☐ Please check that this question paper contains **11** printed pages.

☐ Code number given on the right hand side of the question paper should be written on the title page of the answer-book by the candidate.

☐ Please check that this question paper contains **29** questions.

☐ **Please write down the Serial Number of the question before attempting it.**

☐ 15 minutes time has been allotted to read this question paper. The question paper will be distributed at 10.15 a.m. From 10.15 a.m. to 10.30 a.m., the students will read the question paper only and will not write any answer on the answer-book during this period.

## Chemistry(Theory)

Time allowed : 3 hours   *Maximum Marks : 100*

General Instructions :

(i)   ***All*** *questions are compulsory.*

(ii)   *Question numbers 1 to 8 are very short-answer questions and carry 1 mark.*

(iii)   *Question numbers 9 to 18 are short-answer questions and carry 2 marks each.*

(iv)   *Question numbers 19 to 27 are also short-answer questions and carry 3 marks each.*

(v)   *Question numbers 28 to 30 are long-answer questions and carry 5 marks each*

(vi)   *Use Log Tables, if necessary. Use of calculators is not allowed.*

1. **Give one example each of sol and gel.**

2. **Which reducing agent is employed to get copper from the leached low grade copper ore?**

3. **Write the IUPAC name of the compound**

$$CH_3 - CH - CH_2 - CHO$$
$$\quad\quad\; |$$
$$\quad\quad NH_2$$
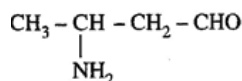
4. **Which of the following isomers is more volatile:**

   O-nitrophenol or p-nitrophenol ?

5. **Some liquids on mixing from 'azeotropes'/ what are 'azeotropes'?**

6. **Arrange the following in increasing order of basic strength:**

   $C_6H_5NH_2$, $C_6H_5NHCH_3$, $C_6H_5CH_2NH_2$

7. **Which component of starch is a branched polymer of α-glucose and insoluble in water?**

8. **Which of the following is more stable complex and why?**

   $[Co(NH_3)_6]^{3+}$ and $[Co(en)_3]^{3+}$
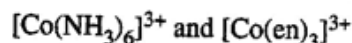
9. **State Henry's law. What is the effect of temperature on the solubility of a gas in a liquid?**
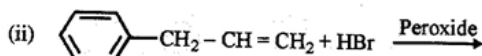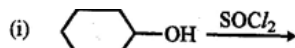
10. **Define the following terms:**

    (i)   **Pseudo first order reaction.**

    (ii)   **Half life period of reaction $(t_{\frac{1}{2}})$.**

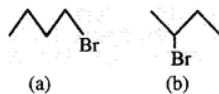11. **Write the principle behind the following methods of refining:**

    (i)   **Hydraulic washing**

    (ii)   **Vapour phase refining**

12. Draw the structure of major monohalo product in each of the following reactions:

    (i) ⬡—OH $\xrightarrow{SOCl_2}$

    (ii) ⬡—$CH_2 - CH = CH_2 + HBr$ $\xrightarrow{\text{Peroxide}}$

13.

    (i)   **Which alkyl halide from the following pair is chiral and undergoes faster**

            S_N2 **reaction?**

    (a)   (b)
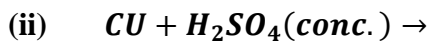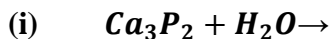
    (ii)   **Out of S_N1 and S_N2, which reaction occurs with**

            (a) Inversion of configuration

(b) Racemization

14. Complete the following chemical equations:

    (i) $Ca_3P_2 + H_2O \rightarrow$

    (ii) $CU + H_2SO_4(conc.) \rightarrow$

<div align="center">OR</div>

Arrange the following in the order of property indicated against each set:

    (i)   HF,HCl,HBr,HI – increasing bond dissociation enthalpy.

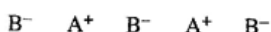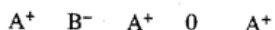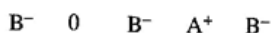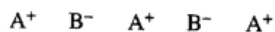   (ii) H_2O, H_2S, H_2Se, H_2Te – increasing acidic character.
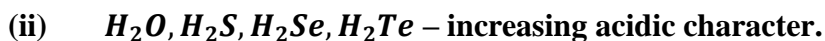
15. Write the IUPAC name of the complex [$Cr(NH_3)_4Cl_2$]$^+$. What type of isomerism does it exhibit?

16. An element with density 11.2 g cm^{-3} forms a f.c.c lattice with edge length of 4x $10^{-8} cm$. Calculate the atomic mass of the element.

    (Given : $N_A = 6.022$ x 10^{23} mol^{-1})

17. Examine the given defective crystal

A$^+$	B$^-$	A$^+$	B$^-$	A$^+$
B$^-$	0	B$^-$	A$^+$	B$^-$
A$^+$	B$^-$	A$^+$	0	A$^+$
B$^-$	A$^+$	B$^-$	A$^+$	B$^-$

    Answer the following questions:
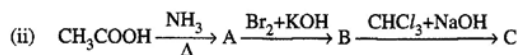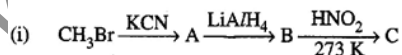
    (i)   What type of stoichiometric defect is shown by the crystal?

    (ii)   How is the density of the crystal affected by this defect?

    (iii) What type of ionic substances show such defect?

18. Calculate the mass of compound (molar mass= 256g mol^{-1}) to be dissolved in 75g of benzene to lower its freezing point by 0.48 K ($K_f = 5.12$ K kg mol^{-1}).

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

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

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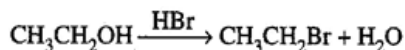
    OR

    How will you convert the following:

    (i)   Nitrobenzene into aniline

(ii)   **Ethanoic acid into methanamine**

(iii)   **Aniline into N-phenylethanamide**

        (write the chemical equations involved.)

20.

(a) **Write the mechanism of the following reaction:**

$$CH_3CH_2OH \xrightarrow{HBr} CH_3CH_2Br + H_2O$$

(b) **Write the equation involved in Reimer-Tiemann reaction.**

21. **After the ban on plastic bags, students of one school decided to make people aware of the harmful effects of plastic bags on environment and Yamuna river. To make the awareness more impactful, they organized rally by joining hands with other schools and distributed paper bags to vegetable vendors, shopkeepers and departmental stores. All students pledged not to use polythene bags in future to save Yamuna River.**

   After reading the above passage, answer the following questions:

   (i)   **What values are shown by the students?**

   (ii)   **What are biodegradable polymers? Give one example.**

   (iii) **Is polythene a condensation or an addition polymer?**

22.

(a) **Draw the structure of the following :**

   (i) XeF_2
   (ii) BrF_3

(b) **Write the structural difference between white phosphorus and red phosphorus.**

23.

(a) **In reference to Freundlich adsorption isotherm write the expression for adsorption of gases on solids in the form of an equation.**

(b) **Write an important characteristic of lyophilic sols.**

(c) **Bases on type of particles of dispersed phase, give one example each of associated colloid and multimolecular colloid.**

24. **Account for the following:**

   (i)   **Bi(V) is a stronger oxidizing agent than Sb(V).**

   (ii)   **N-N single bond is weaker than P-P single bond.**

(iii) Noble gases have very low boiling point.

25.

(i) Name the sweetening agent used in the preparation of sweets for a diabetic patient.

(ii) What are antibiotics? Give an example

(iii) Give two examples of macromolecules that are chosen as drug targets.

26. The following data were obtained during the first order thermal decomposition of SO_2Cl_2 at a constant volume:

$$SO_2Cl_2(g) \longrightarrow SO_2(g) + Cl_2(g)$$

Experiment	Time/s^{-1}	Total pressure/atm
1	0	0.4
2	100	0.7

Calculate the rate constant.

(given: log 4=0.6021 , log 2 = 0.3010)
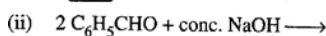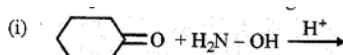
27.

(i) Deficiency of which vitamin causes rickets?

(ii) Give an example for each of fibrous protein and globular protein.

(iii) Write the product formed on reaction of D-glucose with Br_2 water.

28.

(a) Write the products of the following reactions :

(i) $=O + H_2N-OH \xrightarrow{H^+}$

(ii) $2\ C_6H_5CHO + \text{conc. NaOH} \longrightarrow$

(iii) $CH_3COOH \xrightarrow{Cl_2/P}$

(b) Give simple chemical tests to distinguish between the following pairs of compounds:

(i) Benzaldehyde and Benzoic acid

(ii) Propanal and Propanone

<p align="center">OR</p>

(a) Account for the following:

(i) CH_3CHO is more reactive than CH_3COCH_3 towards reaction with HCN.

(ii) Carboxylic acid is a stronger acid than phenol.

(b) Write the chemical equations to illustrate the following name reactions:

(i) **Wolff-Kishner reduction**

(ii) **Aldol condensation**

(iii) **Cannizzaro reaction**
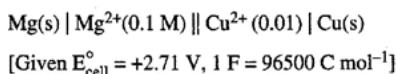
29.

(a) Define the following terms:

    (i) **Limiting molar conductivity**

    (ii) **Fuel cell**

(b) Resistance of a conductivity cell filled with 0.1 mol L^{-1} KCl solution is 100 Ω.is the resistance of the same cell when filled with 0.02 mol L^{-1} KCl solution is 520Ω, calculate the conductivity and molar conductivity of 0.02 mol L^{-1} KCl solution. The conductivity of 0.1 mol L^{-1} KCl solution is 1.29 x $10^{-2}\Omega^{-1}cm^{-1}$.

<div align="center">OR</div>

(a) State Faraday's first law of electrolysis. How much charge in terms of Faraday is required for the reduction of 1 mol of Cu^{2+} to Cu.

(b) Calculate emf of the following cell at 298 K:

$$Mg(s) \,|\, Mg^{2+}(0.1 \text{ M}) \,\|\, Cu^{2+}(0.01) \,|\, Cu(s)$$
[Given E°_{cell} = +2.71 V, 1 F = 96500 C mol^{-1}]

30.

(a) How do you prepare:

    (i) K_2MnO_4 $from$ MnO_2?

    (ii) $Na_2Cr_2O_7$ $from$ Na_2CrO_4?

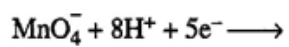(b) Account for the following:

    (i) Mn^{2+} is more stable than Fe^{2+} towards oxidation to +3 state.

    (ii) The enthalpy of atomization is lowest for Zn in 3d series of the transition elements.

    (iii) Actinoid elements show wide range of oxidation states.

<div align="center">OR</div>

(i) Name the element of 3d transition series which shows maximum number of oxidation states. Why does it show so?

(ii) Which transition metal of 3d series has positive E° (M^{2+}/M) value and why?

(iii) Out of Cr^{3+} *and* Mn^{3+}, which is a stronger oxidizing agent and why?

(iv) Name a member of the lanthanoid series which is well known to exhibit +2 oxidation state.

(v) Complete the following equation:

$$MnO_4^- + 8H^+ + 5e^- \longrightarrow$$