Neha
09 **(M)**

PRE-BOARD EXAMINATION (2023-24)
CLASS : XII
SUBJECT: CHEMISTRY (043)

समय : 3 घंटे
Time Allowed : 3 hours

अधिकतम अंक – 70
Maximum Marks : 70

सामान्य निर्देश:

1. इस प्रश्न पत्र में कुल 33 प्रश्न हैं। सभी प्रश्न अनिवार्य हैं।

2. खंड 'क' में 16 बहुविकल्पीय प्रश्न हैं, प्रत्येक प्रश्न 1 अंक का है।

3. खंड 'ख' में 5 लघुउत्तरीय प्रश्न हैं, प्रत्येक प्रश्न 2 अंकों का है।

4. खंड 'ग' में 7 लघुउत्तरीय प्रश्न हैं, प्रत्येक प्रश्न 3 अंकों का है।

5. खंड 'घ' में 2 केस आधारित प्रश्न हैं, प्रत्येक प्रश्न 4 अंकों का है।

6. खंड 'ङ' में 3 दीर्घउत्तरीय प्रश्न हैं, प्रत्येक प्रश्न 5 अंकों का है।

7. लॉग सारणियाँ एवं कैल्कुलेटर के प्रयोग की अनुमति नहीं है।

    $(1F = 96500C, R = 8.314 \, JK^{-1} \, mol^{-1})$

GENERAL INSTRUCTIONS:

1. There are 33 questions in this question paper. All questions are compulsory.

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 study based questions carrying 4 marks each.

6. Section 'E' consists of 3 long answer questions carrying 5 marks each.

7. Use of log tables and calculators is not allowed.

    $(1F = 96500C, R = 8.314 \, JK^{-1} \, mol^{-1})$

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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. Henry's Law constant (at 298K) of solubility in water for Ar, CO_2, HCHO and CH_4 are 40.3, 1.67, 1.83 × 10^{-5} and 0.413 respectively. The correct order of solubility of gases in water will be :

   (a) $Ar < CO_2 < HCHO < CH_4$

   (b) $CO_2 < HCHO < CH_4 < Ar$

   (c) $Ar < CO_2 < CH_4 < HCHO$

   (d) $CH_4 < CO_2 < Ar < HCHO$

2. An azeotropic mixture of two liquids has a boiling point higher than either of the two liquids when it :

   (a) Shows large negative deviation from Raoult's Law

   (b) Shows no deviation from Raoult's Law

   (c) Shows large positive deviation from Raoult's Law

   (d) Obeys Raoult's Law

3. The electricity required for reduction of 0.2 moles of $Cr_2O_7^{2-}$ to Cr^{3+} is :

   (a) 115800 C

   (b) 579000 C

   (c) 19300 C

   (d) 96500 C

4. Most suitable reagent(s) for following conversion is :

$$CH_3 - CH_2 - \overset{\overset{O}{\|}}{C} - CH_2 - COOH \xrightarrow{?} CH_3 - CH_2 - \overset{\overset{OH}{|}}{CH} - CH_2 - COOH$$

   (a) $NaBH_4$

   (b) $LiA\ell H_4$

   (c) H_2/Pd

   (d) DIBAL–H

5. The compound having highest pKa value is :

   (a) Ethanol

   (b) Phenol

   (c) 4-Nitrophenol

   (d) 4-Methylphenol

6. The slope of given plot for a first order reaction is 300 s⁻¹. The rate constant 'k' for the reaction will be :
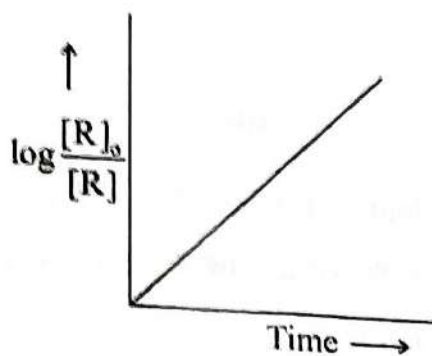
(a) 300 s^{-1}

(b) -300 s^{-1}

(c) 690 s^{-1}

(d) 130 s^{-1}

7. Which transition metal ion will be coloured?

(a) $Sc^{3+} (Z = 21)$

(b) $Ti^{4+} (Z = 22)$

(c) $Cr^{2+} (Z = 24)$

(d) $Zn^{2+} (Z = 30)$

8. 3d element which shows highest oxidation state is?

(a) Sc

(b) Cr

(c) Mn

(d) Co

9. Among the following, the most stable complex is :

(a) $[Fe(H_2O)_6]^{3+}$

(b) $[Fe(NH_3)_6]^{3+}$

(c) $[Fe(C_2O_4)_3]^{3-}$

(d) $[FeCl_6]^{3-}$

10. Primary and secondary valencies of coordination compound $[Co(en)(H_2O)_2Cl_2]^+$ respectively are :

(a) 2, 4

(b) 2, 5

(c) 3, 5

(d) 3, 6

11. Out of the following, optically active molecule is :

(a) Propan-2-ol

(b) Butan-1-ol

(c) Butan-2-ol

(d) 2-Methylbutan-2-ol

12. On hydrolysis, which of the following carbohydrate gives only glucose?

(a) Starch   (b) Fructose

(c) Lactose   (d) Sucrose

For question 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 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): In aqueous solution basic strength of substituted amines follows the order:

$$(CH_3)_2 NH > CH_3 NH_3 > (CH_3)_3 N > NH_3$$

Reason (R) : Methyl ($-CH_3$) group is electron releasing, increases electron density on N-atom of $-NH_2$ group.

14. Assertion (A) : Proponal is more reactive towards nucleophilic addition reaction as compared to benzaldehyde.

Reason (R) : Due to resonance polarity of carbonyl carbon is reduced in benzaldehyde.

15. Assertion (A): Catalyst increases rate of a chemical reaction.

Reason (R) : Addition of catalyst in a reaction mixture increases activation energy.

16. Assertion (A) : Conductivity of an electrolytic solution increases with dilution.

Reason (R) : Conductivity of a solution increases with the increase in number of ions per unit volume.
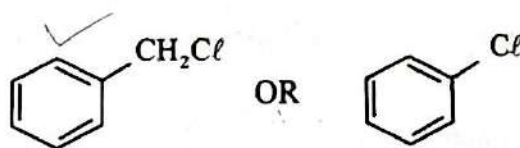
SECTION-B

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

17. For the complex, $K[Cr(H_2O)_2(C_2O_4)_2]^{-3}$

    (a) Write IUPAC name of the complex.

    (b) Write the structure of its isomer which is optically active.

18. Show that in a first order reaction, time required for 99% completion is twice the time required for the completion of 90% of reaction. ($\log 10^n = n$)

19. (a) Define – Racemic mixture.

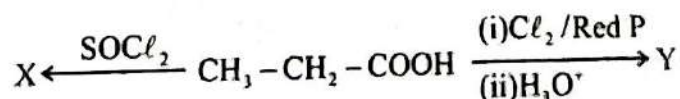   (b) Out of following which compound undergoes S_N1 reaction faster and why?

    $$Cl \quad OR \quad Cl$$
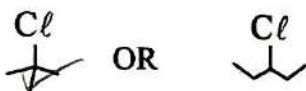
    OR

    (a) Why Grignard reagents are placed under anhydrous condition?

    (b) Out of following which compound undersgoes S_N1 reaction faster and why?

    $$CH_2Cl \quad OR \quad Cl$$

20. (a) Write structure of semicarbazone of benzaldehyde.

    (b) Identify X and Y :

    $$X \xleftarrow{SOCl_2} CH_3-CH_2-COOH \xrightarrow[\text{(ii)}H_3O^+]{\text{(i)}Cl_2/\text{Red P}} Y$$

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21. (a) Explain : Aniline does not undergo Friedel-Crafts reactions.

    (b) Write steps (reactions) for conversion of aniline into 4-Nitroaniline.

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. Mention one difference between following pairs :

    (a) Fibrous and globular proteins

    (b) DNA and RNA

    (c) Amylose and Amylopectin

23. (a) Write reaction of D-glucose with following:

    (i) HI, Δ

    (ii) Br_2 water

    (b) Explain : Amino acids behaves as salts.

24. Represent the cell in which following reaction takes place :

    $$Ni(s) + 2Ag^+(0.002M) \rightarrow Ni^{2+}(0.160M) + 2Ag(s)$$
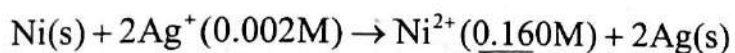
    (Given : $E^\circ_{Ni^{2+}/Ni} = -0.25V$, $E^\circ_{Ag^+/Ag} = 0.80V$, $\log 2 = 0.3010$)

    (a) Calculate E_{cell} at 298 K.

    (b) Calculate maximum work done by cell at given concentration.

25. (a) The rate constant for the first order decomposition of H_2O_2 is given by the following equation :

 $$\log k = 4.34 - \frac{1.25 \times 10^4 K}{T}$$

    Calculate E_a for this reaction.

(b) For a reaction R→P

On increasing concentration of 'R' thrice its original value, rate of reaction becomes 27 times. What is the order of reaction?

26. (a) Explain chelate effect with appropriate example.

(b) $[NiCl_4]^{2-}$ is paramagnetic while $[Ni(CO)_4]$ is diamagnetic though both are tetrahedral. Why?

(c) Write configuration of d-electrons distribution in $[Co(C_2O_4)_3]^{3-}$ in terms of t_{2g} and e_g.

27. (a) Aryl halides are extremely less reactive towards nucleophilic substitution reactions. Explain giving appropriate reasons.

(b) How will you convert but-1-ene into 1-Iodobutane? Write reactions involved.

28. (a) Write steps for synthesis of propan-1-amine by :

(i) Gabriel phthalimide synthesis

(ii) Hoffmann bromamide degradation reaction

(b) Give one chemical test to distinguish between methylamine and dimethylamine.

OR

(a) Complete the reaction sequence by writring A to D :
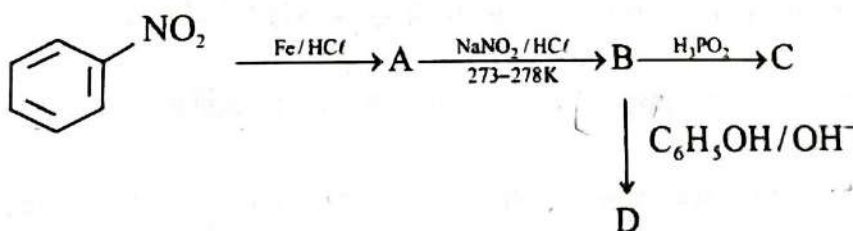
(b) Give one chemical test to distinguish between ethanamine and aniline.

The following questions are case-study 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 follows :

29. Molar conductivity ($\wedge_m$) varies with concentration for strong and weak electrolytes differently. The variation depends on nature of electrolyte as well as concentration. Molar conductivity of two electrolytes at 298 K are listed below :

Concentation mol L^{-1}	Molar conductivity at 298 K ($Scm^2 mol^{-1}$)	
	X	Y
1.0	—	49.1
0.1	5.2	72.8
0.05	7.4	76.9
0.01	16.3	83.8
0.005	22.9	85.7
0.001	49.2	88.5
0.0005	67.7	89.2
At infinite dilution	390.5	91.0

(a) Out of X & Y, which is weak electrolyte and why?

(b) Explain variation of molar conductivity of electrolyte X with reasons.

(c) Limiting molar conductivities for NH_4Cl, NaOH and NaCl are 129.8, 248.1 and 126.4 $Scm^2 mol^{-1}$. Calculate :

(i) limiting molar conductivity of NH_4OH

(ii) percentage dissociation of NH_4OH if molar conductivity of NH_4OH is 37.725 $Scm^2 mol^{-1}$.

(i) Name the law used to calculate limiting molar conductivity of weak electrolytes.

(ii) Using the law calculate limiting molar conductivity of aluminium chloride and aluminium sulphate.

(Given : $\lambda^\circ_{Al^{3+}} = 189.0$, $\lambda^\circ_{SO_4^{2-}} = 160.0$, $\lambda^\circ_{Cl} = 76.3$ Scm^{2}mol^{-1})

30. One of the most convenient and versatile method for preparation of alcohols involves the reaction of Grignard reagent with aldehydes and ketones.

In Grignard reagent (an organometallic halide), the alkyl/aryl group behaves as nucleophile (electron rich) and gets added to electrophilic carbon (electron deficient) of aldehyde or ketone to give an addition product. Hydrolysis of this addition product results in the formation of alcohol.
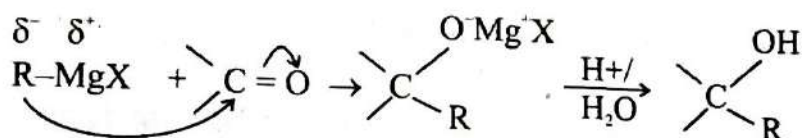

By selecting an appropriate Grignard reagent and an aldehyde or ketone desired primary, secondary or tertiary alcohols may be prepared.

(a) How will you synthesise butan-2-ol using appropriate Grignard's reagent?

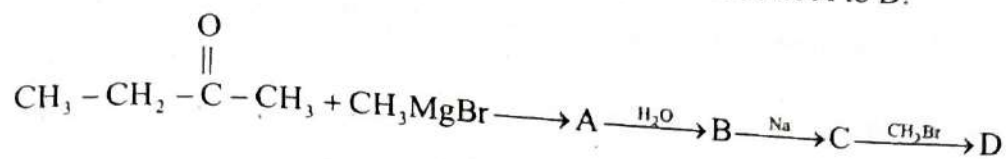(b) Identify reagent(s) X and Y for synthesis of given alcohols from given alkene.
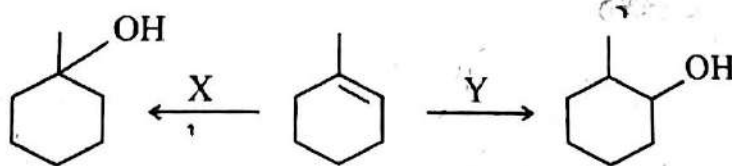
(c) Give the structure and IUPAC name of alcohol formed by reaction of propanone with methylmagnesium bromide followed by hydrolysis. Also write one more method for synthesis of same alcohol as obtained by above reraction.

$CH_3CH_2CH_2CH_3$ + CH_3Mg
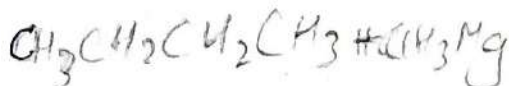
OR

Complete the sequence of reaction by writing structures of A to D.

$$CH_3 - CH_2 - \overset{\overset{\displaystyle O}{\|}}{C} - CH_3 + CH_3MgBr \longrightarrow A \xrightarrow{H_2O} B \xrightarrow{Na} C \xrightarrow{CH_3Br} D$$

SECTION-E

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

31. Attempt **any five** of the following :

(a) Why transition elements exhibits higher enthalpies of atomization?

(b) What happens when permanganate ions reacts with ferrous ions in acidic medium? Write balanced chemical equations.

(c) Cu^+ is unstable in an aqueous solution.

(d) Explain : $Zr (z = 40)$ and $Hf (z = 72)$ have almost identical atomic radii.

(e) Which is stronger reducing agent – Cr^{2+} or Fe^{2+} and why?

(f) Transition metals and their compounds acts as good catalysts. Why?

(g) Complete the following reaction : $KMnO_4 \xrightarrow{heat}$

32. (a) Explain the following :

(i) Measurement of osmotic pressure is preferred method for determination of molar mass of macromolecules such as proteins and polymers.

(ii) Elevation of boiling point for 1.0 M NaCℓ solution is nearly double than that of 1.0 M glucose solution.

(b) A 5% solution (by mass) of sucrose in water has freezing point of 271 K. Calculate the freezing point of 5% glucose solution in water, if freezing point of pure water is 273.15 K.

(Molar mass of sucrose = 372 g mol⁻¹, glucose = 180 g mol⁻¹)

(K_f for water = 1.86 K Kg mol⁻¹)

OR

(a) Explain why air tanks used by scuba divers filled with air diluted with helium?

(b) Aquatic species are more comfortable in cold water than hot water. Why?

(c) Phenol associates in benzene to a certain extent to form a dimer. A solution containing 20g of phenol in 1.0 kg of benzene has its freezing point lowered by 0.69 K. Calculate the fraction of phenol that has dimerised.

(given : K_f for benzene = 5.1 K kg mol⁻¹, Molar mass of phenol = 94 g mol⁻¹)

33. (a) An organic compound 'X' (molecular formula $C_9H_{10}O$) forms 2,4 – DNP addition product. 'X' neither reduces Tollens' reagent nor gives Fehling's test but forms yellow precipitate on heating with I_2/NaOH. 'X' on drastic oxidation with $KMnO_4$ – KOH followed by acidification forms benzene-1,4-dicarboxylic acid.

Deduce structure of 'X', write its IUPAC name and write all reactions mentioned.

(b) Write structure and IUPAC name of product formed by aldol condensation of propanal.

$$CH_3 \overset{6}{\underset{}{\cancel{}}} \overset{\overset{O}{\parallel}}{C}-H$$
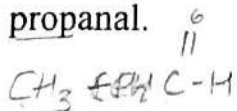
OR

(a) How will you convert following? Write reactions involved.

    (i)   Benzyl alcohol to Phenylethanoic acid

    (ii)   Acetophenone to m-Nitrobenzoic acid

    (iii) Ethanenitrile to Ethane

(b) Although phenoxide ion has more number of resonating structures than carboxylate ion, carboxylic acid is a stronger acid than phenol. Why?

(c) Arrange following in increasing order of reactivity towards HCN :

Propanal, Propanone, Benzaldehyde, Acetophenone