CHEMISTRY

Class 12 - Chemistry

Time Allowed: 3 hours   **Maximum Marks: 70**

General Instructions:

Read the following instructions carefully.

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 very 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

1. The order of reactivity of following alcohols with halogen acids is _____.   **[1]**

   A. CH_3CH_2 —CH_2—OH

   B. $CH_3CH_2 - CH - OH$
   $\quad\quad\quad\quad\quad | $
   $\quad\quad\quad\quad\ CH_3$

   C. $CH_3CH_2 - \overset{CH_3}{\underset{CH_3}{C}} - OH$

   a) (A) > (C) > (B)   b) (C) > (B) > (A)

   c) (B) > (A) > (C)   d) (A) > (B) > (C)

2. Nucleotides are composed of a: **[1]**

   a) pentose sugar and phosphoric acid   b) pentose sugar and nitrogenous base

   c) nitrogenous base, pentose sugar and   d) nitrogenous base and phosphoric acid
      phosphoric acid

3. One mole of a symmetrical alkane on ozonolysis gives two moles of an aldehyde having a molecular mass of   **[1]**
   44u. The alkene is:

   a) 1 – butene   b) 2 – butene

   c) Propene   d) Ethene

4. How many alcohols with molecular formula $C_4H_{10}O$ are chiral in nature?   **[1]**

a) 1

b) 4

c) 3

d) 2

5. The order of the reaction **[1]**

$H_2(g) + Cl_2(g) \xrightarrow{hv} 2HCl(g)$ is:

a) 3

b) 1

c) 0
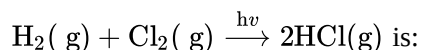
d) 2

6. Match the items given in column I with that in column II: **[1]**

Column I	Column II
(a) The cell reaction $2H_2 + O_2 \rightarrow 2H_2O$.	(i) Nickel-cadmium Storage Cell.
(b) Anodic Reaction is $Zn \rightarrow Zn^{2+} + 2e^-$.	(ii) Mercury Cell.
(c) Cathodic Reaction $HgO(s) + H_2O + 2e^- \rightarrow Hg(l) + 2OH^-$.	(iii) Bacon Cell.
(d) Anodic Reaction $Cd(s) + 2OH^-(aq) \rightarrow Cd(OH)_2(s) + 2e^-$.	(iv) Leclanche cell.

a) (a) - (i), (b) - (ii), (c) - (iii), (d) - (iv)

b) (a) - (ii), (b) - (i), (c) - (iv), (d) - (iii)

c) (a) - (iv), (b) - (ii), (c) - (iii), (d) - (i)

d) (a) - (iii), (b) - (iv), (c) - (ii), (d) - (i)

7. The correct IUPAC name of $CH_3 - \overset{\overset{\displaystyle CH_3}{|}}{\underset{\underset{\displaystyle OH}{|}}{C}} - CH_2CH_3$ is **[1]**

a) 3-Methylbutan-3-ol

b) tert-butyl alcohol

c) 2-Methylbutan-2-ol

d) 2,2-Dimethylpropanol

8. Two among the three components of DNA are β-D-2-deoxyribose and a heterocyclic base. The third component is: **[1]**

a) Uracil

b) Sulphuric acid

c) Phosphoric acid

d) Adenine

9. Order of the photochemical reaction occurring between hydrogen and chlorine is **[1]**

a) Second order

b) Third order

c) Zero order

d) First order

10. $CH_3 - C \equiv CH \xrightarrow[1\%HgSO_4]{40\%H_2SO_4} A \xrightarrow{Isomerisation} CH_3 - \overset{\overset{\displaystyle O}{||}}{C} - CH_3$ **[1]**

The structure of A and type of isomerism in the above reaction are respectively.

a) Prop-2-en-2-ol, geometrical isomerism

b) Prop–1–en–2–ol, metamerism

c) Prop-1-en-2-ol, tautomerism

d) Prop-1-en-1-ol, tautomerism

11. Aspirin is obtained by the acetylation of which of the following compounds? **[1]**

a) Acetyl salicylic acid

b) Salicylaldehyde

c) Salicylic acid

d) Phenol

12. In order to prepare a 1^0 amine from an alkyl halide with simultaneous addition of one CH_2 group in the carbon **[1]**

chain, the reagent used as source of nitrogen is _____.

   a) Sodium amide, $NaNH_2$
   b) Sodium azide, NaN_3

   c) Potassium phthalimide, $C_6H_4(CO)_2N^-K^+$
   d) Ethanolic NaCN

13. **Assertion (A):** Simple proteins on hydrolysis gives α-amino acids. **[1]**

    Reason (R): Prosthetic group is present in simple proteins.

    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.

14. **Assertion (A):** Aldol condensation is usually carried out in a dilute solution of a strong base. **[1]**

    Reason (R): Concentrated solution of strong base involves Cannizzaro reaction.

    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.

15. **Assertion (A):** Addition of Br_2 to but-1-ene gives two optical isomers. **[1]**

    Reason (R): The product contains one asymmetric carbon atom.

    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.

16. **Assertion (A):** Methoxy ethane reacts with HI to give ethanol and iodomethane. **[1]**

    Reason (R): Reaction of ether with HI follows S_N2 mechanism.

    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

17. What happens when **[2]**

   i. a pressure greater than osmotic pressure is applied on the solution side separated from solvent by a semipermeable membrane?

   ii. acetone is added to pure ethanol?

18. Arrange the given in increasing order of acidic character? **[2]**

    CrO_3, CrO, Cr_2O_3

19. **Answer the following:** **[2]**

    (a)   What are the units of a rate constant of a- **[1]**

        a. First order reaction

        b. n^th order reaction.

    (b)   If the activation energy of a reaction is zero, How will the temperature affect the rate of reaction? **[1]**

20. State Faraday's laws of electrolysis. How much charge in terms of Faraday is required for the reduction of 1 mol **[2]** of Cu^{2+} to Cu.

OR

The following curve is obtained when molar conductivity λ_m (y-axis) is plotted against the square root of concentration $C^{1/2}$ (x-axis) for two electrolytes A and B.
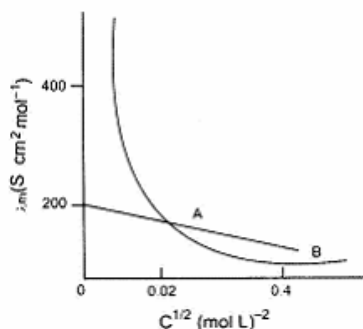
a. What can you say about the nature of the two electrolytes A and B?

b. How do you account for the increase in molar conductivity λ_m for the electrolytes A and B on dilution?

21. Give the IUPAC name of the following compound :- **[2]**
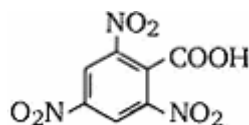
Section C

22. Consult the table of standard electrode potentials and suggest three substances that can oxidise ferrous ions under suitable conditions. **[3]**

23. Three geometrical isomers are possible for $[Co(en)(H_2O)_2(NH_3)_2]^{3+}$. Draw molecular structures of these three isomers. **[3]**

24. Write the equation of the reaction of hydrogen iodide with: **[3]**

   i. 1-propoxypropane

  ii. Methoxybenzene

 iii. Benzyl ethyl ether

OR
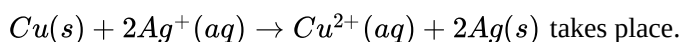
Write the structures of the isomers of alcohols with molecular formula $C_4H_{10}O$. Which of these exhibits optical activity?

25. Oxidation of ketones involves carbon-carbon bond cleavage. Name and write the products formed on oxidation of 2, 5-dimethylhexan-3-one. **[3]**
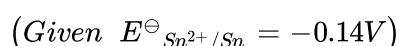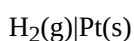
26. a. Write the formulation for the galvanic cell in which the reaction **[3]**

$Cu(s) + 2Ag^+(aq) \rightarrow Cu^{2+}(aq) + 2Ag(s)$ takes place.

Identify the cathode and the anode reactions in it.

b. Write Nernst equation and calculate the emf of the following cell: Sn(s) | Sn^{2+}(0.04M) || H$^+$(0.02M) | H$_2$(g)|Pt(s)

$\left(Given\ \ E^{\ominus}_{Sn^{2+}/Sn} = -0.14V\right)$

27. A hydrocarbon C_5H_{10} does not react with chlorine in dark but gives a single monochloro compound C_5H_9Cl in bright sunlight. Identify the hydrocarbon. **[3]**

28. What is meant by order and molecularity of a reaction? Distinguish between order and molecularity. **[3]**

Section D

29. **Read the following text carefully and answer the questions that follow:** **[4]**

Carbohydrates are essential for life in both plants and animals. Carbohydrates are used as storage molecules as starch in plants and glycogen in animals. Chemically they are polyhydroxy aldehydes or ketones. On the basis of their behaviour on hydrolysis, carbohydrates are classified as monosaccharides, oligosaccharides and polysaccharides. All monosaccharides are reducing sugars, i.e., they are oxidized by Tollens' reagent and Fehling's solution. A monosaccharide like glucose is aldohexose and its molecular formula was found to be $C_6H_{12}O_6$. After reacting with different reagents like HI, H_2N - OH, Bromine water, $(CH_3CO)_2O$, etc. its structure was found to contain one aldehyde group, one primary alcoholic group, ($-CH_2OH$) and four secondary alcoholic

groups (> CHOH). Despite having the aldehyde group, glucose does not give some of the reactions of aldehyde group like Schiff's test, $NaHSO_3$ addition. This explains the existence of glucose in two cyclic hemiacetal forms which differ only in the configuration of the hydroxyl group at C-1.

Answer the following questions:

a. What are reducing sugars? **(1)**

b. Classify the following into monosaccharide and disaccharide:

Fructose, Sucrose, Lactose, Galactose **(1)**

c. Name the polysaccharide which is known as 'animal starch'. Why is it called 'animal starch'? **(2)**

OR

i. Name the isomers of glucose which in the cyclic form differ only in the configuration of the -OH group at C-1.

ii. Presence of which functional group was detected when glucose reacted with Br_2 water? **(2 $\times$ 1 = 2)**

30. **Read the following text carefully and answer the questions that follow:** **[4]**

The Valence Bond Theory (VBT) explains the formation, magnetic behaviour and geometrical shapes of coordination compounds whereas "The Crystal Field Theory" for coordination compounds is based on the effect of different crystal fields (provided by ligands taken as point charges), on the degeneracy of d-orbital energies of the central metal atom/ion. The splitting of the d-orbitals provides different electronic arrangements in strong and weak crystal fields. The crystal field theory attributes the colour of the coordination compounds to d-d transition of the electron. Coordination compounds find extensive applications in metallurgical processes, analytical and medicinal chemistry.

Answer the following questions:

a. What is crystal field splitting energy? **(1)**

b. Give reason for the violet colour of the complex $[Ti(H_2O)_6]^{3+}$ on the basis of crystal field theory. **(1)**

c. $[Cr(NH_3)_6]^{3+}$ is paramagnetic while $[Ni(CN)_4]^{2-}$ is diamagnetic. Explain why. [Atomic No.: Cr = 24, Ni = 28] **(2)**

OR

Explain why $[Fe(CN)_6]^{3-}$ is an inner orbital complex, whereas $[Fe(H_2O)_6]^{3+}$ is an outer orbital complex. **(2)**

[Atomic No.: Fe = 26]

Section E

31. **Attempt any five of the following:** **[5]**

(a) Suggest reasons for the following features of transition metal chemistry: **[1]**

i. The transition metals and their compounds are usually paramagnetic.

ii. The transition metals exhibit variable oxidation states.

(b) Give the structure of dichromate ion. **[1]**

(c) Why Lanthanoids are called f-block element? **[1]**

(d) Reactivity of transition elements decreases almost regularly from Sc to Cu. Explain. **[1]**

(e) In the series Sc (Z = 21) to Zn (Z = 30) the enthalpy of atomization of Zinc is the lowest, i.e. 126 kJ mol^{-1} Why? **[1]**

(f) The second and third rows of transition elements resemble each other much more than they resemble the first row. Explain why? **[1]**

(g) Sc(21), is a transition element but Ca(20) is not. Why? **[1]**

32. Vapour pressure of pure water at 298 K is 23.8 mm Hg. 50 g of urea (NH_2CONH_2) is dissolved in 850 g of water. Calculate the vapour pressure of water for this solution and its relative lowering. **[5]**

OR

Heptane and octane form an ideal solution. At 373 K, the vapour pressures of the two liquid components are 105.2 kPa and 46.8 kPa respectively. What will be the vapour pressure of a mixture of 26.0 g of heptane and 35 g of octane?

33. i. Illustrate the following reactions giving suitable example in each case: **[5]**

    a. Ammonolysis

    b. Coupling reaction

    c. Acetylation of amines

ii. Describe Hinsberg method for the identification of primary, secondary and tertiary amines. Also, write the chemical equations of the reactions involved.

OR

How will you convert:

 i. Ethanoic acid into methanamine

 ii. Hexanenitrile into 1-aminopentane

iii. Methanol to ethanoic acid

iv. Ethanamine into methanamine

 v. Ethanoic acid into propanoic acid