COMMON PRE-BOARD EXAMINATION – 2023

CHEMISTRY THEORY (043)

MAX. MARKS:70 **CLASS: XII** **TIME: 3 HOURS**

GENERAL INSTRUCTIONS:

Read the following Instructions carefully:

- There are 35 questions in this question paper with internal choice.
- SECTION A consists of 18 multiple-choice questions carrying 1 mark each.
- SECTION B consists of 7 very short answer questions carrying 2 mark each.
- SECTION C consists of 5 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 type 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) Which of the following colligative property is used to calculate the molar mass of biomolecules? 1

A) Relative lowering of vapour pressure B) Osmotic pressure

C) Depression in freezing point D) Elevation in boiling point

2) During the rusting of iron 1

A) metal acts as cathode

B) hydrogen ion acts an anode

C) formula of rust is $Fe_3O_4.xH_2O$

D) the overall reaction is $2\ Fe + O_2 + 4\ H^+ \rightarrow 2\ Fe^{2+} + 2\ H_2O$

3) In which of the following compounds transition metal has zero oxidation state? 1

A) $KMnO_4$ B) $K_2Cr_2O_7$ C) $[Fe(CO)_5]$ D) CrO_5

4) What is the correct order of reactivity of alcohols in the following reaction? 1

$$R - OH + HCl \xrightarrow{ZnCl_2} R - Cl + H_2O$$

A) $1^0 > 2^0 > 3^0$ B) $1^0 < 2^0 > 3^0$

C) $3^0 > 2^0 > 1^0$ D) $3^0 > 1^0 > 2^0$

5) The correct IUPAC name of $[Pt(NH_3)_2Cl_2]$ is 1

A) diamminedichloridoplatinum(II)

B) diamminedichloridoplatinum(IV)

C) diamminedichloridoplatinum(0)

D) dichloridodiammineplatinum(IV)

6) Which of the following statements is not correct? 1

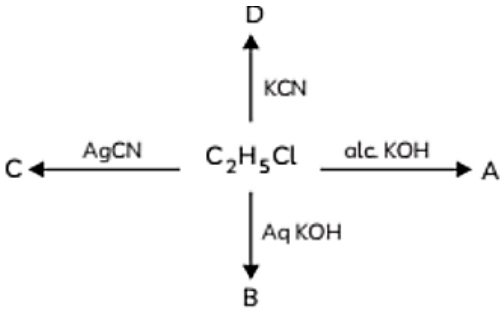
A) Copper liberates hydrogen from acids.

B) In its higher oxidation states, manganese forms stable compounds with oxygen and fluorine.

C) Mn^{3+} is an oxidizing agent in aqueous solution.

D) Cr^{2+} is a reducing agent in aqueous solution.

7) Identify A, B, C and D: 1



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

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

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

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

8) Curdling of milk is an example of 1

A) breaking of peptide linkage B) hydrolysis of lactose

C) breaking of protein into amino acids D) denaturation of protein

9) Due to the presence of ambidentate ligands coordination compounds show 1

isomerism. Palladium complexes of the type $[Pd(C_6H_5)_2(SCN)_2]$ and $[Pd(C_6H_5)_2(NCS)_2]$ are

A) linkage isomers B) coordination isomers

C) ionization isomers D) geometrical isomers

10) Which of the following compound will not give Cannizzaro's reaction? 1

A) CH_3CHO B) HCHO

C) C_6H_5CHO D) $(CH_3)_3CCHO$

11) Which of the following is not the reducing sugar from the following? 1

A) Fructose B) Maltose

C) Sucrose D) Lactose

12) The absorption maxima of several octahedral complex ions are as follows: 1

S.No	Compound	Λ_{max} nm
1	$[Co(NH_3)_6]^{3+}$	475
2	$[Co(CN)_6]^{3-}$	310
3	$[Co(H_2O)_6]^{3+}$	490

The crystal field splitting is maximum for

A) $[Co(H_2O)_6]^{3+}$ B) $[Co(CN)_6]^{3-}$

C) $[Co(NH_3)_6]^{3+}$ D) All the complex ions have the same splitting, Δo

13) Glucose is a/an 1

A) aldopentose B) ketohexose

C) aldohexose D) ketopentose

14) Which of the following carbohydrate is stored in the liver of animals? 1

A) Amylose B) Cellulose

C) Amylopectin D) Glycogen

15) Give below are two statements labelled as Assertion (A) and Reason (R) 1

Assertion (A): An ideal solution obeys Henry's law.

Reason (R): In an ideal solution, solute – solute as well as solvent – solvent interactions are similar to solute – solvent interactions.

Select the most appropriate answer from the options given below:

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.

16) Give below are two statements labelled as Assertion (A) and Reason (R) 1

Assertion (A): Oxalate ion is a bidentate ligand.

Reason (R): Oxalate ion has two donor atoms.

Select the most appropriate answer from the options given below:

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.

17) Give below are two statements labelled as Assertion (A) and Reason (R) 1

Assertion (A): 3^0 alkyl halides are most reactive towards S_N1 reaction.

Reason (R): In S_N1 reaction, the rate of the reaction depends only on the concentration of alkyl halide.

Select the most appropriate answer from the options given below:

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.

18) Give below are two statements labelled as Assertion (A) and Reason (R): 1

Assertion (A): Aldehydes and ketones, both react with Tollens' reagent to form silver mirror

Reason (R): Both aldehydes and ketones contain a carbonyl group.

Select the most appropriate answer from the options given below:

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.

SECTION B

This section contains 7 questions with internal choice in two questions. The following questions are very short answer type and carry 2 marks each.

19) Define the following terms: 2

a) Osmotic pressure

b) van't Hoff factor

20) Arrange the following in order of property indicated for each set. 2

i) CH_3CHO, CH_3CH_2OH, CH_3OCH_3, $CH_3CH_2CH_3$ (increasing order of boiling points)

ii) $(CH_3)_2CHCOOH$, $CH_3CH_2CH(Br)COOH$, $CH_3CH(Br)CH_2COOH$ (increasing order of their acid strengths)

OR

Give reasons:

a. Oxidation of propanal is easier than propanone.

b. Give a simple chemical test to distinguish between propanal and benzaldehyde.

21) i. Convert aniline to fluoro benzene. 2

ii. Explain the term Diazotisation.

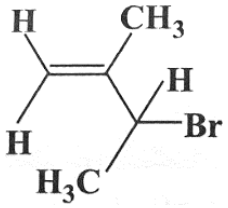
OR

Account for the following:

a) N-ethylethanamine boils at 329.3 K and butanamine boils at 350.8 K, although both are isomeric in nature.

b) Acylation of aniline is carried out in presence of pyridine.

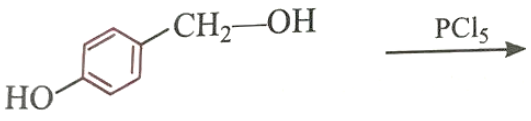
22) i. Write the IUPAC name of the following compound: 2



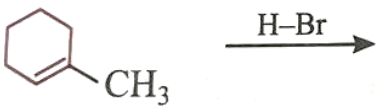
ii. Give any two uses of Carbon tetrachloride.

23) Write the major product(s) in the following reactions: 2

a)



b)



24) a) A reaction is of second order with respect to a reactant. How is the 2

rate of reaction affected if the concentration of the reactant is reduced to half?

b) Define the term Pseudo first order reaction.

25) Write the equations involved in the following reactions: 2

i) Rosenmund reduction reaction.

ii) Gatterman – Koch reaction.

SECTION C

This section contains 5 questions with internal choice in two questions. The following questions are short answer type and carry 3 marks each.

26) Write the cell representation and calculate the emf of the following cell: 3

$Mg(s) + 2Ag^{+}(1\times10^{-3}M) \rightarrow Mg^{2+}(0.2M) + 2Ag(s)$

Given: $E^0(Ag^+/Ag)$= 0.80 V, $E^0(Mg^{2+}/Mg)$= -2.37 V, log 10= 1, log 2=0.3010

27) Answer the following: 3

a) How does the colour change on heating $[Ti(H_2O)_6]^{3+}$ ion? Explain.

b) CO is a stronger complexing reagent than NH_3. Explain.

c) What is meant by crystal field splitting energy?

28) i. Name the reagent used in the following reaction: 3

$$C_6H_5—CH_2—CH_3 \xrightarrow{?} C_6H_5—COO^-K^+$$

ii. Draw the structure of the following:

a. 2,4 – dinitrophenylhydrazone of benzaldehyde

b. 4 – methylpent-3-en-2-one

29) Define **any three** of the following terms: 3

a) Glycosidic linkage

b) Invert sugar

c) Oligosaccharides

d) Vitamins

30) Determine the osmotic pressure of a solution prepared by dissolving 25 mg of K_2SO_4 in 2 litres of water at 25^0C, assuming it to be completely dissociated. (Atomic masses K = 39 u, S = 32 u, O = 16 u) 3

OR

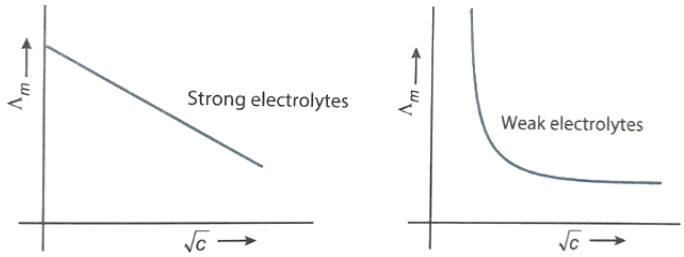
Calculate the freezing point of a solution containing 0.5 g KCl (Molar mass = 74.5 g/mol) dissolved in 100 g water, assuming KCl to be 92% ionized. K_f of

water = 1.86 K kg/mol.

SECTION D

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

31) The conductivity or specific conductance of an electrolytic solution varies with the concentration of the solutions of different electrolytes. For comparing the conductance of the solutions of different electrolytes, it is essential that the solution should have equal volumes and they must contain definite amount of the electrolytes which give ions carrying the same total charge. The conducting power of an electrolytic solution can be expressed in term of equivalent conductance and molar conductance. The molar conductance of a solution does not vary linearly with concentration and it is related with specific conductance. The effect of molar conductance can be studied by plotting values against the square root of the concentration. Following two figures show the behaviour of strong and weak electrolytes with change of concentration. 4



Answer the following questions:

a) Define specific conductance.

b) What is the effect of temperature on electrolytic conductance?

c) The molar conductivity of a 1.5 M solution of an electrolyte is found to be 138.9 S cm^2 mol^{-1}. Calculate the conductivity of this solution.

OR

Calculate the degree of dissociation (α) of acetic acid if its molar conductivity (Λ_m) is 39.05 S cm^2 mol^{-1}. (Given: $\lambda^0_{(H^+)}$ = 349.6 S cm^2 mol^{-1} and $\lambda^0_{(CH3COO^-)}$ = 40.9 S cm^2 mol^{-1})

32) Amines have a lone pair of electrons on nitrogen atom due to which they behave as Lewis base. Larger the value of Kb or smaller the value of pKb stronger is the base. Amines are more basic than alcohols, ethers, esters etc. The basic character of aliphatic amines should increase with the increase of alkyl substitution. But it does not occur in a regular manner as a secondary aliphatic amine is unexpectedly more basic than a tertiary amine in solutions. Aromatic amines are weaker base than ammonia and aliphatic amines. Electrons – donating groups such as – CH_3, - OCH_3 etc., increase the basicity while electron – withdrawing substituents such as – NO_2, halogens. etc., decrease the basicity of amines. The effect of these substituents is more at p – than at m – positions. 4

Answer the following questions:

a) Arrange the following in increasing order of their basic strength in aqueous solution: CH_3NH_2, $(CH_3)_2NH$, $(CH_3)_3N$, NH_3

b) Why are aliphatic amines stronger bases than aromatic amines?

c) Write the reactions of (i) aromatic and (ii) aliphatic primary amines with nitrous acid.

OR

Write chemical reaction of methanamine with benzoyl chloride and write the name of the product obtained.

SECTION E

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

33) Nitrogen pentoxide decomposes according to equation: 5

$2\ N_2O_{5\ (g)} \rightarrow 4\ NO_{2\ (g)} + O_{2\ (g)}$. The first order reaction was allowed to proceed at 40^0C and the data below were collected:

$[N_2O_5]$ (M)	Time (min)
0.400	0.00
0.289	20.0
0.209	40.0
0.151	60.0
0.109	80.0

a) Calculate the rate constant. Include units with your answer.

b) What will be the concentration of N_2O_5 after 100 minutes?

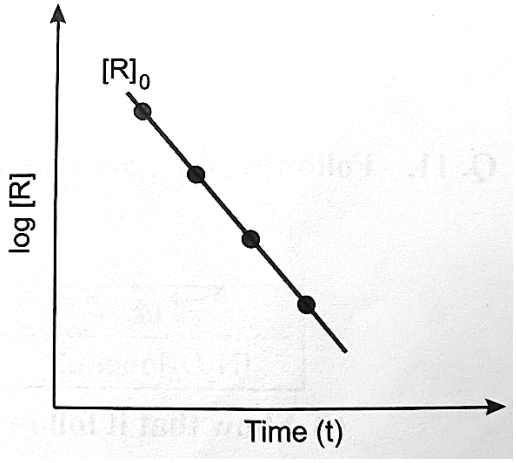
c) Calculate the initial rate of reaction.

(Given: log 10 = 1, log 3 =0.4771, log 4=0.6021, log 2.89=0.4609, antilog 0.7034 = 5.052, antilog 0.4281 = 2.680)

OR

i) The rate constant of a first order reaction increases from 2×10^{-2} to 4×10^{-2} when the temperature changes from 300 K to 310 K. Calculate the energy of activation (Ea).
(log 2 = 0.3010, log 3 = 0.4771, log 4 = 0.6021)

ii) Observe the graph in diagram and answer the following questions:



a) If slope is equal to -2.0×10^{-6} sec^{-1}, what will be the value of rate constant?

b) How does the half-life of zero order reaction relate to its rate constant?

34) An organic compound 'A' on treatment with $CHCl_3$/NaOH gives two compounds 'B' and 'C'. Both B and C give the same product 'D' when distilled with zinc dust. Oxidation of D gives 'E' having molecular formula $C_7H_6O_2$. The sodium salt of E on heating with sodalime gives 'F' which may also be obtained by distilling A with zinc dust. Identify A to F. 5

OR

i. Give equations of the following reactions:

a. Sodium t-butoxide is treated with CH_3Cl.

b. Propene is treated with B_2H_6 followed by H_2O_2/OH^-.

c. Bromine in CS_2 with phenol.

ii. How will you distinguish between ethanol and diethyl ether?

iii. Arrange the following in increasing order of acidity:
phenol, ethanol, water

35) a) Complete the following chemical equations: 5

i. $8\ MnO_4^- + 3\ S_2O_3^{2-} + H_2O \rightarrow$

ii. $Cr_2O_7^{2-} + 3\ Sn^{2+} + 14\ H^+ \rightarrow$

b) Describe the preparation of dichromate from chromite ore.

c) Draw the structure of manganate ion.

d) Transition metals form large number of complex compounds. Give reason.