



Set~4

Series 1HKPQ6/C

Code No. **56(B)**

Roll No.

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Candidates must write the Code on the title page of the answer-book.

- Please check that this question paper contains **18** 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 **33** questions.
- **Please write down the serial number of the question in the answer-book before attempting it.**
- 15 minute 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)



(FOR VISUALLY IMPAIRED CANDIDATES ONLY)

Time allowed : 3 hours

Maximum Marks : 70



General Instructions :

Read the following instructions very carefully and strictly follow them :

- (i) This question paper comprises **four** Sections – **A, B, C** and **D**. There are **33** questions in the question paper. **All** questions are compulsory.
- (ii) **Section A** – Questions no. **1** to **16** are very short answer type questions, with each question / part carrying **1** mark.
- (iii) **Section B** – Questions no. **17** to **25** are short answer type questions, carrying **2** marks each.
- (iv) **Section C** – Questions no. **26** to **30** are long answer type-I questions, carrying **3** marks each.
- (v) **Section D** – Questions no. **31** to **33** are long answer type-II questions, carrying **5** marks each.
- (vi) There is no overall choice in the question paper. However, an internal choice has been provided in 7 questions / parts of one mark, 3 questions of two marks, 2 questions of three marks and all the 3 questions of five marks. You have to attempt only one of the choices in such questions.
- (vii) In addition to this, separate instructions are given with each section and question, wherever necessary.
- (viii) Use of calculators and log tables is **not** permitted.

SECTION A

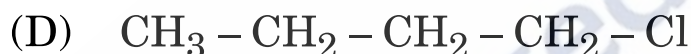
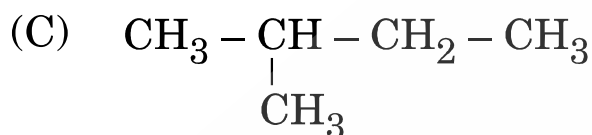
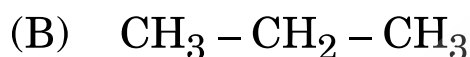
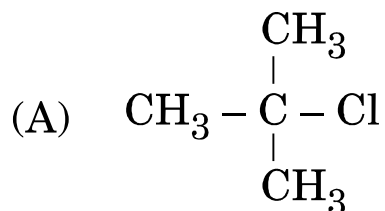
1. Read the passage given below and answer the following questions : $4 \times 1 = 4$

The carbon-halogen bond of alkyl halide is polarised due to high electronegativity of halogen. The boiling points of alkyl halides are comparatively higher than the corresponding hydrocarbons. These are slightly soluble in water but completely soluble in organic solvents. The polarity of C – X bond of alkyl halides is responsible for their nucleophilic substitution, elimination and their reaction with metal atoms. Nucleophilic substitution reactions are categorised as S_N1 and S_N2 on the basis of their kinetic properties.

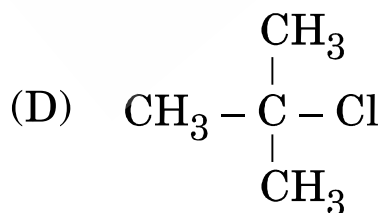
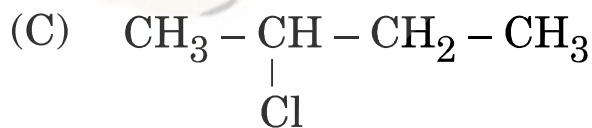
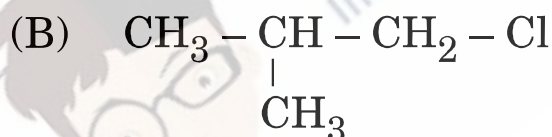


The following questions are multiple choice questions :

(i) Which of the following has the lowest boiling point ?



(ii)(a) Which of the following is least reactive towards $\text{S}_{\text{N}}2$ reaction ?



OR



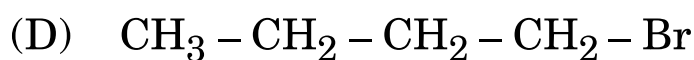
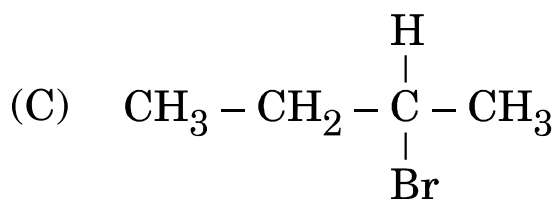
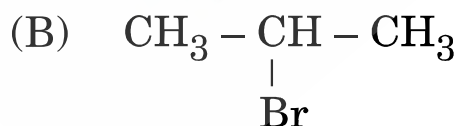
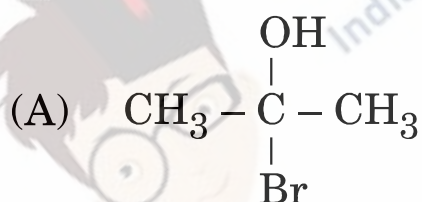
(ii)(b) Which of the following is most reactive towards S_N1 reaction ?

- (A) 1-Bromopentane
- (B) 1-Bromo-2-methylbutane
- (C) 2-Bromopentane
- (D) 1-Bromo-3-methylbutane

(iii) The IUPAC name of $\text{CH}_3 - \text{CH} = \text{CH} - \underset{\text{Cl}}{\text{CH}} - \text{CH}_3$ is :

- (A) 2-Chloropent-3-ene
- (B) 4-Chloropent-3-ene
- (C) 4-Chloropent-2-ene
- (D) 2-Chloropent-4-ene

(iv) Which of the following molecules is chiral in nature ?





2. Read the passage given below and answer the following questions : 4×1=4

Adsorption is the phenomenon of attracting and retaining the molecules of a substance on the surface of a solid resulting into a higher concentration on the surface than in the bulk, while in absorption the substance is uniformly distributed throughout the bulk of the solid. Heat is released during adsorption. Depending upon the forces there are two types of adsorption : Physisorption and Chemisorption. The relationship between extent of adsorption and pressure of the gas at constant temperature is known as Freundlich adsorption isotherm.

In the following questions (Q. No. 2 (i) – (iv)) a statement of assertion followed by a statement of reason is given. Choose the correct answer out of the following choices.

- (A) Assertion and Reason both are correct statements and Reason is the correct explanation of the Assertion.
- (B) Assertion and Reason both are correct statements, but Reason is ***not*** the correct explanation of the Assertion.
- (C) Assertion is a correct statement, but Reason is a wrong statement.
- (D) Assertion is a wrong statement, but Reason is a correct statement.

(i) ***Assertion :*** Adsorption is endothermic in nature.

Reason : The residual attractive forces of the adsorbent are responsible for attracting the adsorbate on its surface.



(ii) (a) *Assertion* : Absorption is a bulk phenomenon.

Reason : Silica gel shows adsorption while anhydrous calcium chloride shows absorption.

OR

(b) *Assertion* : Aqueous solution of raw sugar when passed through charcoal becomes colourless.

Reason : The colouring substances are adsorbed by the charcoal.

(iii) *Assertion* : Physisorption is specific in nature.

Reason : Physisorption arises due to van der Waals forces.

(iv) *Assertion* : The extent of adsorption $\left(\frac{x}{m}\right)$ is constant at high pressure.

Reason : At high pressure $\frac{1}{n} = 0$ and $\frac{x}{m} = \text{constant}$.

The following questions (Q. No. 3 to 11) are multiple choice questions :

3. Nucleic acids are polymers of :

1

- (A) D-ribose
- (B) Amino acids
- (C) Nucleotides
- (D) Nucleosides



4. (a) Which of the following has d^5 configuration ? 1
(Atomic number Mn = 25, Cr = 24, Ti = 22, Cu = 29)
- (A) Mn^{2+}
(B) Cr^{2+}
(C) Ti^{2+}
(D) Cu^{2+}

OR

- (b) Which one of the following transition metals does *not* show variable oxidation states ? 1
(Atomic number Sc = 21, Fe = 26, Cr = 24, Cu = 29)
- (A) Sc
(B) Cr
(C) Cu
(D) Fe

5. (a) What type of defect is shown by NaCl ? 1
- (A) Frenkel defect
(B) Schottky defect
(C) Both Frenkel and Schottky defect
(D) Impurity defect

OR



(b) Which of the following will create F-centre in a crystal ? 1

- (A) ZnS
- (B) NaCl
- (C) AgCl
- (D) AgBr

6. The maximum covalency of nitrogen in N_2O_5 is : 1

- (A) 2
- (B) 4
- (C) 3
- (D) 5

7. (a) The oxidation state of Co in $[Co(NH_3)_4Cl_2]Cl$ is : 1

- (A) +3
- (B) +2
- (C) +4
- (D) +6

OR

(b) Which one of the following is a homoleptic complex ? 1

- (A) $[Pt(NH_3)_2Cl_2]$
- (B) $[Co(NH_3)_4Cl_2]^+$
- (C) $K_4[Fe(CN)_6]$
- (D) $[Co(NH_3)_4Cl(NO_2)]Cl$



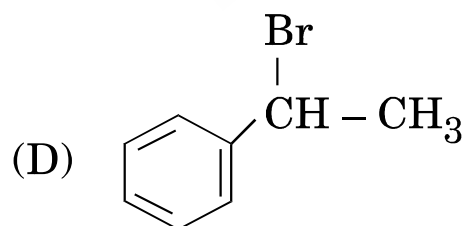
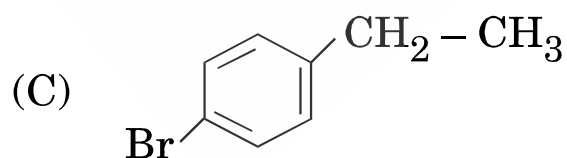
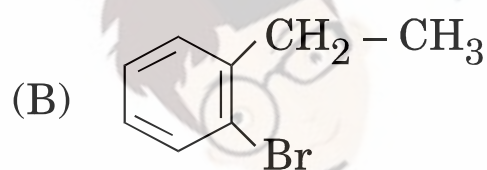
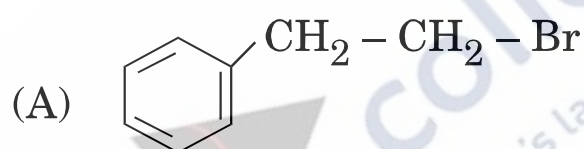
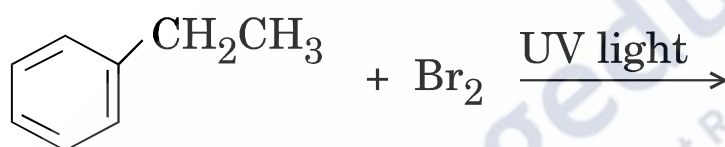
8. Which of the following ligands form a 'chelate' complex with metal ion ?

1

- (A) H_2O
- (B) $\text{H}_2\text{N} - \text{CH}_2 - \text{CH}_2 - \text{NH}_2$
- (C) NH_3
- (D) Cl

9. The major product formed in the following reaction is :

1





10. The formula of the coordination compound pentaamminenitrito-O-cobalt(III) is : 1

- (A) $[\text{Co}(\text{NH}_3)_5(\text{NO}_2)]^+$
- (B) $[\text{Co}(\text{NH}_3)_5(\text{NO}_2)]^{2+}$
- (C) $[\text{Co}(\text{NH}_3)_5(\text{ONO})]^{2+}$
- (D) $[\text{Co}(\text{NH}_3)_5(\text{ONO})]^+$

11. (a) Which of the following is *not* a molecular solid ? 1

- (A) N_2
- (B) I_2
- (C) SiC
- (D) CO_2

OR

(b) The number of atoms per unit cell in a body-centred cubic unit cell is 1

- (A) 4
- (B) 2
- (C) 1
- (D) 3



In the following questions (Q. No. 12 – 16) a statement of assertion followed by a statement of reason is given. Choose the correct answer out of the following choices.

- (A) Assertion and Reason both are correct statements and Reason is the correct explanation of the Assertion.
- (B) Assertion and Reason both are correct statements, but Reason is **not** the correct explanation of the Assertion.
- (C) Assertion is a correct statement, but Reason is a wrong statement.
- (D) Assertion is a wrong statement, but Reason is a correct statement.

- 12.** *Assertion :* p -nitrophenol is more acidic than phenol.
Reason : Nitro group is electron withdrawing group and stabilizes p -nitrophenoxide ion. 1
- 13.** *Assertion :* Despite having an aldehydic group glucose does not give 2,4-DNP test.
Reason : Glucose is a reducing sugar. 1
- 14.** (a) *Assertion :* Iron on reaction with HCl gives FeCl_2 and not FeCl_3 .
Reason : Cl_2 gas produced from the reaction prevents the oxidation of FeCl_2 to FeCl_3 . 1

OR

- (b) *Assertion :* Fluorine has less negative $\Delta_{\text{eg}}\text{H}^\circ$ than chlorine.
Reason : Fluorine has smaller size than chlorine. 1



15. *Assertion :* Propanone is more reactive towards nucleophilic addition as compared to propanal.

Reason : Propanone gives 2,4-DNP test. 1

16. *Assertion :* Noble gases have very low boiling points.

Reason : Noble gases have very weak dispersion forces. 1

SECTION B

The following questions (Q. No. 17 to 25) are short answer type and carry 2 marks each : 9×2=18

- 17.** (a) Write the structures of the products when
- Phenol is treated with bromine water, and
 - Propanol is heated with Cu at 573 K. 2×1=2

OR

- (b) Carry out the following conversions : 2×1=2
- Ethanol to ethyl cyanide
 - Phenol to acetophenone
- 18.** Write two differences between an Ideal solution and Non-ideal solution. 2

- 19.** (a) Write the hybridisation, shape, magnetic behaviour and IUPAC name of the complex $[\text{Fe}(\text{CN})_6]^{4-}$. (Atomic number of Fe = 26) 2

OR

- (b) What is crystal field splitting energy ? How does the magnitude of Δ_0 decide the actual configuration of d-orbitals in a coordination entity ? 2



20. For a first order reaction, show that time required for 99% completion is twice the time required for the completion of 90% of reaction. ($\log 10 = 1$) 2

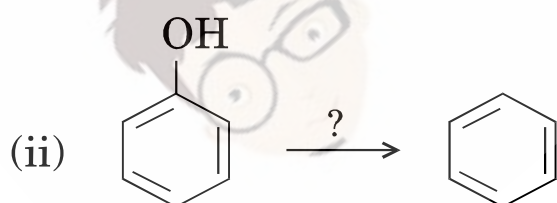
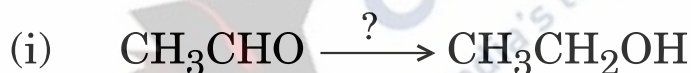
21. (a) Account for the following : 2×1=2

- (i) Transition metals show variable oxidation states.
- (ii) Trivalent lanthanoid ions are coloured both in solid state and aqueous solutions.

OR

(b) Why does Mn show maximum number of oxidation states ? Which oxidation state of Mn is most stable and why ? 2

22. Write the name of reagent(s) used in the following reactions : 2×1=2



23. Why is chlorobenzene less reactive towards nucleophilic substitution ? Give two reasons. 2

24. Write the equations involved in the following reactions : 2×1=2

- (i) Hoffmann bromamide degradation
- (ii) Diazotisation



25. An element with molar mass 72 g mol^{-1} forms a cubic unit cell with edge length 400 pm . If its density is 7.5 g cm^{-3} , identify the nature of the cubic unit cell. 2

SECTION C

Q. No. 26 to 30 are long answer type-I questions carrying 3 marks each. $5 \times 3 = 15$

26. (a) What happens when
- (i) bromobenzene is treated with Mg in the presence of dry ether;
 - (ii) chlorobenzene is treated with CH_3Cl in the presence of anhydrous AlCl_3 ; and
 - (iii) methyl chloride is treated with AgCN ? $3 \times 1 = 3$

OR

- (b) Do the following conversions : $3 \times 1 = 3$
- (i) Chloroethane to butane
 - (ii) 2-bromopropane to 1-bromopropane
 - (iii) Ethyl chloride to propanoic acid

27. (i) Why is $E^\circ_{\text{Cu}^{2+}/\text{Cu}}$ exceptionally positive ?
- (ii) Why is Sc^{3+} colourless but Ti^{3+} is coloured ?
- (iii) Why do transition metals and their compounds show catalytic activities ? $3 \times 1 = 3$



28. (a) Define the following terms : 3×1=3

- (i) Anomers
- (ii) Peptide linkage
- (iii) Denatured protein

OR

(b) What happens when glucose is treated with : 3

- (i) bromine water ?
- (ii) HI ?
- (iii) $\text{H}_2\text{N} - \text{OH}$?

29. Vapour pressure of water at 293 K is 17.536 mm Hg. Calculate the vapour pressure of aqueous solution when 20 g of glucose (Molar mass = 180 g mol^{-1}) is dissolved in 500 g of water. 3

30. A first order reaction takes 30 minutes for 60% decomposition. Calculate $t_{1/2}$. 3

[Given : $\log 2 = 0.3010$, $\log 3 = 0.4771$, $\log 4 = 0.6021$, $\log 10 = 1$]

SECTION D

Q. No. 31 to 33 are long answer type-II questions carrying 5 marks each. 3×5=15

31. (a) (i) Account for the following :

- (I) NH_3 is a stronger base than PH_3 .
- (II) Oxygen shows -2 oxidation state except in OF_2 .
- (III) Fluorine shows anomalous behaviour.



(ii) What happens when

(I) Cl_2 reacts with cold and dilute NaOH ; and

(II) Cu reacts with concentrated H_2SO_4 ? 3+2=5

OR

(b) (i) Arrange the following in the order of property indicated for each set with reason :

(I) $\text{HF}, \text{HCl}, \text{HBr}, \text{HI} \rightarrow$ decreasing acidic strength

(II) $\text{NH}_3, \text{PH}_3, \text{AsH}_3, \text{SbH}_3, \text{BiH}_3 \rightarrow$ increasing bond angle

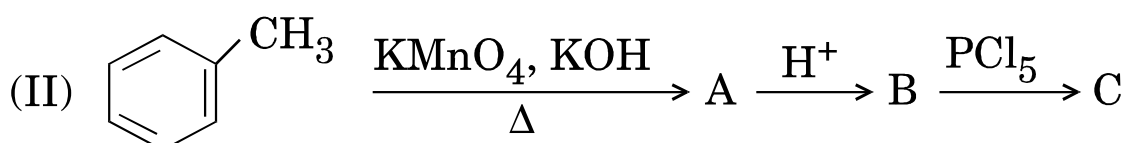
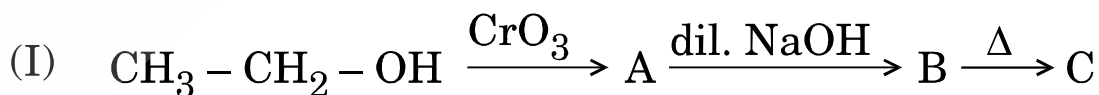
(III) $\text{H}_2\text{O}, \text{H}_2\text{S}, \text{H}_2\text{Se}, \text{H}_2\text{Te} \rightarrow$ increasing acidic strength

(ii) Why are halogens

(I) coloured in nature; and

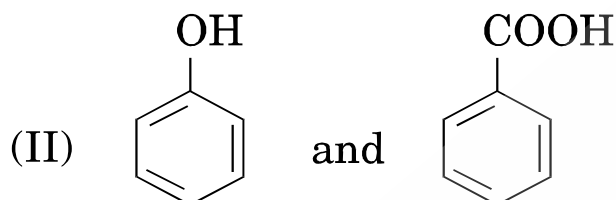
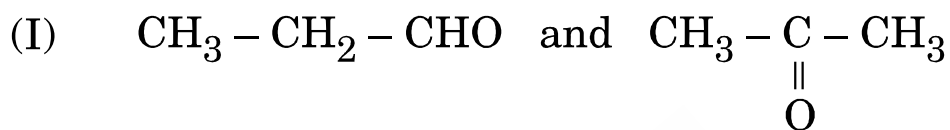
(II) strong oxidising agents? 3+2=5

32. (a) (i) Identify A, B and C in the following reactions :





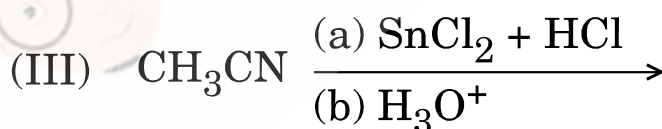
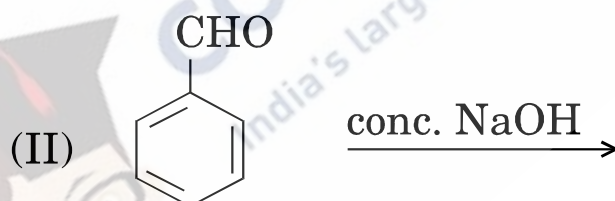
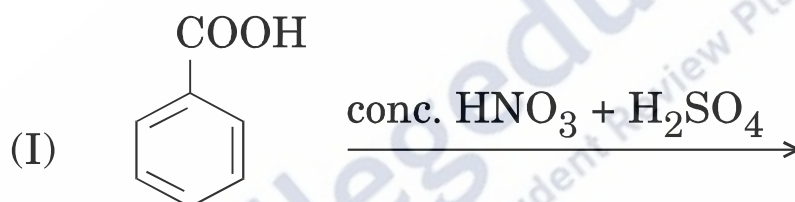
(ii) Distinguish between the following pairs :



3+2=5

OR

(b) (i) Write the product(s) in the following reactions :



(ii) Give reasons :

(I) Carboxylic acids do not give the reactions of carbonyl group.

(II) In semicarbazide ($\text{H}_2\text{NCONHNH}_2$), only one $-\text{NH}_2$ is involved in the formation of semicarbazones.

3+2=5



33. (a) Calculate the emf and ΔG of the following cell at 298 K : 5



Given : $E_{\text{cell}}^{\circ} = + 2.70 \text{ V}$, $1 \text{ F} = 96500 \text{ C mol}^{-1}$, $\log 10 = 1$

OR

(b) (i) Calculate the $\Delta_r G^{\circ}$ and $\log K_c$ for the following reaction :8



$$E_{\text{Fe}^{3+}/\text{Fe}^{2+}}^{\circ} = + 0.77 \text{ V}, \quad E_{\text{Ag}^+/\text{Ag}}^{\circ} = + 0.80 \text{ V}$$

(ii) State Kohlrausch's law of independent migration of ions. Write its one application. 3+2=5



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