

Series HFG1E/1



SET-3

प्रश्न-पत्र कोड
Q.P. Code

56/1/3

रोल नं.

Roll No.

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परीक्षार्थी प्रश्न-पत्र कोड को उत्तर-पुस्तिका के मुख-पृष्ठ पर अवश्य लिखें ।

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

रसायन विज्ञान (सैद्धान्तिक)

CHEMISTRY (Theory)

निर्धारित समय : 3 घण्टे

अधिकतम अंक : 70

Time allowed : 3 hours

Maximum Marks : 70

- कृपया जाँच कर लें कि इस प्रश्न-पत्र में मुद्रित पृष्ठ 19 हैं ।
- प्रश्न-पत्र में दाहिने हाथ की ओर दिए गए प्रश्न-पत्र कोड को परीक्षार्थी उत्तर-पुस्तिका के मुख-पृष्ठ पर लिखें ।
- कृपया जाँच कर लें कि इस प्रश्न-पत्र में 35 प्रश्न हैं ।
- कृपया प्रश्न का उत्तर लिखना शुरू करने से पहले, उत्तर-पुस्तिका में प्रश्न का क्रमांक अवश्य लिखें ।
- इस प्रश्न-पत्र को पढ़ने के लिए 15 मिनट का समय दिया गया है । प्रश्न-पत्र का वितरण पूर्वाह्न में 10.15 बजे किया जाएगा । 10.15 बजे से 10.30 बजे तक छात्र केवल प्रश्न-पत्र को पढ़ेंगे और इस अवधि के दौरान वे उत्तर-पुस्तिका पर कोई उत्तर नहीं लिखेंगे ।
- Please check that this question paper contains 19 printed pages.
- Q.P. Code 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 35 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.



General Instructions :

Read the following instructions carefully and strictly follow them :

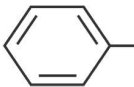
- (i) *This question paper contains **35** questions. **All** questions are **compulsory**.*
- (ii) *This question paper is divided into **five** Sections – **A, B, C, D** and **E**.*
- (iii) *In **Section A** – Questions no. **1** to **18** are multiple choice (MCQ) type questions, carrying **1** mark each.*
- (iv) *In **Section B** – Questions no. **19** to **25** very short answer (VSA) type questions, carrying **2** marks each.*
- (v) *In **Section C** – Questions no. **26** to **30** are short answer (SA) type questions, carrying **3** marks each.*
- (vi) *In **Section D** – Questions no. **31** and **32** are case-based questions carrying **4** marks each.*
- (vii) *In **Section E** – Questions no. **33** to **35** are long answer (LA) type questions carrying **5** marks each.*
- (viii) *There is no overall choice. However, an internal choice has been provided in 2 questions in Section B, 2 questions in Section C, 2 questions in Section D and 2 questions in Section E.*
- (ix) *Use of calculators is **not** allowed.*

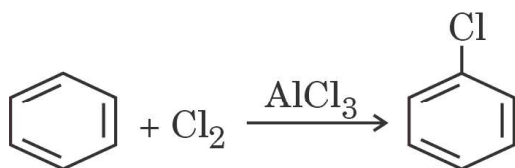
SECTION A

*Questions no. **1** to **18** are Multiple Choice (MCQ) type Questions, carrying **1** mark each.* *18 × 1 = 18*

1. On dissolving ammonium chloride in water at room temperature, the solution feels cool to touch. Under which of the following conditions does salt dissolve faster ?
 - (a) Powdered salt in cold water
 - (b) Powdered salt in hot water
 - (c) Salt crystals in cold water
 - (d) Salt crystals in hot water
2. Lanthanoid contraction is due to increase in :
 - (a) atomic number
 - (b) shielding by 4f electrons
 - (c) effective nuclear charge
 - (d) atomic radius



3. CH_3CONH_2 on reaction with NaOH and Br_2 in alcoholic medium gives :
- (a) CH_3COONa (b) CH_3NH_2
 (c) $\text{CH}_3\text{CH}_2\text{Br}$ (d) $\text{CH}_3\text{CH}_2\text{NH}_2$
4. In the reaction $\text{R}-\text{OH} + \text{HCl} \xrightarrow{\text{ZnCl}_2} \text{RCl} + \text{H}_2\text{O}$, what is the correct order of reactivity of alcohol ?
- (a) $1^\circ < 2^\circ < 3^\circ$ (b) $1^\circ > 3^\circ > 2^\circ$
 (c) $1^\circ > 2^\circ > 3^\circ$ (d) $3^\circ > 1^\circ > 2^\circ$
5. The compounds $[\text{Co}(\text{SO}_4)(\text{NH}_3)_5] \text{Br}$ and $[\text{Co}(\text{Br})(\text{NH}_3)_5] \text{SO}_4$ represent :
- (a) optical isomerism (b) linkage isomerism
 (c) ionisation isomerism (d) coordination isomerism
6. Which of the following is least basic ?
- (a) $(\text{CH}_3)_2\text{NH}$ (b) NH_3
 (c)  NH_2 (d) $(\text{CH}_3)_3\text{N}$
7. The glycosidic linkage involved in linking the glucose units in amylose part of starch is :
- (a) $\text{C}_1 - \text{C}_6$ α linkage (b) $\text{C}_1 - \text{C}_6$ β linkage
 (c) $\text{C}_1 - \text{C}_4$ α linkage (d) $\text{C}_1 - \text{C}_4$ β linkage
8. The order of the reaction
- $$\text{H}_2(\text{g}) + \text{Cl}_2(\text{g}) \xrightarrow{h\nu} 2\text{HCl}(\text{g})$$
- is :
- (a) 2 (b) 1
 (c) 0 (d) 3
9. The species that attacks benzene in following is :



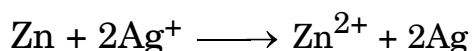
- (a) Cl^- (b) AlCl_4^-
 (c) AlCl_3 (d) Cl^+



10. The most common and stable oxidation state of a Lanthanoid is :

- (a) + 2 (b) + 3
(c) + 4 (d) + 6

11. The correct cell to represent the following reaction is :



- (a) $2\text{Ag} \mid \text{Ag}^+ \parallel \text{Zn} \mid \text{Zn}^{2+}$
(b) $\text{Ag}^+ \mid \text{Ag} \parallel \text{Zn}^{2+} \mid \text{Zn}$
(c) $\text{Ag} \mid \text{Ag}^+ \parallel \text{Zn} \mid \text{Zn}^{2+}$
(d) $\text{Zn} \mid \text{Zn}^{2+} \parallel \text{Ag}^+ \mid \text{Ag}$

12. ΔG and E_{cell}° for a spontaneous reaction will be :

- (a) positive, negative (b) negative, negative
(c) negative, positive (d) positive, positive

13. Which of the following is affected by catalyst ?

- (a) ΔH (b) ΔG
(c) E_a (d) ΔS

14. Which of the following is a non-reducing sugar ?

- (a) Sucrose (b) Maltose
(c) Glucose (d) Lactose

For Questions number 15 to 18, two statements are given — one labelled as Assertion (A) and the other labelled as Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below.

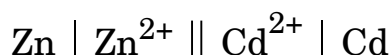
- (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
(b) Both Assertion (A) and Reason (R) are true, but Reason (R) is **not** the correct explanation of the Assertion (A).
(c) Assertion (A) is true, but Reason (R) is false.
(d) Assertion (A) is false, but Reason (R) is true.



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15. *Assertion (A)* : Ammonolysis of alkyl halides is not a suitable method for the preparation of pure primary amines.
Reason (R) : Ammonolysis of alkyl halides yields mainly secondary amines.
16. *Assertion (A)* : The molecularity of the reaction $\text{H}_2 + \text{Br}_2 \longrightarrow 2\text{HBr}$ appears to be 2.
Reason (R) : Two molecules of the reactants are involved in the given elementary reaction.
17. *Assertion (A)* : Low spin tetrahedral complexes are rarely observed.
Reason (R) : Crystal field splitting energy is less than pairing energy for tetrahedral complexes.
18. *Assertion (A)* : Acetylation of aniline gives a monosubstituted product.
Reason (R) : Activating effect of $-\text{NHCOCH}_3$ group is more than that of amino group.

SECTION B

19. (a) Write chemical reaction to show that open structure of D-glucose contains the straight chain. 2
 (b) What type of linkage is responsible for the formation of protein ? 2
20. (a) Calculate $\Delta_r G^\circ$ for the cell reaction at 25°C : 2



Given that : $E_{\text{Zn}^{2+}/\text{Zn}}^\circ = -0.76 \text{ V}$, $E_{\text{Cd}^{2+}/\text{Cd}}^\circ = 0.40 \text{ V}$

$$1 \text{ F} = 96500 \text{ C mol}^{-1}$$

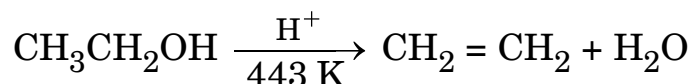
OR

- (b) The electrical resistance of a column of 0.05 mol L^{-1} NaOH solution of diameter 1 cm and length 50 cm is $5.55 \times 10^3 \text{ ohm}$. Calculate the conductivity. 2
21. (a) Account for the following : 1+1=2
 (i) Phenol is a stronger acid than an alcohol.
 (ii) The boiling point of alcohols decreases with increase in branching of alkyl chain.

OR



- (b) (i) Write the mechanism of the following reaction :



- (ii) Write the equation involved in Reimer-Tiemann reaction. 1+1=2

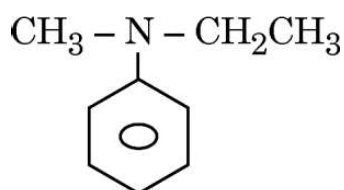
- 22.** Write the main product formed when : 2×1=2

- (a) n-Butyl chloride is treated with alc. KOH.
(b) 2,4,6-Trinitrochlorobenzene is subjected to hydrolysis.

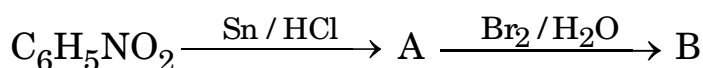
- 23.** Complete the following equations : 1+1=2

- (a) $2\text{MnO}_4^- + 5\text{NO}_2^- + 6\text{H}^+ \longrightarrow$
(b) $\text{Cr}_2\text{O}_7^{2-} + 14\text{H}^+ + 6\text{e}^- \longrightarrow$

- 24.** (a) Write the IUPAC name for the following organic compounds : 2×1=2



- (b) Complete the following :



- 25.** What is Henry's law ? Give one application of it. 2

SECTION C

- 26.** Write main product formed when : 3×1=3

- (a) Methyl chloride is treated with NaI/Acetone.
(b) 2,4,6-trinitrochlorobenzene is subjected to hydrolysis.
(c) n-Butyl chloride is treated with alcoholic KOH.



27. How do you convert the following : (Any *three*) 3×1=3

- (a) Phenol to picric acid
- (b) Propanone to 2-Methylpropan-2-ol
- (c) Phenol to anisole
- (d) Propene to Propan-1-ol

28. (a) Differentiate between Ideal solution and Non-ideal solution.

- (b) 30 g of urea is dissolved in 846 g of water. Calculate the vapour pressure of water for this solution if vapour pressure of pure water at 298 K is 23.8 mm Hg. 3

29. (a) Explain why : 3×1=3

- (i) Carboxyl group in benzoic acid is meta directing.
- (ii) Sodium bisulphite is used for the purification of aldehydes and ketones.
- (iii) Carboxylic acids do not give characteristic reactions of carbonyl group.

OR

(b) Give chemical equation for the following reactions : 3×1=3

- (i) Propanone is treated with dil. $\text{Ba}(\text{OH})_2$.
- (ii) Acetophenone is treated with $\text{Zn}(\text{Hg})/\text{Conc. HCl}$.
- (iii) Benzoyl chloride is hydrogenated in presence of Pd-BaSO_4 .

30. (a) Write the product when D-glucose reacts with conc. HNO_3 .

(b) Amino acids show amphoteric behaviour. Why ?

(c) Write one difference between α -helix and β -pleated structure of protein. 3×1=3



SECTION D

The following questions are case-based questions. Read the case carefully and answer the questions that follow.

- 31.** The rate of reaction is concerned with decrease in concentration of reactants or increase in the concentration of products per unit time. It can be expressed as instantaneous rate at a particular instant of time and average rate over a large interval of time. Mathematical representation of rate of reaction is given by rate law. Rate Constant and order of a reaction can be determined from rate law or its integrated rate equation.

- (i) What is average rate of reaction ? 1
- (ii) Write two factors that affect the rate of reaction. 1
- (iii) (1) What happens to rate of reaction for zero order reaction ?
(2) What is the unit of k for zero order reaction ? 2×1=2

OR

- (iii) (1) For a reaction $P + 2Q \longrightarrow \text{Products}$
Rate = $k[P]^{1/2} [Q]^1$. What is the order of the reaction ?
(2) Define pseudo first order reaction with an example. 2×1=2

- 32.** In coordination compounds, metals show two types of linkages, primary and secondary. Primary valencies are ionisable and are satisfied by negatively charged ions. Secondary valencies are non-ionisable and are satisfied by neutral or negative ions having lone pair of electrons. Primary valencies are non-directional while secondary valencies decide the shape of the complexes.

- (i) If $\text{PtCl}_2 \cdot 2\text{NH}_3$ does not react with AgNO_3 , what will be its formula ? 1



(ii) What is the secondary valency of $[\text{Co(en)}_3]^{3+}$? 1

(iii) (1) Write the formula of Iron(III)hexacyanidoferrate(II).

(2) Write the IUPAC name of $[\text{Co}(\text{NH}_3)_5\text{Cl}] \text{Cl}_2$. $2 \times 1 = 2$

OR

(iii) Write the hybridization and magnetic behaviour of $[\text{Ni}(\text{CN})_4]^{2-}$. 2

[Atomic number : Ni = 28]

SECTION E

33. (a) (i) Carry out the following conversions :

(1) Ethanal to But-2-en-1-al

(2) Propanoic acid to 2-chloropropanoic acid

(ii) An alkene with molecular formula C_5H_{10} on ozonolysis gives a mixture of two compounds 'B' and 'C'. Compound 'B' gives positive Fehling test and also reacts with iodine and NaOH solution. Compound 'C' does not give Fehling solution test but forms iodoform. Identify the compounds 'A', 'B' and 'C'. $2+3=5$

OR

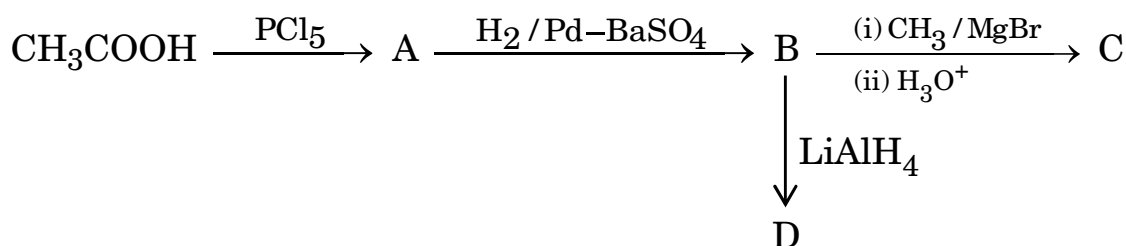
(b) (i) Distinguish with a suitable chemical test :

(1) $\text{CH}_3\text{COCH}_2\text{CH}_3$ and $\text{CH}_3\text{CH}_2\text{CH}_2\text{CHO}$

(2) Ethanal and Ethanoic acid

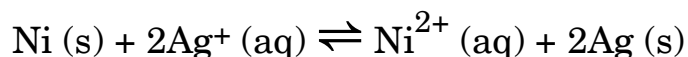
(ii) Write the structure of oxime of acetone.

(iii) Identify A to D. $2+1+2=5$



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34. (a) (i) In 3d series, which transition element has positive $E_{M^{2+}/M}^{\circ}$ value and why ?
- (ii) Name a member of lanthanide series which is well-known to show +4 oxidation state.
- (b) Give reason :
- (i) The highest oxidation state is exhibited in oxoanions of transition metals.
- (ii) HCl is not used to acidify $KMnO_4$ solution. 3+2=5

35. (a) (i) State Kohlrausch's law of independent migration of ions. Write an expression for the limiting molar conductivity of acetic acid according to Kohlrausch's law.
- (ii) Calculate the maximum work and $\log K_c$ for the given reaction at 298 K :



Given : $E_{Ni^{2+}/Ni}^{\circ} = -0.25 \text{ V}$, $E_{Ag^+/Ag}^{\circ} = +0.80 \text{ V}$

$$1 \text{ F} = 96500 \text{ C mol}^{-1} \quad \text{2+3=5}$$

OR

- (b) (i) State Faraday's first law of electrolysis. How much charge, in terms of Faraday, is required for the reduction of 1 mol Cu^{2+} to Cu ?
- (ii) Calculate emf of the following cell at 298 K for
 $Mg(s) | Mg^{2+}(0.1 \text{ M}) || Cu^{2+}(0.01 \text{ M}) | Cu(s)$
 $[E_{cell}^{\circ} = +2.71 \text{ V}, 1 \text{ F} = 96500 \text{ C mol}^{-1}, \log 10 = 1]$ 2+3=5

