Time Allo

GENERAL INSTRUCTIONS:

1. There are 33 questions in the question paper with internal choice.
2. Section A has 16 questions. Carrying one mark each.
3. Section B has 5 very short answer questions. Carrying two marks each.
4. Section C has 7 short answer questions. Carrying three marks each.
5. Section D has 2 case based questions. Carrying four marks each.
6. Section E has 3 long answer questions. Carrying five marks each.
7. All Questions are compulsory

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 factors does not affect the electrode potential of an electrode? (1)

   a) Nature of the electrode (metal) b) Temperature of the solution

   c) Molarity of the solution d) Size of the electrode

2. The value of Henry's Law constant is: (1)

   a) larger for gases with higher solubility

   b) larger for gases with lower solubility

   c) constant for all gases

   d) not related to the solubility of gases

3. What is B in $R\text{-}OH + PX_5 \rightarrow R\text{-}X + B + HX$? (1)

   a) $HPOX_3$ (b) H_3PO_3

   c) POX_3 d) H_3PO_2

4. Which of the following alcohols will not undergo oxidation? (1)

   a) Butanol b) Butan-2-ol

   c) 2-Methylbutan-2-ol d) 3-Methyl butan-2-ol

5. Arrange the following compounds in increasing order of their boiling points (1)

   (i) $(CH_3)_2CH\text{-}CH_2\text{-}Br$ (ii) $CH_3\text{-}CH_2\text{-}CH_2CH_2\text{-}Br$ (iii) $(CH_3)_3C\text{-}Br$

   (a) (ii)<(i)<(iii) (b) (i)<(ii)<(iii)

   (c) (iii)<(i)<(ii) (d) (iii)<(ii)<(i)

6. p-dichlorobenzene has higher melting point than its o- and m- isomers. Why? (1)

a) m- dichlorobenzene is more polar than o-isomer

b) p-isomer has a symmetrical crystalline structure

c) boiling point of o- isomer is more than p-isomers

d) o - dichloro benzene is more polar than m - isomer

7. Which of the following does not react with Hinsberg reagent? (1)

a) $C_2H_5NH_2$ b) $(CH_3)_2NH$

c) $(CH_3)_3N$ d) $CH_3CH(NH_2)CH_3$

8. Iodoform test is not given by (1)

a) Ethanol b) Ethanal

c) Pentan-2-one d) Pentan-3-one

9. Which one of the following has lowest pKa value ? (1)

a) CH_3COOH b) O_2NCH_2COOH

c) $ClCH_2$-COOH d) HCOOH

10. Which of the following does not give Aldol condensation reaction? (1)

a) CH_3CHO b) C_2H_5CHO

c) CH_3COCH_3 (d) C_6H_5CHO

11. Which of the following is formed when an alkyl primary amine reacts with nitrous acid? (1)

a) Alkyl nitrite b) Secondary amine

c) Nitroalkane d) Alcohol

12. Catalytic dehydrogenation of Primary Alcohol gives a___ (1)

a) Ketone b) Aldehyde

c) Alcohol d) Ester

Two statements are given below-one labelled Assertion(A) and the other labelled Reason (R).

a) Both A and R are true, and R is correct explanation for A .

b) Both A and R are true ,but R is not correct explanation for A.

c) A is true, but R is false.

d) A is false , but R is true

13. Assertion (A): Alcohols react both as electophiles and nucleophiles. (1)

Reason (R) : The bond between C-O is broken when alcohols react as nucleophiles

14. Assertion (A): Aromatic primary amines cannot be prepared by Gabriel phthalimide synthesis (1)

Reason (R) : Aryl halides do not undergo nucleophilic substitution with the anion formed by phthalimide

15. a) Assertion (A): An Ideal solution obeys Henry's Law (1)
Reason (R) :In an ideal solution solute-solute as well as solvent-solvent interactions are similar to solute-solvent interaction.

16. b) Assertion (A):-NH_2 group is o and p-directing electrophilic substitution reaction. (1)
Reason (R) : Aniline cannot undergo Friedel-Crafts reaction

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. How much electricity in terms of Faraday is required to produce (1+1)
i) 20g of Ca from $CaCl_2$ ii) 40g of Al from molten Al_2O_3

18. Out of 1^0, 2^0 & 3^0 alcohols,which one is more acidic? Explain its reactivity in increasing order. (2)

19. Calculate the mass of a non-volatile solute (molar mass 40 g mol^{-1}) which should be dissolved in 114 g octane to reduce its vapour pressure to 80%. (2)

OR

Give reasons:
a) Cooking is faster in pressure cooker than in cooking pan (1+1)
b) Red blood cells shrink when placed in saline water but swell in distilled water

20. a) Give structure of products when Phenol reacts with Conc. HNO_3 (1+1)
b) Why o-nitrophenol is steam volatile while p-nitrophenol is not?

21. An organic compound with molecular formula $C_9H_{10}O$ forms 2, 4 – DNP derivative, reduces Tollens' reagent and undergoes Cannizzaro's reaction. On vigorous oxidation it gives 1, 2-benzene-di- carboxylic acid. Identify the compound & show all the chemical reactions. (2)

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. (i) Write similarity & difference between Raoult's Law & Henry's Law (2+1)
(ii) Why aquatic species feel comfortable in cold water?

23. A strip of nickel metal is placed in a 1 molar solution of $Ni(NO_3)_2$ and a strip of silver metal is placed in a 1 molar solution of $AgNO_3$. An electrochemical cell is created when the two solutions are connected by a salt-bridge and the two strips are connected by wires to a voltmeter. (1+2)

(i) Write the balanced chemical equation for the overall reaction occurring in the cell and calculate the cell potential.

(ii) Calculate the cell potential ,E at 25^0C for the cell if the initial concentration of $Ni(NO_3)_2$ is 0.100 molar and the initial concentration of $AgNO_3$ is 1.00 molar.

$[E^0Ni^{+2}/Ni = -0.25\ V\ ;\ E^0Ag^+/Ag = 0.80\ V,\ \log 10^{-1} = -1]$

Or

(i) State Faraday's first law of electrolysis. (1+2)

(ii) A solution of $CuSO_4$ is electrolysed for 10 minutes with a current of 1.5 amperes. What is the mass of copper deposited at the cathode ? (atomic mass of Cu=63.5g mol^{-1})

24. Complete the following giving the structures of major organic products. (1+1+1)

(i) $(CH_3)_3C\ Br + Mg \rightarrow A \xrightarrow{H_2O} B$

(ii) $(CH_3)_3C - CH_2 - Br + C_2H_5ONa \rightarrow A$

(iii) $C_6H_6 + CH_3Cl \xrightarrow[AlCl_3]{Anhy} A$

25. Explain the mechanism for dehydration of alcohol at 413k. (3)

26. Write short notes on: (1+1+1)

(i) Gabriel phthalimide reaction (ii) Coupling reaction

(iii) Gattermann reaction

27. Arrange the following compounds in increasing order of their property as indicated: (1+1+1)

(i) Acetaldehyde, Acetone,Methyl tert butyl ketone(reactivity towards HCN)

(ii) $CH_3CH_2NH_2$, $(C_2H_5)_2NH$, $(C_2H_5)_3N$, NH_3 (Basic strength in aqueous medium)

(iii) $CH_3CH_2CH(Br)COOH$, $CH_3CH(Br)CH_2COOH$, $(CH_3)_2CHCOOH$ (acid strength)

28. Write equations involved in the following reactions: (1+1+1)

(i) Ethanamine reacts with acetyl chloride

(ii) Aniline reacts with bromine water at room temperature

(iii) Aniline on reaction with chloroform and ethanolic potassium hydroxide

SECTION D

The following questions are case based questions. . Each case study carries 4 (1+1+2) marks each & there is one internal choice in one question.

29. **Read the given passage and answer the questions that follow:**

The substitution reaction of alkyl halide mainly occurs by S_N^1 or S_N^2 mechanism. Whatever mechanism alkyl halides follow for the substitution reaction to occur, the polarity of the carbon halogen bond is responsible for these substitution reactions. The rate of S_N^1 reactions are governed by the stability of carbocation whereas for S_N^2 reactions steric

factor is the deciding factor. If the starting material is a chiral compound, we may end up with an inverted product or racemic mixture depending upon the type of mechanism followed by alkyl halide. Cleavage of ethers with HI is also governed by steric factor and stability of carbocation, which indicates that in organic chemistry, these two major factors help us in deciding the kind of product formed.

Answer the following questions :

(i) Predict the stereochemistry of the product formed if an optically active alkyl halide undergoes substitution reaction by S_N^2 mechanism (1)

(ii) Predict the major product formed when 2-Bromobutane undergoes a reaction with alcoholic KOH. (1)

(iii) Justify and arrange the following compounds of each set in increasing order of reactivity towards the : (2)

(a) 1-Bromobutane, 2-Bromobutane, 2-Bromo-2-Methylpropane (S_N^1 reaction)

(b) 1-Bromobutane, 2-Bromobutane, 2-Bromo-2-Methylpropane (S_N^2 reaction)

OR

Write the S_N^1 reaction & explain its mechanism.

30. A Lead storage battery is the most important type of secondary cell having a lead anode and a grid of lead packed with PbO_2 as cathode. A 38% solution of sulphuric acid is used as electrolyte.(Density=1.294g/ml). The battery holds 3.5 L of the acid. During the discharge of the battery,the density of H_2SO_4 falls to 1.139 g/ml(20% H_2SO_4 by mass)

Answer the following questions :

(i) Write the reaction taking place at the cathode when the battery is in use. (1)

(ii) How much electricity in terms of Faradays is required to carry out the reduction of one mole of PbO_2 ? (1)

(iii) What is the overall cell reaction of lead storage battery during recharging? (2)

OR

Lead storage battery is considered a secondary cell. Why?

SECTION-E

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

31. a) Write the reaction of 2, 4 -dinitrophenylhydrazine with benzaldehyde. (1+1+1+1+1=5)

b) Write the chemical equation involved in Rosenmund's reduction.

c) Why are alpha-hydrogens of aldehydes and ketones acidic in nature?

d) Write a chemical test to distinguish between Benzaldehyde and Benzoic acid?

e) Which acid of the following is a stronger acid ? $F_3C\text{-}C_6H_5\text{-}COOH$ **OR** $H_3C\text{-}C_6H_5\text{-}COOH$

OR

(3+2=5)

i) Give reasons for the following:

a) Benzaldehyde reduces Tollen's reagent but not the Fehling's solution.

b) $(CH_3)_2CH\text{-}CHO$ undergoes aldol condensation whereas $(CH_3)_3C\text{-}CHO$ does not.

c) Benzoic acid does not undergo Friedel-Crafts reaction.

ii) How will you convert:

a) Propan-2-ol to propanone

b) Phenol to 2,4,6-tribromophenol

32. a) Why a person suffering from high blood pressure is advised to take minimum quantity of common salt?

b) 2g of benzoic acid (C_6H_5COOH) dissolved in 25g of benzene shows a depression in freezing point equal to 1.62 K. Molal depression constant for benzene is 4.9K Kg/mol. What is the percentage association of acid if it forms dimer in solution?

(2+3=5)

OR

a) Why do gases always tend to be less soluble in liquids as the temperature is raised?

b) Determine the osmotic pressure of a solution prepared by dissolving 0.025g of K_2SO_4 in 2 litre of water at 25°C, assuming that it is completely dissociated. (R=0.0821 L atm k^{-1} mol^{-1} ,M_B =174 $gmol^{-1}$) (2+3=5)

33. a) The standard electrode potential (E°) for Daniel cell is +1.1 V. Calculate the $\Delta G°$ for the reaction

$Zn(s) + Cu^{2+}(aq) \rightarrow Zn^{2+}(aq) + Cu(s)$

b) State Kohlrausch's law.

c) Which cell was used in Apollo Space Programme? (2+2+1=5)

OR

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

b) How does conductivity varies with dilution?

c) What is the effect of catalyst on Gibbs energy (ΔG) and activation energy of a reaction?

d) What should be the sign of change in Energy & change in Gibbs energy for a reaction to be spontaneous? (2+1+1+1=5)