HALF YEARLY EXAMINATION, 2024-25

CHEMISTRY

Time – 3:00 Hrs. **Class – XII** **M.M. : 80**

Date – 18.09.2024 (Wednesday)

Name of the student _____Section _____

GENERAL INSTRUCTIONS:

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 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.

Q.1 What would be the major product formed when $(CH_3)_3C–OH$ is heated at 358 K in the presence of H_3PO_4:

a) $(CH_3)_3COOH$ b) $(CH_3)_3CHO$ c) $(CH_3)_2C=CH_2$ d) $(CH_3)_3C\text{-}O\text{-}C\text{-}(CH_3)_3$

Q.2 Which among the following compound will exhibit optical isomerism

a) Tert-butylamine b) Sec-butylamine c) Isobutylamine d) n-butylamine

Q.3 Which of the following purines (nitrogenous bases with two-ring structure) are common to RNA and DNA?

a) Adenine, Thymine b) Guanine, Thymine c) Thymine, Cytosine d) Adenine, Guanine

Q.4 Alkenes decolourise bromine water in presence of CCl_4 due to formation of:

a) allyl bromide b) vinyl bromide c) bromoform d) vicinal dibromide

Q.5 Phenol and benzoic acid may be distinguished by their reaction with:

a) Aqueous NaOH b) Aqueous $NaHCO_3$ c) Tollen's reagent d) Fehling solution

Q.6 Which of the following alkyl iodide cannot be produced by the reaction of HI with an appropriate ether:

(a) $(CH_3)_3C–CH_2–I$ (b) $(CH_3)_2CH–I$ (c) $C_6H_5CH_2–I$ (d) $C_6H_5–I$

Q.7 Ankit has been given four organic compounds: a primary amine, a secondary amine, a secondary alcohol and a tertiary alcohol. Which of the following can Ankit use to identify all the compounds?

a) Tollen's reagent and bromine water b) 2,4 DNP and Lucas reagent

c) Hinsberg's reagent and Lucas's reagent d) Sodium metal and Hinsberg's reagent

Q.8 Which of the following is not true about enzymes?

a) All enzymes are fibrous proteins

b) Enzymes are needed in small quantities

c) Enzymes reduce the magnitude of activation energy.

d) They are specific for a reaction and the substrate.

Q.9 Identify the products (1) and (2) in the following reactions:

$C_2H_5Cl + KCN \longrightarrow$ (1) and $C_2H_5Cl + KNO_2 \longrightarrow$ (2)

a) (1) C_2H_5CN (2) $C_2H_5NO_2$ b) (1) C_2H_5NC (2) $C_2H_5NO_2$

c) (1) C_2H_5CN (2) C_2H_5ONO d) (1) C_2H_5NC (2) C_2H_5ONO

Q.10 "Williamson synthesis of ether is an example of:

a) electrophilic substitution b) nucleophilic substitution

c) nucleophilic addition d) electrophilic addition

Q.11 Which of the following reactions can be used to obtain benzaldehyde from benzene?

a) Rosenmund's Reduction b) Stephen's Reaction

c) Etard's Reaction d) Gatterman-Koch Reaction

Q.12 Which of the following is the correct order of the solubility in water?

a) propane < ethylamine < ethyl alcohol b) propane < ethyl alcohol < ethylamine

c) ethyl alcohol < propane < ethylamine d) ethyl alcohol < ethylamine < propane

Q.13 Given below are two statements labelled as Assertion (A) and Reason (R)

Assertion (A): Phenol on treatment with Br_2 in CS_2 gives ortho and para bromophenol.

Reason (R): Carbon disulphide is a solvent of low polarity, hence leads to monobromination of phenols

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.

b) A is true but R is false.

c) A is false but R is true.

Q.14 Given below are two statements.

Statement 1: Benzaldehyde is more reactive than ethanal towards nucleophilic attack.

Statement 2: The overall effect of – I and +R effect of phenyl group decreases the electron density on the carbon atom of >C =O group in benzaldehyde.

Select the most appropriate answer from the options given below:

a) Statement 1 is correct and statement 2 is incorrect.

b) Statement 1 is incorrect and statement 2 is correct.

c) Statement 1 and 2 both are correct.

d) Statement 1 and 2 both are incorrect.

Q.15 Given below are two statements labeled as Assertion (A) and Reason (R).

Assertion: Glucose reacts with hydroxylamine to form an oxime and alsoadds a molecule of hydrogen cyanide to give cyanohydrin.

Reason: The carbonyl group is present in the open chain structure of glucose.

Select the most appropriate answer from the options given below:

a) Both assertion and reason are correct statements, and reason is the correct explanation of the assertion.

b) Both assertion and reason are correct statements, but reason is not the correct explanation of the assertion.

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

d) Assertion is wrong, but reason is correct statement

Q.16 Given below are two statements labeled as Assertion (A) and Reason (R)

Assertion (A): Halogens are ortho and para-directing groups

Reason (R): Halogens are electron-withdrawing groups

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

Answer the following questions.

Q.17 Explain why the dipole moment of chlorobenzene is lower than that of cyclohexyl chloride

Q.18 Give an example of:

a) an amine each with basic strength greater than and less than N-Methylmethanamine in gaseous state

b) an isomeric amine each with boiling point less than and more than N-Ethyl ethanamine.

Q.19 What is the difference between essential and non-essential amino acids?

Q.20 Ortho and para nitrophenols are more acidic than phenol. Draw the resonance structures of the corresponding phenoxide lons.

OR

Grignard reagent should be prepared under anhydrous conditions. Explain.

Q.21 Arrange the following as indicated

a) n-Butane, Propan-1-ol, Propanal, Acetone, Methoxymethane (increasing order of boiling point)

b) Acetaldehyde, Acetone, Acetophenone, (increasing order of reactivity towards nucleophilic addition)

SECTION - C

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

Q.22 Write short notes on the following:

1. Carbylamine reaction 2. Diazotisation 3. Hoffmann's bromamide reaction

Q.23 An organic compound 'A' is having a molecular formula C_7H_8O. On oxidation with acidified $KMnO_4$ it forms compound 'B'. Compound 'B' can also be obtained from compound C, on its reaction with NaOH and then with CO_2 followed by hydrolysis. Compound C can be easily formed when butylphenylether is made to react with HI.

Identify the compound A, B and C. Write the chemical reactions involved.

Q.24 Give equations of the following reactions:

a) Oxidation of propan-1-ol with alkaline $KMnO_4$ solution.

b) Br_2 / water in phenol.

c) Dilute HNO_3 with phenol.

OR

How are the following conversions carried out?

a) Propene → Propan-2-ol

b) Benzyl chloride → Benzyl alcohol

c) Ethyl magnesium chloride → Propan-1-ol.

Q.25 Same alkyl halides undergo substitution whereas some undergo elimination reaction on treatment with bases, in different medium. Discuss the role of medium with the help of example which are responsible for this difference.

OR

Write the structures of the following compounds.

a) α-Methoxy propionaldehyde

b) 3-Hydroxybutanal

c) 2-Hydroxycyclopentane carbaldehyde

Q.26 What is meant by the following terms? Give an example of the reaction in each case.

a) Cyanohydrin b) Acetal c) Semicarbazone

Q.27 Convert Propanamide to the following compounds in not more than two steps:

a) N- Ethylpropanamine b) Ethanol c) Propanoic acid

Q.28 What happens when D- glucose is treated with following reagents

(a) Bromine water (b) HI (c) HNO_3

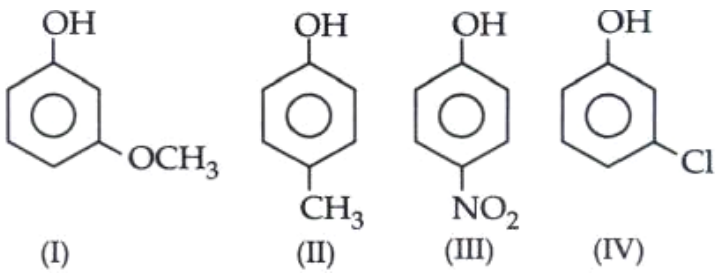
SECTION - D

Read the passage given below and answer the following questions: (1+1+2)

Q.29 Both alcohols and phenols are acidic in nature, but phenols are more acidic than alcohols. Acidic strength of alcohols mainly depends upon the inductive effect. Acidic strength of phenols depends upon a combination of both inductive effect and resonance effects of the substituent and its position on the benzene ring. Electron withdrawing groups increases the acidic strength of phenols whereas electron donating groups decreases the acidic strength of phenols. Phenol's a weaker acid than carboxylic acid.

a) Why Phenols are more acidic as compared to alcohols?

b) The correct decreasing order of pK_a value is



(I) (II) (III) (IV)

c)

c) Phenol when treated with the sodium metal and CH_3 MgBr separately liberates A(g) and B(g). Identify both liberated gases.

OR

c) Discuss the mechanism of esterification reaction.

Read the passage given below and answer the following questions: (1+1+2)

Q.30 The amines are basic in nature due to the presence of a lone pair of electrons on N-atom of the -NH_2 group, which it can donate to electron deficient compounds. Aliphatic amines are stronger bases than NH_3 because of the +1 effect of the alkyl groups. Greater the number of alkyl groups attached to N-atom, higher is the electron density on it and more will be the basicity. Thus, the order of basic nature of amines is expected to be 3° > 2° > 1°, however the observed order is 2° > 1° > 3°. This is explained on the basis of crowding on N-atom of the amine by alkyl groups which hinders the approach and bonding by a proton, consequently, the electron pair which is present on N is unavailable for donation and hence 3° amines are the weakest bases. Aromatic amines are weaker bases than ammonia and aliphatic amines. Electron -donating groups such as -CH_3-OCH_3, etc. increase the basicity while electron-withdrawing substitutes such as -NO_2, -CN, halogens, etc. decrease the basicity of amines. The effect of these substituents is more at para than at meta-positions.

(a) Why do -NH_2 group facilitates Electrophilic attack in aniline?

(b) Arrange the following in increasing order of basicity in aqueous medium.

$C_2H_5)_2NH$, $(C_2H_5)_3N$, $C_2H_5NH_2$, NH_3

(c) Electrophilic substitution is more readily carries out in aromatic amines than in benzene. Why?

OR

(c) Aniline does not undergoes friedel craft reaction. Explain.

SECTION - E

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

Q.31 Answer the following questions:

a) Draw the structure of the ethylene ketal of hexan-3-one.

b) Between Benzoic acid and acetic acid which is more acidic and why?

c) An optically active organic compound 'A', with molecular formula, $C_5H_{10}O_2$ when treated with Chlorine in the presence of Red Phosphorous forms compound 'B', $C_5H_9O_2Cl$, whereas when it is treated with thionyl chloride forms compound 'C', C_5H_9OCl. Compound C, on further hydrogenation with palladium on $BaSO_4$ in the presence of S, forms compound D, $C_5H_{10}O$. Compound D gives positive Tollen's test and regenerates A. A can also be obtained by base hydrolysis and further acidification of C. Write the reaction for the formation of 'A' from 'C' and Identify A, B, C, D.

OR

a) Bring about the following conversions:

i) Propanal to 2-methyl pentanol

ii) Iodobenzene to benzoic acid

b) Though Carboxylic acids have >C=O group in their structure, but they are not prone to nucleophilic addition reactions. Why?

c) An organic compound A, with molecular formulae C_9H_{12} is oxidized to monocarboxylic acid B, $C_7H_6O_2$ on vigorous oxidation with Potassium permanganate, whereas when oxidized in presence of air and further treated with dilute acid forms phenol. Sodium salt of B finds use as a food preservative and esters of B are used in perfumery. Identify A and B and write the equation.

Q.32 What happens when:

a) n-butyl chloride is treated with alcoholic KOH.

b) bromobenzene is treated with Mg in the presence of dry ether.

c) chlorobenzene is subjected to hydrolysis.

d) ethyl chloride is treated with aqueous KOH

e) methyl bromide is treated with sodium in the presence of dry ether.

OR

Among all the isomers of molecular formula C_4H_9Br identify

a) (i) the one isomer which is optically active.

(ii) the one isomer which is highly reactive towards SN_2 reaction.

(iii) the two isomers which give same product on dehydrohalogenation with alcoholic KOH.

b) Haloarenes are less reactive than haloakanes towards nucleophilic substitution reaction. Explain:

Q.33 Answer the following questions:

i) a) Name an important carbohydrate which makes the cell wall of bacteria and plants. What is the basic unit of this carbohydrate?

b) How are these basic units linked to each other, name the linkage.

c) Draw the Haworth structure of the basic unit.

ii) Identify the disaccharide with molecular formulae, $C_{12}H_{22}O_{11}$, which produces 2 moles of α-D (+) Glucose on hydrolysis. What will be the observation when Tollen's reagent is added to such a disaccharide.

iii) Change in optical rotation is observed when sucrose is hydrolysed. What is the reason for the inversion of configuration observed?

OR

Answer the following questions:

(i) a) A polynucleotide chain is seen to produce pentose sugar, phosphoric acid, Adenine, Guanine, Cytosine and Thymine on complete hydrolysis. Name the nucleic acid having such a polynucleotide chain. How are the bases paired in this polynucleotide?

b) What links these nucleotides together in a polynucleotide?

c) Give one important function and one application of the above nucleic acid.

ii) Keratin is a hair protein. What kind of tertiary protein is this? Describe the structure and links present in this protein. Comment on its solubility in water?