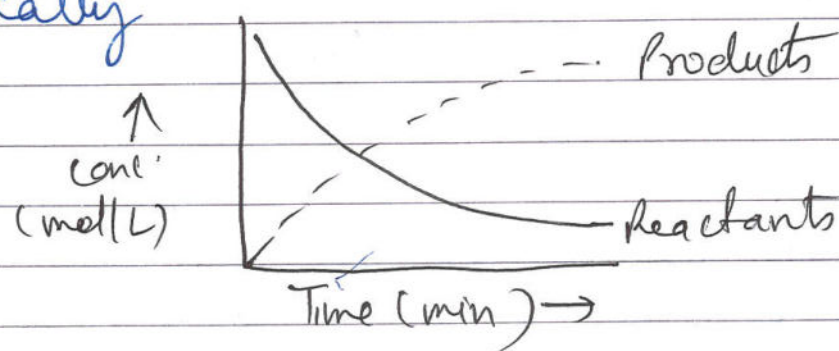
Given  $E^\circ_{(\text{Sn}^{2+}/\text{Sn})} = -0.14\text{V}$  Pt (s)

$$E^\circ_{(\text{H}^+/\text{H}_2)} = 0.00\text{V}, \log 10 = 1$$

### SECTION - I

The following questions are case-based questions. Each question has an internal choice and carries 4 (2+1+1) marks each. Read the passage carefully and answer the questions that follow.

29. As a chemical reaction proceeds, the concentrations of the reactants keep on decreasing while those of products keep on increasing, as shown graphically.



However, the rate of reaction is also found to decrease. This shows that the rate of reaction is directly related to the concentration of reactants. The effect of concentration on reaction rate was first studied by Guldberg and Waage in 1867 in the form of law of mass action. For a general reaction  $aA + bB \rightarrow \text{Products}$

$$\text{Rate} \propto [A]^a [B]^b \quad \text{or} \quad \text{Rate} = k[A]^a [B]^b$$

But experimentally rate of reaction depends only upon  $\alpha$  concentration of Reactant A &  $\beta$  concentration of Reactant B. Thus,

$$\text{Rate} \propto [A]^\alpha [B]^\beta \quad \text{or} \quad \text{Rate} = k[A]^\alpha [B]^\beta$$

- (i) In a reaction if the concentration of A is tripled, the rate of reaction becomes 27 times. What is the order of reaction? (1)
- (ii) For which type of reactions, order and molecularity have same values? (1)
- (iii) For a reaction  $A + B \rightarrow \text{products}$ , the rate law is  $\text{Rate} = k[A][B]^{3/2}$ . Can the reaction be an elementary reaction? (2)
- [OR]
- (iii) Why is the probability of reaction with molecularity higher than three very rare? (2)

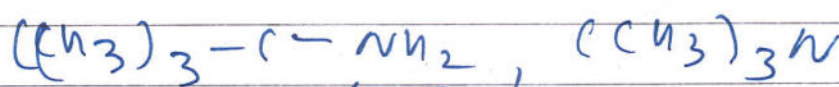
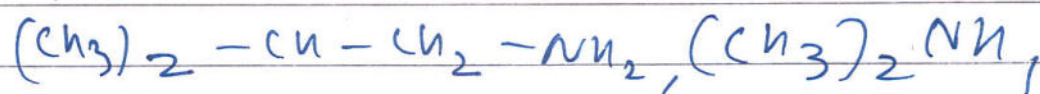
30. Amines are nitrogen containing compounds. They can be  $1^\circ$ ,  $2^\circ$ ,  $3^\circ$  or even  $4^\circ$ . Amines show isomerism. Amines can be prepared from nitro compounds, cyanides and amides using different reagents.

Ammonolysis is also a method of preparation of amines from RX. This method gives mixture of ~~alkyl~~ amines. Gabriel phthalimide reaction is useful to prepare  $1^\circ$  amines only.  $2^\circ/3^\circ$  & aryl amines can't be prepared by this method.

(i) Why only  $1^\circ$  aliphatic amines can be prepared by Gabriel phthalimide reaction but not aromatic amines? (1)

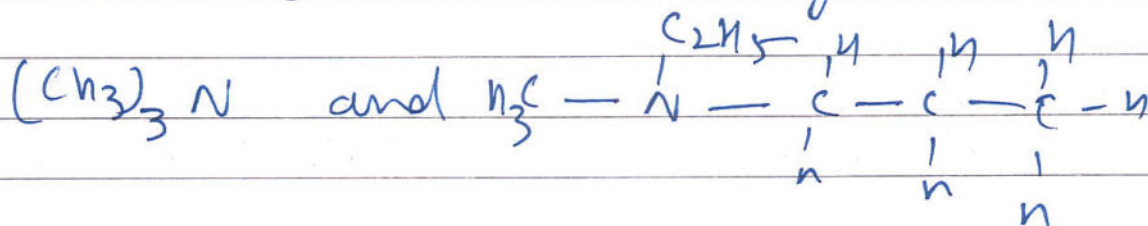
(ii) Ammonolysis is not considered to be a good method to prepare amines. Why? (1)

(iii) Select  $2^\circ$  amines from the following. (2)



OR

Write IUPAC name of



(2)

## SECTION - F

The following questions are long answer types and carry 5 marks each. All questions have an internal choice.

31. Answer the following questions:

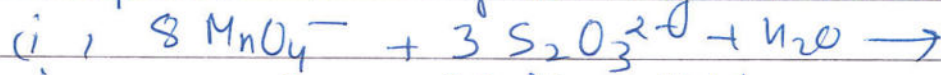
(a) Write the ionic equation for reaction of KI with acidified  $\text{KMnO}_4$ . (1)

(b) When chromite ore,  $\text{FeCr}_2\text{O}_4$  is fused with  $\text{NaOH}$  in the presence of air, a yellow coloured compound (A) is obtained which on acidification with dilute  $\text{H}_2\text{SO}_4$  gives a compound (B). Compound (B) on reaction with  $\text{KCl}$  forms an orange coloured crystalline compound (C).

(i) Write the formulae of compounds A, B and C. (1/2)

(ii) Write one use of compound (C). (1/2)

(c) Complete the following chemical equation:



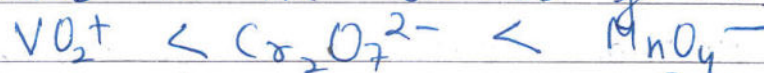
OR

31. (a) How would you account for the following?

(i) The highest oxidation state of a transition metal is usually exhibited in its oxide. (1)



(ii) The oxidising power of the following three oxo-ions in the series follows the order: (1)

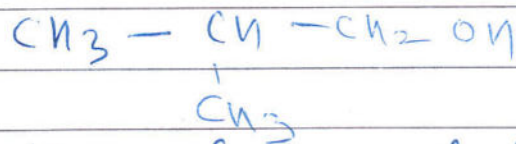


(b) For the complex  $[\text{Fe}(\text{en})_2\text{Cl}_2]\text{Cl}$ , identify (1/2 x 6)

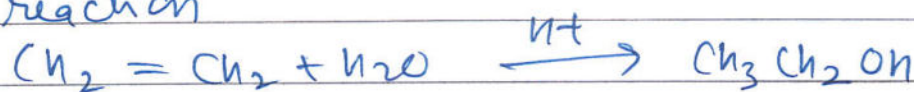
the following:

- (i) oxidation number of iron
- (ii) Hybrid orbitals and shape of the complex
- (iii) Magnetic behaviour of the complex
- (iv) Number of its geometrical isomers
- (v) Whether there may be optical isomer also
- (vi) Name the complex

32. (a) Show how will you synthesize the following alcohol by the reaction of a suitable Grignard's reagent on methanal? (2)



(b) Write the mechanism of the following reaction (3)



OR

(a) How will you convert (2)

- (i) Benzyl chloride to Benzyl alcohol
- (ii) Phenol to *o*-hydroxy benzaldehyde

- (b) Williamson's process is used for the preparation of ethers from alkyl halide. Identify the alkyl bromide and sodium alkoxide used for preparation of 2-ethoxy-3-methylpentane. (1)
- (c) tert-butyl chloride on heating with sodium methoxide gives 2-methylpropene instead of tert-butyl methyl ether. Why? (1)
- (d) Write a chemical test to distinguish between (i) 1-propanol and (ii) propan-2-ol. (1)

33. (A) 10% solution (by mass) of sucrose in water has a freezing point of 269.15 K. Calculate the freezing point of 10% glucose in water if the freezing point of pure water is 273.15 K. (Given: Molar mass of sucrose = 342 g mol<sup>-1</sup> and molar mass of glucose = 180 g mol<sup>-1</sup>) (3)

- (b) Define reverse osmosis. (1)
- (c) Why are aquatic species more comfortable in cold water in comparison to warm water? (1)

OR

33. (B) Give reasons

- (i) Mixture of ethanol and acetone shows positive deviation from Raoult's law (1)



(ii) A solution containing non-volatile solute have higher boiling point than pure solvent (1)

(b) Calculate the mass of  $\text{CaCl}_2$  (Molar mass =  $111 \text{ g/mol}$ ) to be dissolved in  $500 \text{ g}$  of water to lower its freezing point by  $2 \text{ K}$ , assuming that  $\text{CaCl}_2$  undergoes complete dissociation ( $K_f$  for water =  $1.86 \text{ K kg mol}^{-1}$ ) (3)

MODEL BOARD QUESTION PAPER

Page No	
Date	

CHEMISTRY

CLASS - XII

Mm = 70

General Instructions :

- There are 33 questions in this question paper with internal choice.
- Section A consists of 16 multiple choice questions carrying 1 mark each.
- Section B consists of 5 short answer questions carrying 2 marks each.
- Section C consists of 7 short answer questions carrying 3 marks each.
- Section D consists of 2 case based questions carrying 4 marks each.
- Section E consists of 3 long answer questions carrying 5 marks each.
- All questions are compulsory.

Section - A

Q1. In which of the following oxometal anions does the metal NOT exhibit an oxidation state equal to its group number ?

- a.  $\text{CrO}_4^{2-}$       b.  $\text{MnO}_4^-$       c.  $\text{Cr}_2\text{O}_7^{2-}$       d.  $\text{MnO}_4^{2-}$

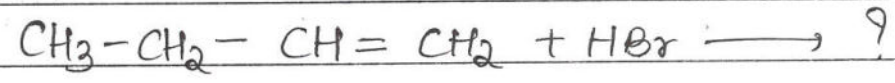
Q2. Given below are four haloalkane compounds  
tert-bromobutane, tert-iodobutane, iodobutane,  
bromobutane.

Which of them would be the most easily undergo  $\text{S}_\text{N}1$  and  $\text{S}_\text{N}2$  reactions ?

Option	SN <sup>1</sup> reaction	SN <sup>2</sup> reaction
P	tert-iodobutane	iodobutane
Q	tert-bromobutane	bromobutane
R	iodobutane	tert-iodobutane
S	bromobutane	tert-bromobutane

a) P      b) Q      c) R      d) S

Q3. Which of the following will be the major product formed in the reaction below?



- a)  $\text{CH}_3\text{CH}_2\text{-CH}_2\text{-CH}_2\text{Br}$       b)  $\text{CH}_3\text{-CH}_2\text{-CHBr-CH}_3$   
 c)  $\text{CH}_3\text{-CHBr-CH=CH}_2$       d)  $\text{CH}_3\text{-CH=CH-CH}_2\text{Br}$

Q4. Benzene sulphonyl chloride is a chemical which can be used to identify the class of an amine. When an amine 'A' reacts with benzene sulphonyl chloride it gives precipitate of sulphonamides which is soluble in alkali. The amine A is:

- a) N-Ethylethanamine      b) N,N-diethylethanamine  
 c) Ethanamine      d) N-methylbenzenamine

Q5. If the rate of a reaction  $2\text{A} + \text{B} \rightarrow \text{C} + 2\text{D}$  is  $k[\text{A}]^0[\text{B}]$ . By what factor will the rate of reaction increase if the concentration of A increases by a factor of 2 and that of B increases by a factor of 3.

a. 5      b. 6      c. 2      d. 3

Q6. A carbonyl compound 'X' undergoes the reactions given in the table below.

Reaction	Result
Tollen's test	+ve
Iodoform test	+ve
Aldol condensation	forms aldol product.

Which of the following could compound X be?

a. Propanal      b. propanone      c. ethanal  
d. methanal.

Q7. Which one of the following sets correctly represents the increase in the paramagnetic property of the ions?

- a)  $Ti^{3+} < Fe^{2+} < Cr^{3+} < Mn^{2+}$   
 b)  $Ti^{3+} < Mn^{2+} < Fe^{2+} < Cr^{3+}$   
 c)  $Mn^{2+} < Fe^{2+} < Cr^{3+} < Ti^{3+}$   
 d)  $Ti^{3+} < Cr^{3+} < Fe^{2+} < Mn^{2+}$

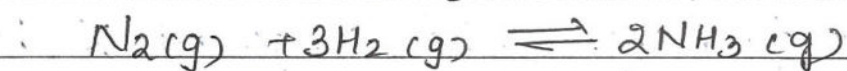
Q8. The product of hydrolysis of lactose are :-

- a)  $\beta$ -D Galactose and  $\beta$ -D Glucose  
 b)  $\alpha$ -D Glucose and  $\beta$ -D fructose  
 c)  $\alpha$ -D Glucose and  $\alpha$ -D Galactose  
 d) 2 units of  $\alpha$ -D Glucose.

Q9  $[M(AA)_2X_2]$  is a type of a coordination compound in which  $M$  = metal ion,  $AA$  = symmetrical bidentate ligand,  $X$  = monodentate ligand. Which of the following isomerism does this compound exhibit?

- a) Only Geometrical isomerism      b) only optical isomerism  
 c) Both geometrical and optical isomerism  
 d) Coordination isomerism.

Q10. For the chemical reaction:



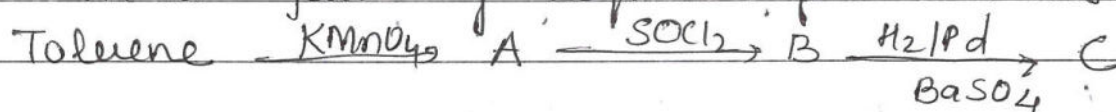
the correct equation is

- a)  $3 \frac{d[H_2]}{dt} = 2 \frac{d[NH_3]}{dt}$       b)  $-\frac{1}{3} \frac{d[H_2]}{dt} = -\frac{1}{2} \frac{d[NH_3]}{dt}$   
 c)  $-\frac{d[N_2]}{dt} = 2 \frac{d[NH_3]}{dt}$       d)  $-\frac{d[N_2]}{dt} = +\frac{1}{2} \frac{d[NH_3]}{dt}$

Q11. Which of the following is the correct order of methyl substituted amines in aqueous solution?

- a)  $CH_3NH_2 > (CH_3)_2NH > (CH_3)_3N$   
 b)  $(CH_3)_2NH > CH_3NH_2 > (CH_3)_3N$   
 c)  $(CH_3)_3N > CH_3NH_2 > (CH_3)_2NH$   
 d)  $(CH_3)_3N > (CH_3)_2NH > CH_3NH_2$

Q12. In the following sequence of reactions:



The product  $C$  is

- a)  $C_6H_5CH_2OH$       b)  $C_6H_5CHO$   
 c)  $C_6H_5COOH$       d)  $C_6H_5CH_3$

Q13. Assertion: Both  $[\text{Ni}(\text{CO})_4]$  and  $[\text{NiCl}_4]^{2-}$  are tetrahedral complexes.

Reason: Both CO and Cl are weak field ligands.

Q14. Assertion: For weak electrolytes, degree of molar conductivity shows a sharp increase when the electrolytic solution is diluted.

Reason: For weak electrolytes, degree of dissociation increases with dilution of solution.

Q15. Assertion: Denaturation of protein does not change the primary structure of protein.

Reason: The bonding between the carbon and hydrogen atoms during denaturation of proteins remains intact.

Q16. Assertion: The half life for a zero order reaction is independent of the initial concentration of the reactant.

Reason: For a zero order reaction, rate is equal to rate constant.

For Question No. 13 to 16, select the most appropriate answer from the options given below:

A) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

B) Both Assertion and Reason are true, but Reason is not the correct explanation of Assertion.

C) Assertion is true but Reason is false.

D) Assertion is false but Reason is true.



SECTION - B

Q17. A 5% solution of  $\text{Na}_2\text{SO}_4 \cdot 10\text{H}_2\text{O}$  (MW=322) is isotonic with 2% solution of non-electrolytic, non volatile substance X. Find the molecular weight of X (2)

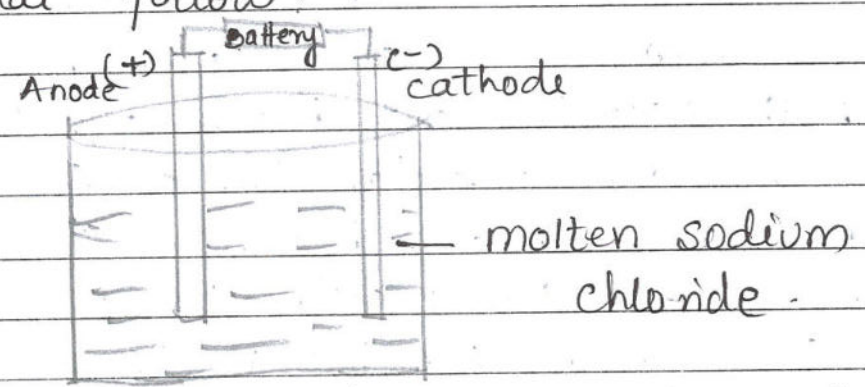
OR

Suman took two glasses of water from a water filter. She cools the one glass in a refrigerator and warms the the other glass of water on a stove.

Which glass of water will hold more dissolved oxygen? Explain using Henry's Law. (2)

Q18. A complex  $[\text{Co}(\text{A})_4\text{B}_2]\text{Br}$  is octahedral in shape. The oxidation state of Co is +3. When this complex is treated with  $\text{AgNO}_3$  it gives one mole yellow precipitate of  $\text{AgBr}$ . Based on the above information, what is the denticity and charge on the ligands A and B. Give reason for it. (2)

Q19. Look at the diagram and answer the questions that follow:



(i) what is the expected product at anode? Give the reaction occurring at anode.

(ii) state the law that governs this process  
(1+1)

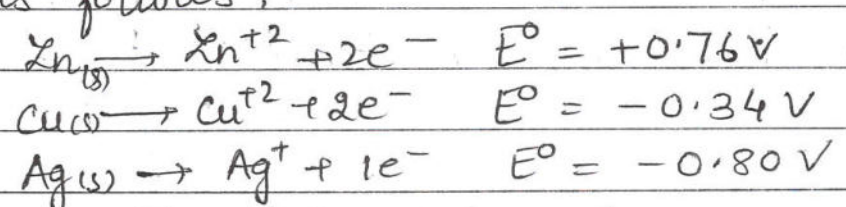
Q20. Write chemical equation for the following  
(any two) (1+1)

- (i) isobutyl chloride is treated with alcoholic KOH
- (ii) ethyl chloride is treated with ethanolic potassium cyanide.
- (iii) bromobenzene is treated with magnesium in presence of dry ether.

Q21. The two strands in DNA are not identical but are complementary. Explain. (2)

SECTION - C

Q22. In an experiment, the potential of Zinc, copper and silver half cells are found to be as follows:



Using the data given above,

- (i) write the correct cell representation of a cell with a cell potential equal to 0.46 V
- (ii) Calculate the value of standard Gibb's free energy change ( $\Delta G^\circ$ ) for the above cell. (1+2)

Q23. Account for the following (1+1+1)

- Transition metals have high enthalpy of atomization.
- Of the  $d^4$  species,  $Cr^{+2}$  is strongly reducing and manganese (III) is strongly oxidizing.
- The highest oxidation state is exhibited in oxoanions of a metal.

Q24 (i) Draw the structure of acetaldehyde dimethyl acetal

- How will you convert ethanal into But-2-enal
- Give a chemical test to distinguish between propanal and propanone.

(1+1+1)

OR

- Arrange the following compounds in increasing order of their property indicated.

$CH_3CH_2CH(Br)COOH$ ,  $(CH_3)_2CHCOOH$ ,  $CH_3CH_2CH_2COOH$ ,  
 $CH_3CH(Br)CH_2COOH$  (acidic strength)

- predict the product when cyclohexane carbaldehyde reacts with zinc amalgam and dil HCl.
- Convert Benzoic acid to Benzaldehyde.

Q25 (i) Differentiate between Keratin and Insulin

- How many peptide linkages are present in a tripeptide?
- Write one structural difference between DNA and RNA.

(1+1+1)

Q26. (i) Phenol reacts with dil  $\text{HNO}_3$  at low temp. The products are separated in two beakers. Rahul and Aditya recorded the boiling point of the compounds as below:

Rahul's reading

Beaker - 1	Boiling pt - 489 K
Beaker - 2	Boiling pt - 387 K

Aditya's reading

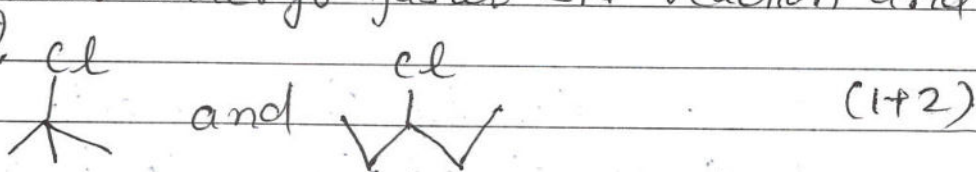
Beaker - 1	Boiling pt - 387 K
Beaker - 2	Boiling pt - 489 K

If beaker 1 contains p-nitrophenol and beaker-2 contains o-nitrophenol, identify the student whose data collection is correct. Give reason for your answer.

(ii) To prepare n-propyl ethyl ether, write the suitable reagents by Williamson synthesis. (2+1=03)

Q27 (i) Among the isomeric alkanes of molecular formula  $\text{C}_5\text{H}_{12}$ , identify the one that on photochemical chlorination yields a single monochloride.

(ii) In the given pair of halogen compounds, which will undergo faster  $\text{S}_\text{N}1$  reaction and why?



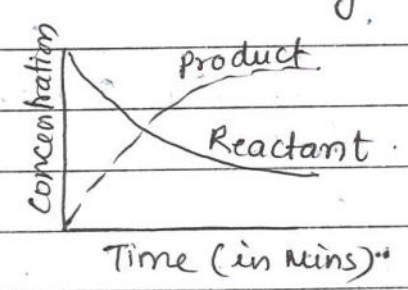
Q28 (i) Conductivity of 0.00241 M acetic acid is  $7.896 \times 10^{-5} \text{ S cm}^{-1}$ . Calculate its molar

conductivity and if  $\Lambda_m^\circ$  for acetic acid is  $390.5 \text{ Scm}^2 \text{ mol}^{-1}$ , what is its degree of dissociation

(ii) Unlike dry cell, mercury cell has a constant cell potential throughout its life. Why? (2+1)

SECTION-D

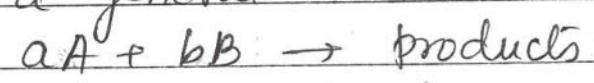
Q29. As a chemical reaction proceeds, the concentration of the reactants keeps on decreasing while those of the products keeps on increasing as shown graphically.



The effect of concentration on the rate of reaction was studied by Guldberg and Waage.

They put forward Law of mass action. However experimentally, it is observed that rate of reaction may not depend on all concentration terms of reactants.

for a general reaction



we may write rate law as:

$$\text{rate} = k[A]^{\alpha}[B]^{\beta}$$

where  $\alpha + \beta$  is called order of reaction

k is the rate constant.

(i) In the reaction if the concentration of reactant A is tripled. The rate becomes 27 times. what is the order of the reaction?

(ii) for a reaction  $A+B \rightarrow \text{products}$ , rate law is  $r = k[A][B]^{3/2}$ . what is the unit of rate constant for this?

(iii) Why is the probability of reaction with high molecularity are very rare?  
 OR

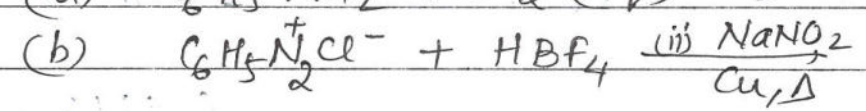
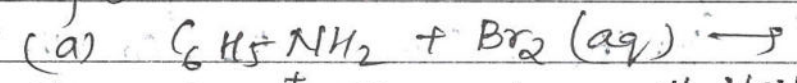
(iii) Show that for a first order reaction, rate constant is independent of concentration of the reactants. (1+1+2)

Q30. Amines are usually formed from nitro compounds, halides, amides etc. They exhibit hydrogen bonding which influence their physical properties. In alkyl amines, a combination of electron releasing, steric and hydrogen bonding factors influence the basic nature of amines. In Aniline,  $\text{NH}_2$  group is o, p directing and a powerful activating group. Aniline undergoes bromination, nitration and sulphonation. It reacts with nitrous acid and HCl to give diazonium salt. Diazonium salt is very useful in daily life as it gives lots of products when combining with different reagents. Aniline is less basic than aliphatic amines.

(i) Aniline on nitration gives a substantial amount of m-nitroaniline though amino group is ortho and p-directing. Why?

(ii) Draw the zwitter ion structure of sulphamic acid.

(iii) Complete the reaction and write the main products



OR

Convert (i) aniline to p-bromo aniline

(ii) aniline to phenol.

(1+1+2)

SECTION-E

Q31(i) When  $\text{AgNO}_3$  is added into the solution of a coordination compound  $\text{PdCl}_2 \cdot 4\text{NH}_3$ , it produces 2 moles of  $\text{AgCl}$  precipitate. On the basis of the information above, designate the following.

(a) Coordination number of central metal ion.

(b) Oxidation number of Palladium.

(ii) Out of  $[\text{Fe}(\text{CN})_6]^{4-}$  and  $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$

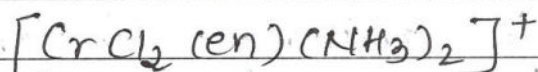
which is an outer orbital complex and which is an inner orbital complex?

What type of hybridization is involved in each case and compare their magnetic behaviour.

(2+3)

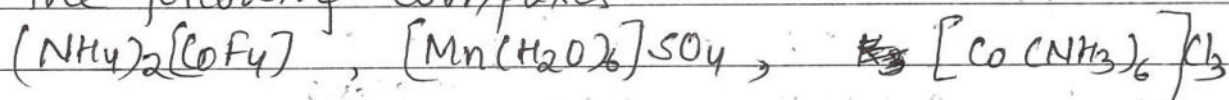
OR

(i) Write the IUPAC name of the complex



(ii) Why CO is a stronger ligand than  $\text{NH}_3$  for many metals?

(iii) Give the oxidation state and d-orbital occupation (as per crystal field theory) in the following complexes.

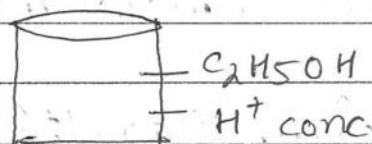


(1+1+3)

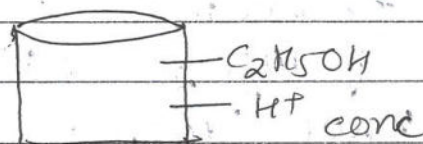
Q32. A) Identify suitable reagents for the following

Experiment	Compound	Reagent/catalyst	Product
A	propan-1-ol		propanoic acid
B	Acetone		propan-2-ol
C	ethanol		acetaldehyde
D	phenol		picric acid

B) Experiment I Experiment II



Temperature - 443K



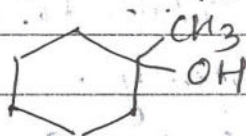
Temperature - 413K

Write products of experiment 1 and 2. Among these which experiment have C-C bond length minimum?

C) Out of formic acid and ethanoic acid which will give Hell-Volhard Zelinsky reaction and why? (2+2+1)

OR

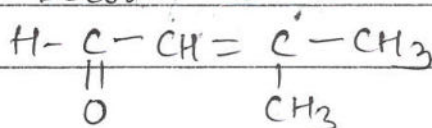
A) Show how would you synthesize the given alcohols from appropriate alkenes?



B) Write the names of reagents and equations for the preparation of the given ether by Williamson synthesis

2-methyl-2-methoxypropane.

C) One of the products of an aldol condensation is given below





write the name and structure of the reactants used.

(1+2+2)

Q33. A) Calculate the boiling point elevation for a solution prepared by adding 10 g of  $MgCl_2$  to 200 g of water assuming  $MgCl_2$  is completely dissociated.

$K_b$  for water =  $0.512 \text{ K kg mol}^{-1}$ , molar mass of  $MgCl_2 = 95 \text{ g mol}^{-1}$ .

B) What type of deviation from Raoult's Law is shown by ethanol and acetone mixture? Give reason.

(3+2)

OR

A) Ravi's automobile radiator is filled with 1.0 kg of water. How many grams of ethylene glycol (molar mass =  $62 \text{ g mol}^{-1}$ ) must Ravi add to get the freezing point of solution lowered to  $-2.8^\circ\text{C}$ .  $K_f$  for water is  $1.86 \text{ K kg mol}^{-1}$ .

B) Account for the following.

- (i) People living at high altitude feel weak and unable to think properly.
- (ii) A solution of chlorobenzene and bromobenzene behave as ideal solution.

MODEL QUESTION PAPER.

CLASS: XII

SUBJECT: CHEMISTRY

TIME: 3 Hrs

MM: 70

General Instructions:

- (i) This question paper contains 33 questions. All questions are compulsory.
- (ii) This question paper is divided into five sections - Section A, B, C, D and E.
- (iii) Section A - questions number 1 to 16 are multiple choice type questions. Each question carries 1 mark.
- (iv) Section B - questions number 17 to 21 are very short answer type questions. Each question carries 2 marks.
- (v) Section C - questions number 22 to 28 are short answer type questions. Each question carries 3 marks.
- (vi) Section D - questions number 29 and 30 are case-based questions. Each question carries 4 marks.
- (vii) Section E - questions number 31 to 33 are long answer type questions. Each question carries 5 marks.
- (viii) There is no overall choice given in the question paper. However, an internal choice has been provided in few questions in all the sections except Section A.
- (ix) Use of calculators is not allowed.

SECTION A

Questions no. 1 to 16 are Multiple Choice type Questions, carrying one mark each.  $16 \times 1 = 16$

1. Arrange the following in the increasing order of their boiling points:

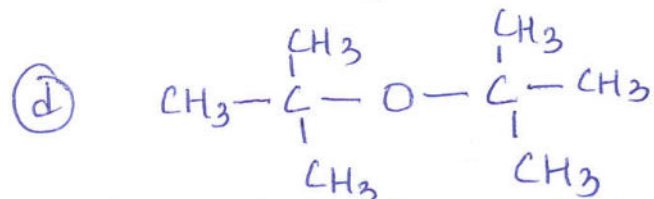
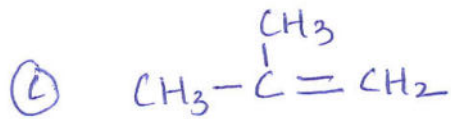
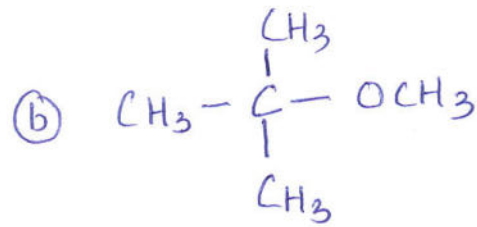
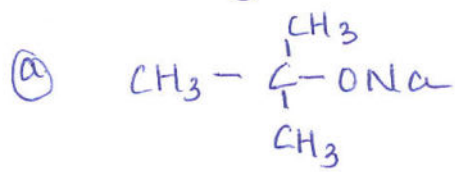
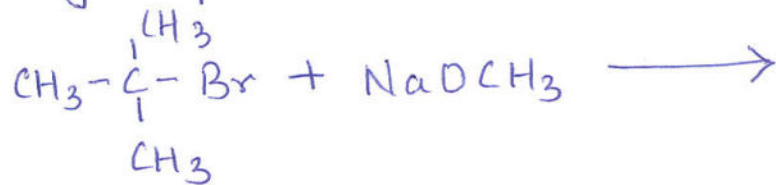
A: Butanamine      B: N,N-Dimethylethanamine

C: N-Ethylethanamine

(a)  $C < B < A$       (b)  $A < B < C$       (c)  $A < C < B$

(d)  $B < C < A$ .

2. Major product formed in the following reaction:



3. Which of the following characteristics of transition metals is associated with their catalytic activity?

(a) Variable oxidation states

(b) Paramagnetic nature

(c) Colour of hydrated ions

(d) High enthalpy of atomisation

4. The addition of catalyst during a chemical reaction alters which of the following quantities of the reaction?

(a) Enthalpy

(b) Activation energy

(c) Entropy

(d) Internal energy

5. Which of the following tests/reactions is given by aldehydes as well as ketones?

(a) Fehling's test

(b) Tollen's test

(c) 2,4-DNP test

(d) Cannizzaro reaction

6. The relative lowering of vapour pressure of an aqueous solution containing non-volatile solute is 0.0225. The mole-fraction of the non-volatile solute is:

(a) 0.80

(b) 0.7225

(c) 0.15

(d) 0.0225

7. Which of the following cell is used in inverter?

(a) Fuel cell

(b) Mercury cell

(c) Lead storage cell

(d) Dry cell

8. Transition metals are known to make interstitial compounds. Formation of interstitial compounds makes the transition metal:

- (a) more hard (b) more soft (c) more ductile (d) more metallic

9. The coordination number of cobalt in the complex  $[\text{Co}(\text{en})_3]^{3+}$  is:

- (a) 3 (b) 6 (c) 4 (d) 5

10. An  $\alpha$ -helix is a structural feature of:

- (a) sucrose (b) polypeptides (c) nucleotides (d) Starch

11. Which of the following ligand form chelate complex?

- (a)  $\text{C}_2\text{O}_4^{2-}$  (b)  $\text{Cl}^-$  (c)  $\text{NO}_2^-$  (d)  $\text{NH}_3$

12. The oxidation of toluene to benzaldehyde by chromyl chloride is called

- (a) Etard reaction (b) Reimer-Tiemann reaction  
(c) Stephen's reaction (d) Cannizzaro's reaction

For Questions number 13 to 16, two statements are given - one labelled as Assertion (A) and the other labelled as Reason (R). Select the correct answer to these questions from the codes (A), (B), (C) and (D) as given below.

(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A)

(B) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A)

(C) Assertion (A) is true, but Reason (R) is false.

(D) Assertion (A) is false, but Reason (R) is true.

13. Assertion (A): The boiling point of 0.1M urea solution is less than 0.1M KCl solution

Reason (R): Elevation of boiling point is directly proportional to the number of species present in the solution.

14. Assertion (A): Order of reaction is applicable to elementary as well as complex reaction.

Reason (R): For a complex reaction molecularity has no meaning.

15. Assertion (A): Phenols are stronger acids than alcohols.

Reason (R): Alkoxide ion is more stable than phenoxide.

16. Assertion (A): Diazonium salts of aromatic amines are more stable than those of aliphatic amines.

Reason (R): Diazonium salts of aliphatic amines show resonance.

### SECTION-B

17. Why does a solution containing non-volatile solute have higher boiling point than the pure solvent? What type of deviation from Raoult's law is shown by a mixture of ethanol and acetone? (1+1=2)

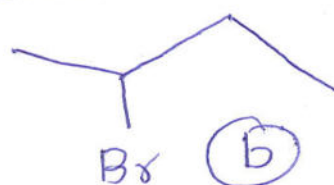
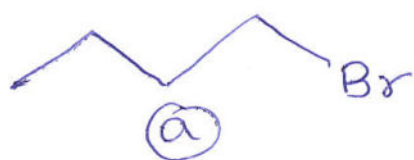
18. For the reaction  $2\text{N}_2\text{O}_5(\text{g}) \rightarrow 4\text{NO}_2(\text{g}) + \text{O}_2(\text{g})$  the rate of formation of  $\text{NO}_2(\text{g})$  is  $2.8 \times 10^{-3} \text{ M s}^{-1}$ . Calculate the rate of disappearance of  $\text{N}_2\text{O}_5$  (2)

OR

Show that in case of a first order reaction, the time taken for completion of 99% reaction is twice the time required for 90% completion of the reaction ( $\log 10 = 1$ ) (2)

19. When  $\text{FeCr}_2\text{O}_4$  is fused with  $\text{Na}_2\text{CO}_3$  in the presence of air it gives a yellow solution of compound (A). Compound (A) on acidification gives compound (B). Compound (B) on reaction with  $\text{KCl}$  forms an orange coloured (C). An acidified solution of compound (C) oxidises  $\text{Na}_2\text{SO}_3$  to D. Identify A, B, C and D. ( $\frac{1}{2} \times 4 = 2$ )

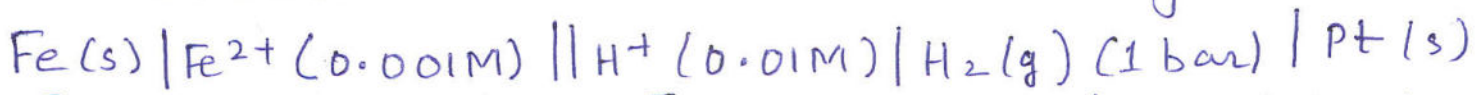
20. (1) Which alkyl halide from the following pair is chiral and undergoes faster  $\text{S}_\text{N}2$  reaction?



- 11) Out of  $S_N1$  and  $S_N2$ , which reaction occurs with  
 (a) Inversion of configuration (b) Racemisation. (1+1=2) <sup>3</sup>
- 12) Write the reaction involved when D-glucose is treated with the following reagents: (1+1=2)
- i) HCN ii) Bromine water

### SECTION-C

22. Calculate the emf of the following cell at 298K.



Given  $E^\circ_{\text{cell}} = +0.44\text{V}$  [  $\log 2 = 0.3010$ ,  $\log 3 = 0.4771$  ]  
 $\log 10 = 1$  ] (3)

OR

The conductivity of 0.001 mol L<sup>-1</sup> solution of CH<sub>3</sub>COOH is  $3.905 \times 10^{-5} \text{ S cm}^{-1}$ . Calculate its molar conductivity and degree of dissociation ( $\alpha$ ). [ Given  $\lambda^\circ_{\text{H}^+} = 349.6 \text{ S cm}^2 \text{ mol}^{-1}$   $\lambda^\circ_{\text{CH}_3\text{COO}^-} = 40.9 \text{ S cm}^2 \text{ mol}^{-1}$  ] (3)  
 (1x3=3)

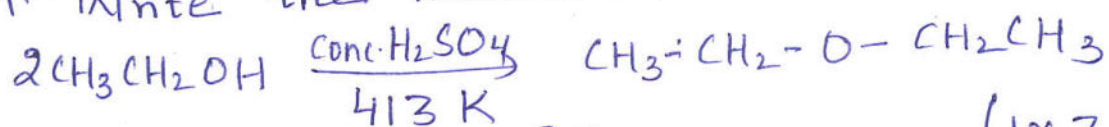
23. Give reason :

(a) p-dichlorobenzene has higher melting point than those of o- and m-isomers.

(b) Butan-1-ol is optically inactive but butan-2-ol is optically active.

(c) n-Butyl bromide has higher boiling point than tert-butyl bromide

24. Write the mechanism of the following reaction: (3)



25. Convert the following: (1x3=3)

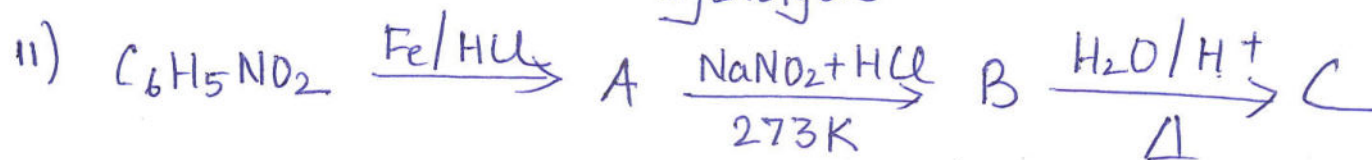
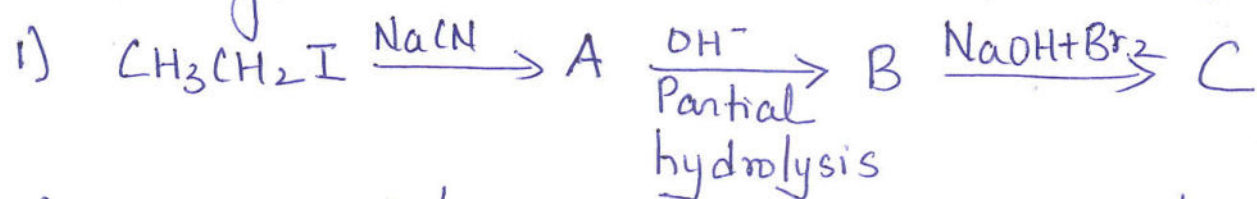
(a) Benzoic acid to Benzaldehyde

(b) Propanone to Propene

(c) Ethanal to 3-hydroxy butanal

26. The rate constant of a reaction quadruples when the temperature changes from 300K to 320K. Calculate the activation energy for this reaction [  $\log 2 = 0.3010$   $\log 4 = 0.60$  ]

27) Give the structures of A, B and C in the following reactions:  $(2 \times 1\frac{1}{2} = 3)$



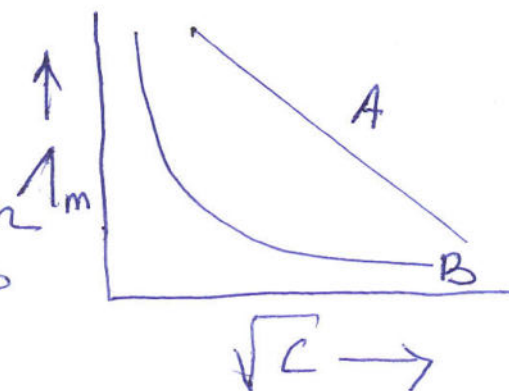
28. In the plot of molar conductivity ( $\Lambda_m$ ) Vs square root of concentration ( $C^{1/2}$ ), following curves are obtained for two electrolytes A and B.

(a) Answer the following:

i) Predict the nature of electrolytes A and B.

ii) What happens on extrapolation of  $\Lambda_m$  to concentration zero for electrolytes A and B.

(b) State Kohlrausch's law.



### SECTION-D

The following questions are case-based questions. Read the case carefully and answer the questions that follow

29. The sequence of bases along the DNA and RNA chain establishes its primary structure which controls the specific properties of the nucleic acid. RNA molecule is usually a single chain of ribose-containing nucleotide. On the basis of X-ray analysis of DNA, J.D. Watson and F.H.C. Crick (shared noble prize in 1962) proposed a three dimensional secondary structure for DNA. DNA molecule is a long and highly complex, spirally twisted, double helix, ladder like structure. The two polynucleotide chains or strands are linked up by hydrogen bonding between the nitrogenous base molecules of their nucleotide monomers. Adenine (purine) always links with thymine (pyrimidine) with the help of two hydrogen bonds and guanine (purine) with cytosine (pyrimidine) with the help of three hydrogen bonds. Hence, the two

strands extend in opposite directions, i.e. are <sup>(4)</sup> antiparallel and complementary.

(i) Name the base that is found in nucleotide of RNA only.

(ii) Write the main structural differences between DNA and RNA.

(iii) Name the bases present in RNA. Which one of these is not present in DNA?

Write the main <sup>OR</sup> functional differences between DNA and RNA. Of the four bases, name those which are common to both DNA and RNA.

30. Within the 3d-series, manganese exhibits oxidation states in aqueous solution from +2 to +7, ranging from  $Mn^{2+}(aq)$  to  $MnO_4^-(aq)$ . Likewise, iron forms both  $Fe^{2+}(aq)$  and  $Fe^{3+}(aq)$  as well as the  $FeO_4^{2-}$  ion. Cr and Mn form oxyanions  $CrO_4^{2-}$ ,  $MnO_4^-$ , owing to their willingness to form multiple bonds. The pattern with the early transition metals - in the 3d series up to Mn, and for the 4d, 5d metals up to Ru and Os - is that the maximum oxidation state corresponds to the number of 'outer shell' electrons. The highest oxidation states of the 3d-metals may depend upon complex formation (e.g. the stabilization of  $Co^{3+}$  by ammonia) or upon the pH (thus  $MnO_4^{2-}(aq)$  is prone to disproportionation in acidic solution).

Within the 3d-series, there is considerable variation in relative stability of oxidation states, sometimes on moving from one metal to a neighbour; thus, for iron,  $Fe^{3+}$  is more stable than  $Fe^{2+}$ , especially in alkaline conditions, while the reverse is true for cobalt. The ability of transition metals to exhibit a wide range of oxidation states is marked with metals such as vanadium, where the standard potentials can be rather small, making a switch between states relatively easy.

(i) What is the oxidation state of iron in ferric?

(ii) Which is more stable  $Fe^{2+}$  or  $Fe^{3+}$ ?

(iii) Why is the maximum oxidation state of chromium in its compounds +6?



OR

Vanadium had the ability to exhibit a wide range of oxidation states. Explain why?

SECTION-E

31 (a) Identify which liquid will have a higher vapour pressure at  $90^{\circ}\text{C}$  if the boiling points of two liquids A and B are  $140^{\circ}\text{C}$  and  $180^{\circ}\text{C}$ , respectively.

(b) Blood cells are isotonic with 0.9% sodium chloride solution. What happens if we place blood cells in a solution containing:

(i) 1.2% sodium chloride solution?

(ii) 0.4% sodium chloride solution?

(c) 3.9 g of benzoic acid dissolved in 49 g of benzene shows a depression in freezing point of  $1.62\text{K}$ . Calculate the van't Hoff factor and predict the nature of solute (associated or dissociated) [Given molar mass of benzoic acid =  $122\text{g mol}^{-1}$  ( $1+2+2=5$ )]

OR

(a) (i) Gas (A) is more soluble in water than Gas (B) at the same temperature. Which one of the two gases, will have the higher value of  $K_H$  (Henry's constant) and why?

(ii) In non-ideal solution, what type of deviation shows the formation of maximum boiling azeotropes?

(b) Determine the osmotic pressure of a solution prepared by dissolving  $2.5 \times 10^{-2}\text{g}$  of  $\text{K}_2\text{SO}_4$  in 2L of water at  $25^{\circ}\text{C}$ , assuming that it is completely dissociated [R =  $0.0821\text{ L atm K}^{-1}\text{ mol}^{-1}$ , Molar mass of  $\text{K}_2\text{SO}_4 = 174\text{g mol}^{-1}$ ]

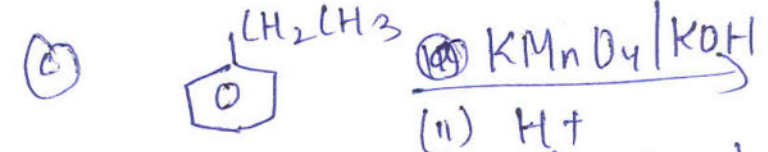
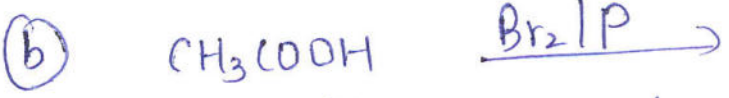
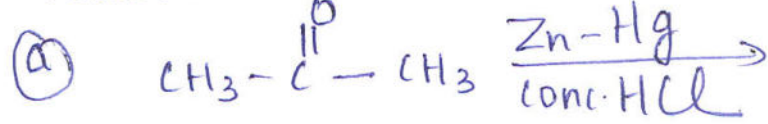
32 When a co-ordination compound  $\text{CoCl}_3 \cdot 4\text{NH}_3$  is mixed with  $\text{AgNO}_3$ , 1 mole of  $\text{AgCl}$  is precipitated per mole of the compound. Write

- 1) Structural formulae of the complex.  
 II) IUPAC name of the complex.
- (b) Using valence bond theory, predict the hybridization and magnetic character of the complex  $[\text{Ni}(\text{CO})_4]$  (Atomic no Ni = 28)
- (c) What type of isomerism is shown by the complex  $[\text{Co}(\text{NH}_3)_5\text{SO}_4]\text{Br}$ ? (2+2+1=5)

OR

- (a) Give reason:
- (i)  $\text{Co}^{2+}$  is easily oxidised to  $\text{Co}^{3+}$  in presence of a strong ligand.
- (ii)  $\text{CO}$  is a stronger complexing reagent than  $\text{NH}_3$ .
- (iii) The molecular shape of  $[\text{Ni}(\text{CO})_4]$  is not the same as that of  $[\text{Ni}(\text{CN})_4]^{2-}$
- (b) On the basis of crystal field theory, write the electronic configuration for  $d^4$  ion, if  $\Delta_0 > P$ .
- (c) Draw the geometrical isomers of complex  $[\text{Pt}(\text{en})_2\text{Cl}_2]^{2+}$ . (3+1+1=5)

33. (i) Write the major product(s) in the following reactions:



- (ii) Give chemical test to distinguish between the following pair of compounds:
- (a) Phenol and benzoic acid
- (b) Acetophenone and ethyl benzoate (3+2=5)
- OR

- (i) Give reason:
- (a) Propanone is less reactive than ethanal towards addition of HCN

m<sup>th</sup>

- (b) Benzoic acid does not give Friedel-Crafts reaction.
- (14) Write the reaction involved in Wolff-Kishner reduction reaction.
- (iii) Arrange the following in increasing order of their property as indicated:  
2,4-dinitrobenzoic acid, 4-methoxy benzoic acid, 4-nitrobenzoic acid
- (iv) Name the reagent in the following reaction:

