Directorate of Education, Govt. of NCT of Delhi

Practice Paper (2024-25)

Class-XII

Chemistry (043)

Time: 3 Hours **Maximum Marks: 70**

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.

(i) Use the following values of physical constants wherever required:

$R = 8.314\ J\ K^{-1}\ mol^{-1}$, $1\ F = 96500\ C\ mol^{-1}$

SECTION-A

Directions (Q. No. 1-16) : 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. Dissolution of potassium dichromate in water is exothermic. On increasing the temperature, solubility of potassium dichromate in water will-

(a) increases

(b) decreases

(c) no change

(d) unpredictable

2. The standard electrode potential for the cell: Mg | Mg^{2+} (0.2 M) || Ag^{+} (0.01 M) | Ag is 3.17 V. The standard Gibbs energy change for the reaction occurring in cell will be-

(a) 3.17 F

(b) 6.34 F

(c) -6.34 F

(d) Insufficient data to calculate

3. The rate constant, *k* of a reaction is 2.5 min^{-1} , the order of reaction is –

(a) zero

(b) first

(c) second

(d) cannot be determined

4. Out of the following transition elements, the highest oxidation state is shown by:

(a) Sc (Z = 21)

(b) Cr (Z = 24)

(c) Mn (Z = 25)

(d) Cu (Z = 29)

5. Which of the following structure of proteins does not affected by the denaturation of proteins?

(a) Primary

(b) Secondary

(c) Tertiary

(d) Quaternary

6. For a complex $[Co\mathbf{X}_6]^{3-}$, the crystal field splitting energy(Δ_o) would be maximum when **X** is -

(a) CN^-

(b) NO_2^-

(c) Cl^-

(d) OH^-

7. α-D-(+)-glucose and β-D-(+)-glucose are–

(a) Enantiomers

(b) Geometrical isomers

(c) Anomers

(d) Epimers

8. The major product formed by the reaction of $(CH_3)_3C–Br$ and CH_3ONa is–

(a) 2-Ethoxy-2-methylpropane

(b) 2-Methylpropene

(c) 2,2-Dimethylpropane

(d) 2-Methylpropane-2-ol

9. The most suitable reagent(s) for following conversion is/are–

$CH_3–CH=CH–CH_2–CN \rightarrow CH_3–CH=CH–CH_2–CHO$

(a) $H_2/Pd\text{-}BaSO_4$

(b) DIBAL-H

(c) PCC

(d) CrO_2Cl_2

10. Among following, compound having highest pK_a value is–

(a) Ethanol

(b) Phenol

(c) *p*-Methoxyphenol

(d) *p*-Nitrophenol

11. Amine which cannot be synthesised by Gabriel phthalimide synthesis is–

(a) Ethanamine

(b) Aniline

(c) Benzyl amine

(d) Propan-1-amine

12. Out of the following molecules, select one which is chiral–

(a) 1-Chloropentane

(b) 2-Chloropentane

(c) 3-Chloropentane

(d) 2-Chloro-2-methylbutane

13. **Assertion:** Glucose is reducing sugar.

Reason: Glucose reduces Fehling's solution and Tollens' reagent.

(a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

(b) Both Assertion and Reason are true but Reason is not a correct explanation of Assertion.

(c) Assertion is true but Reason is false.

(d) Assertion is false but Reason is true.

14. **Assertion:** Propan-2-ol undergoes acid catalysed dehydration easily as compared to propan-1-ol.

Reason: Rate of dehydration depends upon ease of protonation of alcohols.

(a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

(b) Both Assertion and Reason are true but Reason is not a correct explanation of Assertion.

(c) Assertion is true but Reason is false.

(d) Assertion is false but Reason is true.

15. **Assertion :** *cis*-$[CrCl_2(ox)_2]^{3-}$ is optically inactive.

Reason : *cis*-$[CrCl_2(ox)_2]^{3-}$ forms non-superimposable mirror image.

(a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

(b) Both Assertion and Reason are true but Reason is not a correct explanation of Assertion.

(c) Assertion is true but Reason is false.

(d) Assertion is false but Reason is true.

16. **Assertion:** Sc^{3+} ions are coloured.

Reason: Colour of d-block elements is due to d-d transition.

(a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

(b) Both Assertion and Reason are true but Reason is not a correct explanation of Assertion.

(c) Assertion is true but Reason is false.

(d) Assertion is false but Reason is true.

SECTION-B

Directions (Q. Nos. 17-21) : 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. Calculate mass of a non-volatile solute (molar mass 40 g mol^{-1}) which should be dissolved in 114g of octane to reduce its vapour pressure to 80%.

18. Write IUPAC names of following complexes:

i) $[CoCl_2(en)(NH_3)_2]^+$

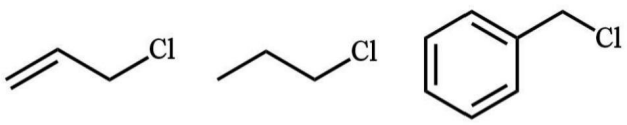
ii) $K[Pt(H_2O)Cl_3]$

19. Depict the structures of following:

i) semicarbazone of acetone

ii) oxime of benzaldehyde

20. Arrange the following in increasing order of reactivity towards S_N1 reaction, giving appropriate reasons:



OR

Chlorobenzene reacts with NaOH under drastic conditions (623 K, 300 atm) while reaction of chloropropane with NaOH takes place at room temperature. Explain the reasons.

21. Three test tubes labelled as 'A', 'B' and 'C' were filled with different amines. Some tests were performed using different reagents and following observations were made:
    - 'A' and 'B' forms foul smelling compounds on heating with chloroform and KOH.
    - 'B' forms white precipitate with bromine water; it also forms orange dye by coupling with phenol.
    - 'C' reacts with benzene sulphonyl chloride forming a substituted product insoluble in alkali.

    If amines present in test tubes were Aniline, Ethanamine, N-Methylethanamine irrespective of order, identify amines in test tubes labelled as 'A', 'B' and 'C' giving appropriate reasons.

SECTION-C

Directions (Q. Nos. 22-28) : This section contains 5 questions with internal choice in one question. The following questions are short answer type and carry 3 marks each.

22. Give plausible explanation for following observations:

    i) Nitration of aniline gives significant amount of *meta*- product in addition of *para*- product.
    ii) Aniline is less basic than ammonia while cyclohexylamine is more basic than ammonia.
    iii) Aniline does not undergoes Friedel-Crafts reactions.

23. A first order reaction is 25% complete in 40 minutes. How much time will it take for 50% completion of the reaction.
    (Given: *log* 2 = 0.301, *log* 3 = 0.4771, *log* 4 = 0.6021)

24. i) Among the isomers of C_4H_9Br, depict structure of isomer which:

    (a) has highest boiling point
    (b) is optically active

ii) Explain following with appropriate reasons:

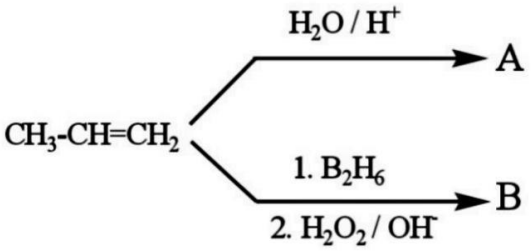
(a) 1-Chloropropane on reaction with aqueous KOH forms propan-1-ol while heating with alcoholic KOH results in formation of propene.

(b) Thionyl chloride is preferred over other reagents for preparation of chloroalkanes from alcohols.

25. 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 (E_a).
(Given: *log* 2 = 0.301, *log* 3 = 0.4771, *log* 4 = 0.6021)

26. Mention the electrode reactions taking place in following cell:
Ni(s) | Ni^{2+} (0.160 M) || Ag^{+}(0.002 M) | Ag(s)
Also calculate the EMF of the given cell at 298 K.
[Given: $E°_{Ni^{2+}|Ni} = -0.25V$, $E°_{Ag^{+}|Ag} = 0.80V$]

27. Consider the following reactions:



i) Identify the products A and B.

ii) Explain the mechanism of the reaction involved in conversion of propene into **A**.

iii) A carbonyl compound on reduction with $NaBH_4$ forms compound **A.** Identify carbonyl compound.

OR

i) Out of *ortho*-Nitrophenol and *para*-Nitrophenol, which is more steam volatile and why?

ii) Give an example of following reactions:

(a) Reimer-Tiemann reaction

(b) Williamson synthesis

28. i) Determine the coordination number and oxidation state of platinum in the complex $[Pt(en)_2Cl_2]$.

ii) Identify the complex(es) which exhibits geometrical isomerism:

$[Ni(CN)_4]^{2-}$, $[Co(NH_3)_3Cl_3]$, $[Cr(en)_2(NH_3)_2]^{3+}$, $[Co(en)_3]^{3+}$

iii) Explain: $[Fe(H_2O)_6]^{3+}$ is strongly paramagnetic while $[Fe(CN)_6]^{3-}$ is weakly paramagnetic.

SECTION-D

Directions (Q. Nos. 29-30) : The following questions are case-based questions. Each question has an internal choice and carries 4 marks each.

29. Three students conducted an experiment to measure osmotic pressures of 0.5 molar solutions of sodium chloride, calcium chloride and glucose taken in random order at 300K. The recorded data are presented in the table below:

Sr. No.	Student	Osmotic Pressure / atm
1.	Anuj	24.6
2.	Swati	12.3
3.	Saksham	36.9

i) Which student measured the osmotic pressure of 0.5 M NaCl solution? Provide justification for your answer.

ii) Under what condition reverse osmosis occurs through semi permeable membrane?

iii) Calculate the concentration of K_2SO_4 that would be isotonic to the 0.5 M NaCl solution at 300 K.

OR

10 g glucose (molar mass 180 g/mol) and 10 g urea (molar mass 60 g/mol) are dissolved in 250 mL water the corresponding osmotic pressures were found to be $\mathbf{\Pi_1}$ and $\mathbf{\Pi_2}$ respectively. Determine the relationship between osmotic pressures $\mathbf{\Pi_1}$ and $\mathbf{\Pi_2}$.

30. All proteins are made up of α-amino acids which act as the building blocks. α-amino acids that are synthesised in the body are known as non-essential α-amino acids while the one which the body fails to synthesise are called essential α-amino acids.

All of them exist as dipolar ions also known as zwitter ions. For all the α-amino acids, there is a certain pH of the medium known as isoelectric point at which the dipolar ions behave as electrically neutral species. In acidic medium, the ion migrates towards cathode while in basic medium, it migrates towards anode on passing electric current.

i) Write two examples of essential α-amino acids.

ii) Out of the following, which is basic amino acid?

Aspartic acid, histidine, valine, leucine

OR

Name the α-amino acid which is optically inactive.

iii) Mention a difference between following pair of terms:

(a) Fibrous and globular proteins

(b) Primary and secondary structure of proteins

SECTION-E

Directions (Q. No. 31-33) : The following questions are long answer type and carry 5 marks each. All questions have an internal choice.

31. i) Account for the following:

(a) Transition elements shows variable oxidation states.

(b) Atomic radii of *4d* and *5d* series elements are nearly same.

(c) Transition metals and their compounds are used as catalysts.

ii) Complete and balance following reactions:

(a) $MnO_4^- + H_2O + I^- \rightarrow$

(b) $Cr_2O_7^{2-} + Fe^{2+} + H^+ \rightarrow$

OR

i) Write the balanced ionic equations for the reaction of $KMnO_4$ with following in acidic medium:

(a) H_2S

(b) $FeSO_4$

ii) Account for the following:

(a) Cu^+ is unstable in aqueous solution.

(b) A transition metal exhibits highest oxidation state in oxides and fluorides.

iii) Name one element of the lanthanoid series which exhibits:

(a) +4 oxidation state

(b) +2 oxidation state.

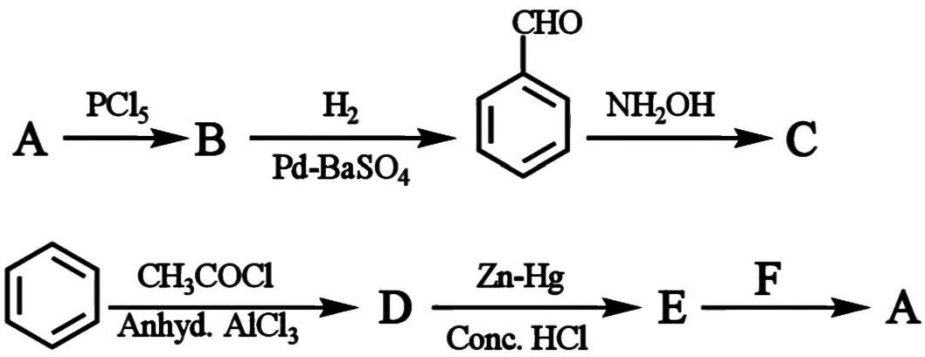
32. i) An organic compound 'A' with molecular formula C_8H_8O forms an orange-red precipitate with 2,4-DNP reagent and gives yellow precipitate on heating with iodine in the presence of sodium hydroxide. It neither reduces Tollens' or Fehling's reagent, nor does it decolourise bromine water or Baeyer's reagent. On drastic oxidation with chromic acid, it gives a carboxylic acid 'B' having molecular formula $C_7H_6O_2$.Identify the compounds 'A' and 'B' and explain the reactions involved.

ii) Out of following compounds, which undergoes Cannizzaro reaction? Give reason to support your answer. Also write the product(s) formed by the reaction.

Ethanal, Propanal, Propanone, Benzaldehyde, Acetophenone

OR

i) Identify product(s) / reagent(s) **A, B, C, D, E** and **F** in given reaction sequences:



ii) Write the structure of major product formed when propylbenzene reacts with $KMnO_4$–KOH followed by treatment with H_3O^+.

iii) Mention a chemical test to distinguish between methanoic acid and ethanoic acid.

33. i) State Faraday's second law of electrolysis.

Aqueous copper sulphate solution and aqueous silver nitrate solution are electrolysed by 1 ampere current for 10 minutes in separate electrolytic cells. If the amount of silver deposited is 1.08 g, how much copper will deposited?

(Atomic mass of Cu = 63.54 g mol^{-1}, Ag = 108 g mol^{-1})

ii) What type of cells constitutes lead storage battery? Write anode, cathode and overall reaction taking place in cell when the current is drawn from it.

OR

i) Molar conductivities(Λ_m^o) at infinite dilution of NaCl, HCl and CH_3COONa are 126.4, 425.9 and 91.0 $Scm^2\ mol^{-1}$ respectively. Calculate Λ_m^o (in S $cm^2\ mol^{-1}$) for CH_3COOH. How much CH_3COOH will be in dissociated form at a particular concentration, if its molar conductivity is 78.1 $Scm^2\ mol^{-1}$?

ii) Identify the nature of electrolytes represented by **A** and **B** in given graph. Discuss the reason of these variations taking suitable example.