Class: CBSE XII **Subject: Chemistry Theory (043)**

Time allowed: 3 hours **Pre-Mocks** **70 marks**

General Instructions:

Read the following instructions carefully.

(a) There are **33** questions in this question paper with internal choice.

(b) SECTION A consists of 16 multiple -choice questions carrying 1 mark each.

(c) SECTION B consists of 5 short answer questions carrying 2 marks each.

(d) SECTION C consists of 7 short answer questions carrying 3 marks each.

(e) SECTION D consists of 2 case - based questions carrying 4 marks each.

(f) SECTION E consists of 3 long answer questions carrying 5 marks each.

(g) All questions are compulsory.

(h) 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. Given that the dissociation contant of acetic is 1.8×10^{-5} and its molar conductivity at infinite dilution is 390.7 $\Omega^{-1}cm^2mol^{-1}$. The molar conductivity of 0.01 M acetic acid solution will be

   a) $1.657\Omega^{-1}cm^2$ b) $16.57\Omega^{-1}cm^2$

   c) $165.7\Omega^{-1}cm^2$ d) $33.04\Omega^{-1}cm^2$

2.

In the given reaction :

$$[A] + [B] \xrightarrow[5^\circ C]{NaOH} H_3C-\underset{\displaystyle OH}{\underset{|}{CH}}-\underset{\displaystyle CH_3}{\underset{|}{CH}}-CHO$$

[A] and [B] will respectively be :

a. H_3C-CH_2-CHO and CH_3-CH_2-CHO b. H_3C-CHO and CH_3-CH_2-CHO

c. H_3C-CHO and CH_3-CHO d. H_3C-CHO and $H_3C-\underset{\displaystyle CH_3}{\underset{|}{\overset{\displaystyle CH_3}{\overset{|}{C}}}}-CHO$

3.

Which of the following is not a fat soluble vitamin?

a. Vitamin A
b. Vitamin B–complex
c. Vitamin D
d. Vitamin E

4.

The compound that will not give iodoform on treatment with alkali and iodine is

a. acetone
b. ethanol
c. diethyl ketone
d. isopropyl alcohol

5.

An S_N2 rection at an asymmetric carbon of a compound always gives

a. an enantiomer of the substrate
b. a product with opposite optical rotation
c. a mixture of diastereomers
d. a single stereoisomer

6.

The first ionization enthalpy of elements of 5d-series are higher than those of 3d- and 4d-series. This is because

a. the atomic radii of elements of 5d-series are smaller than those of 3d- and 4d-series
b. the nuclear charges of elements of 5d-series are higher than those of 3d- and 4d-series
c. the valence shell electrons of 5d elements experience greater effective nuclear charge than 3d- and 4d-elements due to poor shielding of 4f subshell electrons
d. there is apperciable shielding of 4f-subshell electrons on valence shell electrons of 5d elements

7.

For an ideal solution with $p_A^0 > p_B^0$ Which of the following is true?

a). $(X_A)_{liquid} = (X_A)_{vapour}$
b). $(X_A)_{liquid} > (X_A)_{vapour}$
c). $(X_A)_{liquid} < (X_A)_{vapour}$
d). There is no relationship between $(X_A)_{liquid}$ and $(X_A)_{vapour}$

8.

Benzene diazonium chloride on reaction with phenol in weakly basic medium gives

a. diphenyl ether
b. p–hydroxyazobenzene
c. chlorobenzene
d. benzene

9.

The compound which reacts fastest with Lucas reagent at room temperature is

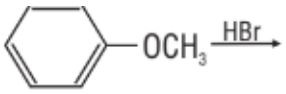
a. butan–2–ol
b. butan–1–ol
c. 2–methyl propan–1–ol
d. 2–methyl propan–2–ol

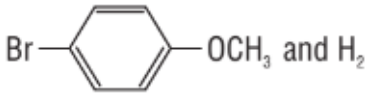
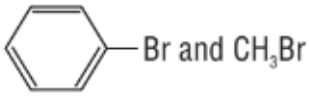
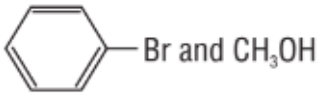
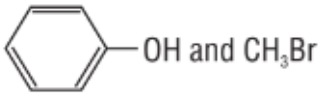
10.

The reaction X $\longrightarrow$ product follows first order kinetics. In 40 minutes, the concentration of X changes from 0.1 M to 0.025 M, then the rate of reaction when concentration of X is 0.01 M is

a. 1.73×10^{-4} M/min
b. 3.47×10^{-5} M/min
c. 3.47×10^{-4} M/min
d. 1.73×10^{-5} M/min

11.

In the reaction  the products are

a. 
b. 
c. 
d. 

12.

Colour in transition metal compounds is attributed to

a. small sized metal ions
b. absorption of light in UV region
c. complete ns subshell
d. incomplete (n-1) dsubshell

Directions : Each of these questions contain two statements, Assertion and Reason. Each of these questions also has four alternative choices, only one of which is the correct answer. You have to select one of the codes (a), (b), (c) and (d) given below.

(a) Assertion is correct, reason is correct; reason is a correct explanation for assertion.

(b) Assertion is correct, reason is correct; reason is not a correct explanation for assertion.

(c) Assertion is correct, reason is incorrect.

(d) Assertion is incorrect, reason is correct.

13.

Assertion : The bond angle in alcohols is slightly less than the tetrahedral angle.

Reason : In alcohols, the oxygen of –OH group is attached to sp^3 hybridized carbon atom.

14.

Assertion : Formaldehyde is a planar molecule.

Reason : It contains sp^2 hybridised carbon atom.

15.

Assertion : At isoelectric point, the amino group does not migrate under the influence of electric field.

Reason : At isoelectric point, amino acid exists as a zwitterion.

16.

Assertion : Galvanised iron does not rust.

Reason : Zinc has a more negative electrode potential than iron.

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.

(i) What aspect of the reaction is influenced by the presence of catalyst which increases the rate of the reaction?

(ii) In some cases it is found that a large number of colliding molecules have energy more than threshold energy, yet reaction is slow, why?

18.

A solution containing 18 g of non-volatile solute in 200g of water freezes at 272.07 K. calculate the molecular mass of solute (given K_f = 1.86 K/m)

19.

Account for the following:

(i) Preparation of ethers by acid dehydration of secondary or tertiary alcohols is not a suitable method.

(ii) The boiling points of ethers are lower than isomeric alcohols.

(iii) Phenylmethyl ether reacts with HI to give phenol and methyl iodide and not iodo benzene and methyl alcohol

20. (a). Arrange the following in order of increasing reactivity towards nucleophilic addition reaction : ethanal, propanal,propanone, butanone.

(b). Monochloroethanoic acid has a higher pKa value than dichloroethane acid. Why?

OR

Do the following conversions in not more than two steps:

(i) Benzoic acid to benzaldehyde

(ii) Ethyl benzene to Benzoic acid

21. The two strands in DNA are not identical but complementary. Explain.

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 the formula for the following coordination compound
Diamminetetrabromoplatinum (VI) bromide
(b) Tetrahedral complexes do not show geometrical isomerism. Why?
(c) What are t2g and eg orbitals ?

23. (a)

A zinc rod is dipped in 0.1 M solution of $ZnSO_4$. The salt is 95% dissociated at this dilution at 298 K. Calculate the electrode potential. [$E°_{Zn^{2+}}/Zn = -0.76$ V]

(b)

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

(c)

The electrical resistance of a column of 0.05 mol L^{-1} NaOH solution of diameter 1 cm and length 50 cm is 5.55 X 10^3 ohm. Calculate its resistivity, conductivity and molar conductivity.

24.

Give the structures of A, B and C in the following reactions :

(i) $CH_3Br \xrightarrow{KCN} A \xrightarrow{LiAlH_4} B \xrightarrow[273\ K]{HNO_2} C$

(ii) $CH_3COOH \xrightarrow[\Delta]{NH_3} A \xrightarrow{Br_2 + KOH} B \xrightarrow{CHCl_3 + NaOH} C$

25.

An organic compound (A) on treatment with acetic acid in the presence of sulphuric acid produces an ester (B). (A) on mild oxidation gives (C). (C) with 50% KOH followed by acidification with dilute HC1 generates (A) and (D). (D) with $PC1_5$ followed by reaction with ammonia gives (E). (E) on dehydration produces hydrocyanic acid. Identify the compounds A, B, C, D and E.

OR

An aromatic compound A on treatment with aqueous ammonia and heating forms a compound B which on heating with Br_2 and KOH forms a compound C of molecular formula C_6H_7N.Write the structures and IUPAC names of A, B, C.

26. Which sugar is called invert sugar? Why is it called so?

27.

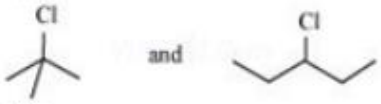
a) Give reason

i) **Dextro- and laevorotatory isomers of Butan-2-ol difficult to separate by fractional distillation**

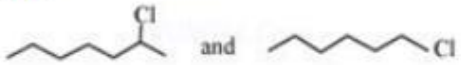
ii) **(±) 2 – Butanol is optically inactive.**

b) **In the following pairs of compounds which compound undergoes S_N^1 reactions**

(i)



(ii)



28. Show that the time required for 99% completion of a first order reaction is twice the time required for the completion of 90% of reaction. (3)

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.

29.

The carbon – oxygen double bond is polarised in aldehydes and ketones due to higher electronegativity of oxygen relative to carbon. Therefore they undergo nucleophilic addition reactions with a number of nucleophiles such as HCN, $NaHSO_3$, alcohols, ammonia derivatives and Grignard reagents. Aldehydes are easily oxidised by mild oxidising agents as compared to ketones. The carbonyl group of carboxylic acid does not give reactions of aldehydes and ketones. Carboxylic acids are considerably more acidic than alcohols and most of simple phenols.

Answer the following :

(a) Write the name of the product when an aldehyde reacts with excess alcohol in presence of dry HC*l*. **1**

(b) Why carboxylic acid is a stronger acid than phenol ? **1**

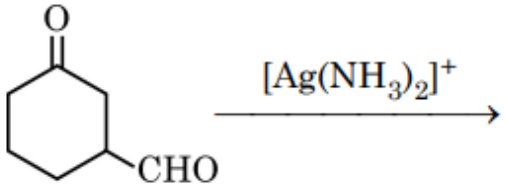
(c) (i) Arrange the following compounds in increasing order of their reactivity towards CH_3MgBr :

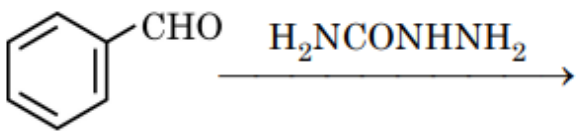
CH_3CHO, $(CH_3)_3C-\overset{\overset{O}{\|}}{C}-CH_3$, $CH_3-\overset{\overset{O}{\|}}{C}-CH_3$

(ii) Write a chemical test to distinguish between propanal and propanone. **2 × 1**

OR

(c) Write the main product in the following :

(i) 

(ii) 

2 × 1

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30.

In coordination compounds, metals show two types of linkages, primary and secondary. Primary valencies are ionisable and are satisfied by negatively charged ions. Secondary valencies are non-ionisable and are satisfied by neutral or negative ions having lone pair of electrons. Primary valencies are non-directional while secondary valencies decide the shape of the complexes.

(i) If $PtCl_2 . 2NH_3$ does not react with $AgNO_3$, what will be its formula ? *1*

(ii) What is the secondary valency of $[Co(en)_3]^{3+}$? *1*

(iii) (1) Write the formula of Iron(III)hexacyanidoferrate(II).

(2) Write the IUPAC name of $[Co(NH_3)_5Cl]\ Cl_2$. *2×1=2*

OR

(iii) Write the hybridization and magnetic behaviour of $[Ni(CN)_4]^{2-}$. *2*

[Atomic number : Ni = 28]

SECTION E

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

31. (a) Complete the following chemical equations for reactions :

(*i*) $MnO_4^-(aq) + S_2O_3^{2-}(aq) + H_2O(l) \longrightarrow$

(*ii*) $Cr_2O_7^{2-}(aq) + H_2S(g) + H^+(aq) \longrightarrow$

(b) Give an explanation for each of the following observations :

(i) The gradual decrease 'n' size (actinoid contraction) from element to element is greater among the actinoids than that among the lanthanoids (lanthanoid contraction).

(ii) The greatest number of oxidation states are exhibited by the members in the middle of a transition series.

(iii) With the same d-orbital configuration d^4, Cr^{2+} ion is a reducing agent but Mn^{3+} ion is an oxidising agent.

OR

(I) Account for the following : **2 + 2 + 1**

(i) Transition metals form alloys.

(ii) Ce^{4+} is a strong oxidising agent.

(II) Write one similarity and one difference between chemistry of Lanthanoids and Actinoids.

(III) Complete the following ionic equation :

$$Cr_2O_7^{2-} + 2OH^- \longrightarrow$$

32.

(i) Two liquids A and B on mixing form an ideal solution. At 30^0C vapour pressure of solution containing 3 mol of A and 1 mol of B is 550 mmHg. But when 4 mol of A and 1 mol of B are mixed. The vapour pressure of solution thus formed is 560 mm Hg. What would be the V.P of pure A and B?

(ii) Explain the fact that Raoult's Law is a special case of Henry's Law.

OR

0.6 mL of acetic acid (CH_3COOH), having density 1.06 g mL^{-1}, is dissolved in 1 litre of water. The depression in freezing point observed for this strength of acid was 0.0205°C. Calculate the van't Hoff factor and the dissociation constant of acid.

33.

(A)Illustrate the following reactions giving a chemical equation in each case :

(i) Gabriel phthalimide synthesis

(ii) Hofmann's bromamide reaction.

(B) Describe a chemical test each to distinguish between the following :

(i) Ethylamine and aniline

(ii) Methylamine and dimethylamine

(iii) Aniline and N-methylaniline

OR

(i) Write the structures of main products when benzene diazonium chloride ($C_6H_5N_2^+Cl^-$) reacts with the following reagents : (a) HBF_4/D (b) Cu/HBr

(ii) Write the structures of A, B and C in the 4following reactions :

(a) $C_6H_5NO_2 \xrightarrow{Sn/HCl} A \xrightarrow[273\ K]{NaNO_2 + HCl} B \xrightarrow[H_2O]{\Delta} C$

(b) $CH_3Cl \xrightarrow{KCN} A \xrightarrow{LiAlH_4} B \xrightarrow[273\ K]{HNO_2} C$