

Series HFG1E/1



SET-1

प्रश्न-पत्र कोड
Q.P. Code

56/1/1

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.*

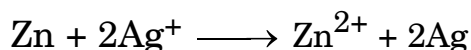
SECTION A

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

- 1.** The colligative property used for the determination of molar mass of polymers and proteins is :
 - (a) Osmotic pressure
 - (b) Depression in freezing point
 - (c) Relative lowering in vapour pressure
 - (d) Elevation in boiling point
- 2.** Low concentration of oxygen in the blood and tissues of people living at high altitude is due to :
 - (a) high atmospheric pressure
 - (b) low temperature
 - (c) low atmospheric pressure
 - (d) both low temperature and high atmospheric pressure



3. 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) $\text{Zn} \mid \text{Zn}^{2+} \parallel \text{Ag}^+ \mid \text{Ag}$

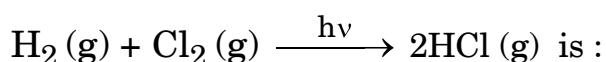
4. ΔG and E_{cell}° for a spontaneous reaction will be :

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

5. Which of the following is affected by catalyst ?

- (a) ΔH
- (b) ΔG
- (c) E_a
- (d) ΔS

6. The order of the reaction



- (a) 2
- (b) 1
- (c) 0
- (d) 3

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

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

8. 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

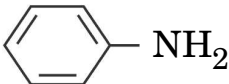
9. The synthesis of alkyl fluoride is best obtained from :

- (a) Free radicals
- (b) Swartz reaction
- (c) Sandmeyer reaction
- (d) Finkelstein reaction

10. 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) $3^\circ > 1^\circ > 2^\circ$



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11. 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) $\text{CH}_3\text{CH}_2\text{NH}_2$
12. Which of the following is least basic ?
- (a) $(\text{CH}_3)_2\text{NH}$ (b) NH_3
(c)  (d) $(\text{CH}_3)_3\text{N}$
13. The glycosidic linkage involved in linking the glucose units in amylase 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
14. An α -helix is a structural feature of :
- (a) Sucrose (b) Starch
(c) Polypeptides (d) Nucleotides

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.
15. **Assertion (A) :** $-\text{NH}_2$ group is *o*- and *p*-directing in electrophilic substitution reactions.

Reason (R) : Aniline cannot undergo Friedel-Crafts reaction.



16. *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.
17. *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.
18. *Assertion (A)* : Low spin tetrahedral complexes are rarely observed.
Reason (R) : Crystal field splitting energy is less than pairing energy for tetrahedral complexes.

SECTION B

19. What is Henry's law ? Give one application of it. 2
20. (a) On diluting two electrolytes 'A' and 'B', the Λ_m of 'A' increases 25 times while that of 'B' increases by 1.5 times. Which of the two electrolytes is strong ? Justify your answer graphically. 2

OR

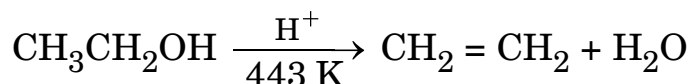
- (b) The electrical resistance of a column of 0.05 mol L^{-1} NaOH solution of diameter 1 cm and length 50 cm is $5.55 \times 10^3 \text{ ohm}$. Calculate the conductivity. 2
21. Complete the following equations : 1+1=2
- (a) $2\text{MnO}_4^- + 5\text{NO}_2^- + 6\text{H}^+ \longrightarrow$
- (b) $\text{Cr}_2\text{O}_7^{2-} + 14\text{H}^+ + 6\text{e}^- \longrightarrow$
22. (a) $\text{CH}_3 - \underset{\text{OH}}{\text{CH}} - \text{CH}_3 \xrightarrow{\text{PCl}_5} \text{'A'} \xrightarrow{\text{AgCN}} \text{'B'}$
- (b) $\text{CH}_3\text{CH}_2\text{CH}_2\text{Cl} + \text{KOH} \xrightarrow{\text{ethanol}} \text{'A'} \xrightarrow{\text{HBr}} \text{'B'}$
- Identify 'A' and 'B' in the above reactions. 1+1=2



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23. (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

24. Explain briefly : 1+1=2

- (a) Carbylamine reaction
- (b) Gabriel phthalimide synthesis

25. (a) Write chemical reaction to show that open structure of D-glucose contains the straight chain.
- (b) What type of linkage is responsible for the formation of protein ? 2

SECTION C

26. (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
27. 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.
28. 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



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) An organic compound 'A', having the molecular formula C_3H_8O on treatment with Cu at 573 K, gives 'B'. 'B' does not reduce Fehling's solution but gives a yellow precipitate of the compound 'C' with $I_2/NaOH$. Deduce the structures of A, B and C. 3

30. (a) What are the hydrolysis products of (i) Lactose, (ii) Maltose ?
- (b) Give the basic structural difference between starch and cellulose. 2+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.



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- (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 ? $2 \times 1 = 2$

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. $2 \times 1 = 2$

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 $[\text{Co}(\text{en})_3]^{3+}$? 1
- (iii) (1) Write the formula of Iron(III)hexacyanidoferrate(II).
- (2) Write the IUPAC name of $[\text{Co}(\text{NH}_3)_5\text{Cl}] \text{Cl}_2$. $2 \times 1 = 2$

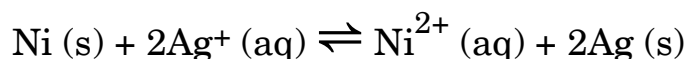
OR

- (iii) Write the hybridization and magnetic behaviour of $[\text{Ni}(\text{CN})_4]^{2-}$. 2
[Atomic number : Ni = 28]



SECTION E

33. (a) (i) 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 :



$$\text{Given : } E^\circ_{\text{Ni}^{2+}/\text{Ni}} = -0.25 \text{ V}, \quad E^\circ_{\text{Ag}^+/\text{Ag}} = +0.80 \text{ V}$$

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

$$2+3=5$$

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



$$[E^\circ_{\text{cell}} = +2.71 \text{ V}, \quad 1 \text{ F} = 96500 \text{ C mol}^{-1}, \quad \log 10 = 1]$$

$$2+3=5$$

34. Assign reason for each of the following :

$$5 \times 1 = 5$$

- (i) Manganese exhibits the highest oxidation state of +7 among the 3d series of transition elements.
- (ii) Transition metals and their compounds are generally found to be good catalysts in chemical reactions.
- (iii) Cr^{2+} is reducing in nature while with the same d-orbital configuration (d^4) Mn^{3+} is an oxidising agent.
- (iv) Zn has lowest enthalpy of atomization.
- (v) Cu^+ is unstable in an aqueous solution.



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35. (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) $CH_3COCH_2CH_3$ and $CH_3CH_2CH_2CHO$
 - (2) Ethanal and Ethanoic acid
- (ii) Write the structure of oxime of acetone.
- (iii) Identify A to D. 2+1+2=5

