

Time: 3 hrs. Total Marks: 70

**General Instruction:**

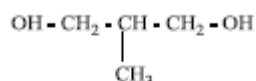
There are total **26** questions and five sections in the question paper.

All questions are compulsory

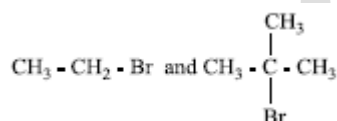
1. Section A contains questions number **1 to 5**; very short answer type questions of 1 mark each.
2. Section B contains questions number **6 to 10**, short-answer type I questions of 2 marks each.
3. Section C contains questions number **11 to 22**, short answer type II questions of 3 marks each.
4. Section D contains question number **23**, value based question of 4 marks.
5. Section E contains questions number **24 to 26**, long-answer type questions of 5 marks each.
6. There is no overall choice in the question paper; however, an internal choice is provided in one question of 2 marks, one question of 3 marks and all the three questions of 5 marks. In these questions, an examinee is to attempt any of the two given alternatives.

**Section A**

1. Write a method by which lyophobic colloids can be coagulated.
2. What is the formula of a compound in which the element Y forms hcp lattice and atoms of X occupy 2/3rd of tetrahedral voids?
3. Out of white phosphorus and red phosphorus, which one is more reactive and why?
4. Write the IUPAC name of the given compound:



5. Which would undergo SN1 reaction faster in the following pair and why?



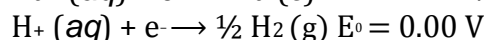
6. State Henry's law. Why do gases always tend to be less soluble in liquids as the temperature is raised?

**OR**

State Raoult's law for the solution containing volatile components. Write two differences between an ideal solution and a non-ideal solution.

7.

(a) Following reactions occur at cathode during the electrolysis of aqueous sodium chloride solution:



On the basis of their standard reduction electrode potential ( $E^\circ$ ) values, which reaction is feasible at the cathode and why?

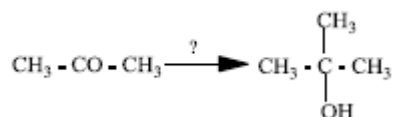
(b) Why does the cell potential of mercury cell remain constant throughout its life?

8. Why do the transition elements have higher enthalpies of atomization? In 3d series (Sc to Zn), which element has the lowest enthalpy of atomization and why?

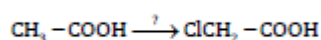
9. (i) Write down the IUPAC name of the following complex:  $[\text{Co}(\text{NH}_3)_5(\text{NO}_2)](\text{NO}_3)_2$   
 (ii) Write the formula for the following complex: Potassium tetracyanonickelate (II)

10. Name the reagents used in the following reactions:

(i)



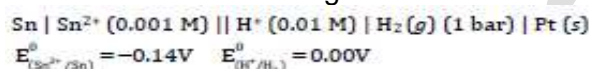
(ii)



11. Calculate the amount of  $\text{CaCl}_2$  (molar mass =  $111 \text{ g mol}^{-1}$ ) which must be added to 500 g of water to lower its freezing point by 2 K, assuming  $\text{CaCl}_2$  is completely dissociated. ( $K_f$  for water =  $1.86 \text{ K kg mol}^{-1}$ )

12. An element with density  $10 \text{ g cm}^{-3}$  forms a cubic unit cell with edge length of  $3 \times 10^{-8} \text{ cm}$ . What is the nature of the cubic unit cell if the atomic mass of the element is  $81 \text{ g mol}^{-1}$ ?

13. Calculate emf of the following cell at  $25^\circ\text{C}$ :



14. Give reasons for the following observations:

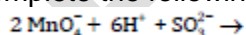
- Physisorption decreases with increase in temperature.
- Addition of alum purifies the water.
- Brownian movement provides stability to the colloidal solution

15.

- Name the method used for the refining of zirconium.
- What is the role of CO in the extraction of Iron?
- Reduction of metal oxide to metal becomes easier if the metal obtained is in liquid state. Why?

16.

- How would you account for the following:
  - The chemistry of actinoids is more complicated as compared to lanthanoids.
  - Transition metals form complex compounds.
- Complete the following equation:



17.

- Draw the geometrical isomers of complex  $[\text{Co}(\text{en})_2\text{Cl}_2]^+$ .
- On the basis of crystal field theory, write the electronic configuration for d4 ion if  $\Delta_0 > P$ .
- $[\text{NiCl}_4]^{2-}$  is paramagnetic, while  $[\text{Ni}(\text{CO})_4]$  is diamagnetic, though both are tetrahedral. Why? (Atomic number of Ni = 28)

18. How do you convert the following:
- Prop-1-ene to 1-fluoropropane
  - Chlorobenzene to 2-chlorotoluene
  - Ethanol to propane nitrile

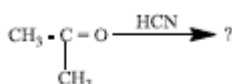
OR

Write the main products when

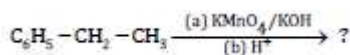
- n-butyl chloride is treated with alcoholic KOH.
  - 2, 4, 6-trinitrochlorobenzene is subjected to hydrolysis.
  - methyl chloride is treated with AgCN.
19. Give reasons for the following:
- o-nitrophenol is more acidic than o-methoxyphenol.
  - Butan-1-ol has a higher boiling point than diethyl ether.
  - $(\text{CH}_3)_3\text{C}-\text{O}-\text{CH}_3$  on reaction with HI gives  $(\text{CH}_3)_3\text{C}-\text{I}$  and  $\text{CH}_3-\text{OH}$  as the main products and not  $(\text{CH}_3)_3\text{C}-\text{OH}$  and  $\text{CH}_3-\text{I}$ .

20. Predict the products of the following reactions:

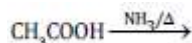
(i)



(ii)



(iii)



21. Write the names and structures of the monomers of the following polymers: [3]

- Nylon-6
- Novolac
- Buna-N

22.

- Which one of the following is a polysaccharide: Starch, Maltose, Fructose, Glucose
- What is the difference between native protein and denatured protein?
- Write the name of the vitamin responsible for the coagulation of blood.

23. Seeing the growing cases of diabetes and depression among young children, Mr. Lugani, the principal of one reputed school, organised a seminar in which he invites parents and principals. They all resolved this issue by strictly banning junk food in schools and introducing healthy snacks and drinks like soup, lassi, milk etc. in school canteens. They also decided to make compulsory half an hour of daily physical activities for the students in the health survey in most of the school and discovered a tremendous improvement in the health of the students. After reading the above passage, answer the following questions:
- What are the values (at least two) displayed by Mr. Lugani?
  - As a student, how can you spread awareness about this issue?
  - What are antidepressant drugs? Give an example.
  - Name the sweetening agent used in the preparation of sweets for a diabetic patient.

- 24.
- (a) Illustrate the following reaction giving suitable example in each case:
- Hoffmann bromamide degradation reaction
  - Diazotization
  - Gabriel phthalimide synthesis
- (b) Distinguish between the following pairs of compounds:
- Aniline and N-methyl aniline
  - $(\text{CH}_3)_2\text{NH}$  and  $(\text{CH}_3)_3\text{N}$
- OR**
- (a) Write the structures of main products when benzene diazonium chloride  $(\text{C}_6\text{H}_5\text{N}_2^+\text{Cl}^-)$  reacts with the following reagents:
- $\text{CuCN/KCN}$
  - $\text{H}_2\text{O}$
  - $\text{CH}_3\text{CH}_2\text{OH}$
- (b) Arrange the following:
- $\text{C}_2\text{H}_5\text{NH}_2$ ,  $\text{C}_2\text{H}_5\text{OH}$ ,  $(\text{CH}_3)_3\text{N}$  – in the increasing order of their boiling point
  - Aniline, p-nitro aniline, p-methyl aniline - in the increasing order of their basic strength
- 25.
- (a) What is rate of reaction? Write two factors that affect the rate of reaction.
- (b) The rate constant of a first order reaction increases from  $4 \times 10^{-2}$  to  $8 \times 10^{-2}$  when the temperature changes from  $27^\circ\text{C}$  to  $37^\circ\text{C}$ . Calculate the energy of activation ( $E_a$ ).  
( $\log 2 = 0.301$ ,  $\log 3 = 0.4771$ ,  $\log 4 = 0.6021$ )
- OR**
- (a) For a reaction  $\text{A} + \text{B} \rightarrow \text{P}$ , the rate is given by  $\text{Rate} = k [\text{A}] [\text{B}]^2$
- How is the rate of reaction affected if the concentration of B is doubled?
  - What is the overall order of reaction if A is present in large excess?
- (b) A first order reaction takes 23.1 minutes for 50% completion. Calculate the time required for 75%  
( $\log 2 = 0.301$ ,  $\log 3 = 0.4771$ ,  $\log 4 = 0.6021$ )
- 26.
- (a) Account for the following:
- Interhalogens are more reactive than pure halogens.
  - $\text{N}_2$  is less reactive at room temperature.
  - Reducing character increases from  $\text{NH}_3$  to  $\text{BiH}_3$ .
- (b) Draw the structures of the following:
- $\text{H}_4\text{P}_2\text{O}_7$  (Pyrophosphoric acid)
  - $\text{XeF}_4$
- OR**
- (a) Which poisonous gas is evolved when white phosphorus is heated with conc. NaOH solution? Write the chemical equation involved.
- (b) Which noble gas has the lowest boiling point?
- (c) Fluorine is a stronger oxidising agent than chlorine. Why?
- (d) What happens when  $\text{H}_3\text{PO}_3$  is heated?
- (e) Complete the equation:  
 $\text{PbS} + \text{O}_3 \rightarrow$