



Series RP5PS/5



SET-3

प्रश्न-पत्र कोड
Q.P. Code 56/5/3

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.

नोट

- (I) कृपया जाँच कर लें कि इस प्रश्न-पत्र में मुद्रित पृष्ठ 23 हैं।
- (II) कृपया जाँच कर लें कि इस प्रश्न-पत्र में 33 प्रश्न हैं।
- (III) प्रश्न-पत्र में दाहिने हाथ की ओर दिए गए प्रश्न-पत्र कोड को परीक्षार्थी उत्तर-पुस्तिका के मुख-पृष्ठ पर लिखें।
- (IV) कृपया प्रश्न का उत्तर लिखना शुरू करने से पहले, उत्तर-पुस्तिका में प्रश्न का क्रमांक अवश्य लिखें।
- (V) 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 परीक्षार्थी केवल प्रश्न-पत्र को पढ़ेंगे और इस अवधि के दौरान वे उत्तर-पुस्तिका पर कोई उत्तर नहीं लिखेंगे।

NOTE

- (I) Please check that this question paper contains 23 printed pages.
- (II) Please check that this question paper contains 33 questions.
- (III) 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.
- (IV) Please write down the serial number of the question in the answer-book before attempting it.
- (V) 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 candidates will read the question paper only and will not write any answer on the answer-book during this period.

रसायन विज्ञान (सैद्धांतिक)

CHEMISTRY (Theory)

निर्धारित समय : 3 घण्टे

Time allowed : 3 hours

अधिकतम अंक : 70

Maximum Marks : 70

56/5/3/22

227 C

1



P.T.O.



GENERAL INSTRUCTIONS :

Read the following instructions carefully and follow them :

- (i) *This question paper contains 33 questions. All questions are compulsory.*
- (ii) *Question paper is divided into FIVE sections – Section A, B, C, D and E.*
- (iii) *Section A – question number 1 to 16 are multiple choice type questions. Each question carries 1 mark.*
- (iv) *Section B – question number 17 to 21 are very short answer type questions. Each question carries 2 marks.*
- (v) *Section C – question number 22 to 28 are short answer type questions. Each question carries 3 marks.*
- (vi) *Section D – question number 29 and 30 are case-based questions. Each question carries 4 marks.*
- (vii) *Section E – question number 31 to 33 are long answer type questions. Each question carries 5 marks.*
- (viii) *There is no overall choice given in the question paper. However, an internal choice has been provided in few questions in all the Sections except section A.*
- (ix) *Kindly note that there is a separate question paper for Visually Impaired candidates.*
- (x) *Use of calculator is NOT allowed.*

SECTION – A

Question No. 1 to 16 are Multiple Choice type Questions, carrying 1 mark each.

$16 \times 1 = 16$

1. Van't Hoff factor for K_2SO_4 solution, assuming complete ionization is

- (A) 1
- (B) 3
- (C) 13
- (D) 2

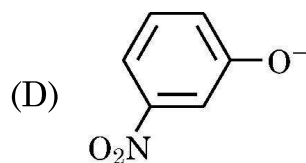
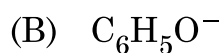




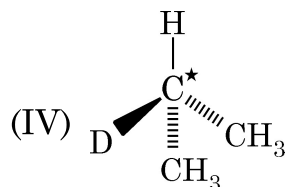
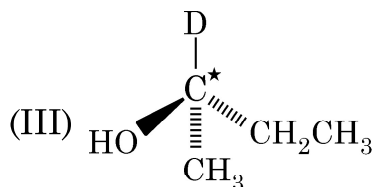
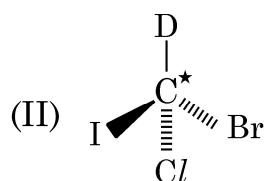
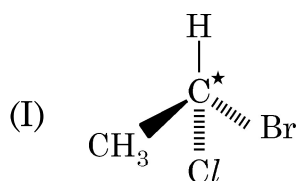
2. Dilution affects both conductivity as well as molar conductivity. Effect of dilution on both is as follows :

- (A) both increase with dilution.
- (B) both decrease with dilution.
- (C) conductivity increases whereas molar conductivity decreases on dilution.
- (D) conductivity decreases whereas molar conductivity increases on dilution.

3. Which of the following species can act as the strongest base ?



4. In which of the following molecules, C atom marked with asterisk is chiral ?

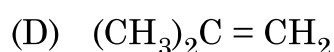
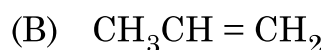




5. The rate of a reaction increases sixteen times when the concentration of the reactant increases four times. The order of the reaction is
- (A) 2.5 (B) 2.0
(C) 1.5 (D) 0.5
6. Which of the following cell is used in hearing aids ?
- (A) Mercury cell (B) $\text{H}_2 - \text{O}_2$ fuel cell
(C) Dry cell (D) Ni-Cd cell
7. Isotonic solutions have the same
- (A) density (B) refractive index
(C) osmotic pressure (D) volume
8. Transition metals are known to make interstitial compounds. Formation of interstitial compounds makes the transition metal
- (A) more hard (B) more soft
(C) more ductile (D) more metallic
9. Auto-oxidation of chloroform in air and light produces a poisonous gas known as
- (A) Phosphine (B) Mustard gas
(C) Phosgene (D) Tear gas



10. Out of the following alkenes, the one which will produce tertiary butyl alcohol on acid catalysed hydration is



11. The correct name of the given reaction is



(A) Sandmeyer's reaction

(B) Gabriel Phthalimide synthesis

(C) Carbyl amine reaction

(D) Hoffmann bromamide degradation reaction

12. The specific sequence in which amino acids are arranged in a protein is called its

(A) Primary structure

(B) Secondary structure

(C) Tertiary structure

(D) Quaternary structure





For questions number **13** to **16**, 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 Assertion (A).
- (C) Assertion (A) is true, but Reason (R) is false.
- (D) Assertion (A) is false, but Reason (R) is true.

13. **Assertion (A)** : The units of rate constant of a zero order reaction and rate of reaction are the same.

Reason (R) : In zero order reaction, the rate of reaction is independent of the concentration of reactants.

14. **Assertion (A)** : Zr and Hf are of almost similar atomic radii.

Reason (R) : This is due to Lanthanoid contraction.

15. **Assertion (A)** : p-methoxyphenol is a stronger acid than m-methoxy phenol.

Reason (R) : Methoxy group exerts +R effect at both ortho and para position.



16. **Assertion (A)** : Inversion of configuration is observed when 1-Bromobutane is hydrolysed.

Reason (R) : The reaction is S_N2 and proceeds with the formation of transition state.

SECTION – B

17. (a) Carry out the following conversions :

(i) Nitrobenzene to Aniline 1

(ii) Aniline to Phenol 1

OR

(b) (i) Write a chemical test to distinguish between Dimethyl amine and Ethanamine. 1

(ii) Write the product formed when benzene diazonium chloride is treated with KI. 1

18. Define the following terms : 1 × 2

(a) Limiting molar conductivity ($\wedge^\circ m$)

(b) Fuel cell

19. Classify the following sugars into monosaccharides and disaccharides : 2
Sucrose, Lactose, Glucose, Fructose

20. Resistance of a conductivity cell filled with $0.2 \text{ mol L}^{-1} \text{ KCl}$ solution is 200Ω . If the resistance of the same cell when filled with $0.05 \text{ mol L}^{-1} \text{ KCl}$ solution is 620Ω , calculate the conductivity and molar conductivity of $0.05 \text{ mol L}^{-1} \text{ KCl}$ solution. The conductivity of $0.2 \text{ mol L}^{-1} \text{ KCl}$ solution is 0.0248 S cm^{-1} . 2

21. A first order reaction takes 40 min for 75% decomposition. Calculate rate constant. 2

[Given : $\log 2 = 0.30$, $\log 4 = 0.60$]



SECTION – C

22. A compound 'X' with molecular formula C_3H_9N reacts with $C_6H_5SO_2Cl$ to give a solid, insoluble in alkali. Identify 'X' and give the IUPAC name of the product. Write the reaction involved. 3

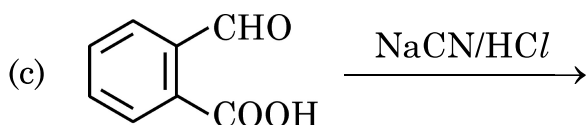
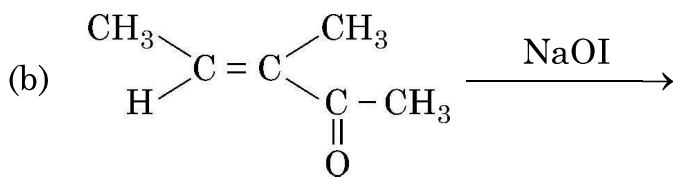
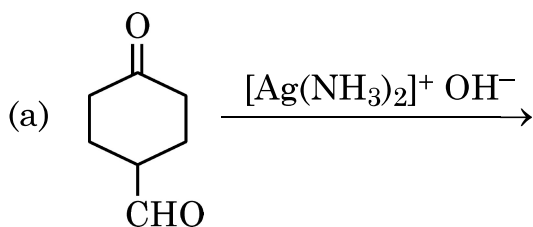
23. Account for the following : 1 × 3

- (a) Haloalkanes react with $AgCN$ to form isocyanide as main product.
- (b) Allyl chloride shows high reactivity towards S_N1 reaction.
- (c) Haloarenes are extremely less reactive towards nucleophilic substitution reactions.

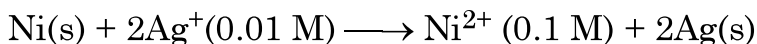
24. Write the IUPAC names of the following coordination compounds (any **three**) : 1 × 3

- (a) $[Co(NH_3)_4Cl(NO_2)]Cl$
- (b) $[Ni(NH_3)_6]Cl_2$
- (c) $K_3[Cr(C_2O_4)_3]$
- (d) $[Co(en)_2Br_2]^+$

25. Draw the structures of major product(s) in each of the following reactions : 1 × 3



26. Calculate the emf of the following cell : 3



Given that $E_{cell}^\circ = 1.05\text{ V}$, $\log 10 = 1$





27. Give the structure of the major product expected from the following reactions : 1 × 3

- (a) Reaction of propanal with methyl magnesium bromide followed by hydrolysis.
- (b) Reaction of phenol with Br_2 in CS_2 .
- (c) Reaction of propene with diborane followed by oxidation.

28. The rate constant of a reaction quadruples when the temperature changes from 700 K to 720 K. Calculate the activation energy for this reaction. 3

[$\log 2 = 0.30$, $\log 4 = 0.60$, $2.303 R = 19.15 \text{ J K}^{-1} \text{ mol}^{-1}$]

SECTION – D

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

29. The oxidation number of the central atom in a complex is defined as the charge it would carry if all the ligands are removed along with the electron pairs that are shared with the central atom. Similarly the charge on the complex is the sum of the charges of the constituent parts i.e. the sum of the charges on the central metal ion and its surrounding ligands. Based on this, the complex is called neutral if the sum of the charges of the constituents is equal to zero. However, for an anion or cationic complex, the sum of the charges of the constituents is equal to the charge on the coordination sphere.

Based on the above information, answer the following questions :

- (a) What is the secondary valence of Co in $[\text{Co}(\text{NH}_3)_4\text{Cl}_2]^+$? 1
- (b) What type of isomerism is shown by the complex $[\text{Cr}(\text{H}_2\text{O})_6]\text{Cl}_3$ and $[\text{Cr}(\text{H}_2\text{O})_5\text{Cl}]\text{Cl}_2 \cdot \text{H}_2\text{O}$? 1





- (c) Write the electronic configuration of d^4 ion on the basis of crystal field theory when

2

(i) $\Delta_0 < P$

(ii) $\Delta_0 > P$

OR

- (c) Find the oxidation state and coordination number of the central metal ion in $[\text{Co}(\text{H}_2\text{O})(\text{CN})(\text{en})_2]^{2+}$

2

30. Certain organic compounds are required in small amounts in our diet but their deficiency causes specific disease. These compounds are called vitamins. Most of the vitamins cannot be synthesized in our body but plants can synthesize almost all of them. So they are considered as essential food factors. However, the bacteria of the gut can produce some of the vitamins required by us. All the vitamins are generally available in our diet. The term 'vitamin' was coined from the words vital + amine, since the earlier identified compounds had amino group. Vitamins are classified into two groups depending upon their solubility in water or fat namely-fat soluble vitamins and water soluble vitamins.

- (a) What is the other name of Vitamin B₆ ?

1

- (b) Name the vitamin whose deficiency causes increased blood clotting time.

1

- (c) Xerophthalmia is caused by the deficiency of which vitamin ? Give two sources of this vitamin.

2

OR

- (c) Why can't vitamin C be stored in our body ? Name the disease caused by the deficiency of this vitamin.

2





SECTION – E

31. (a) (i) Ishan's automobile radiator is filled with 1.0 kg of water. How many grams of ethylene glycol (Molar mass = 62 g mol^{-1}) must Ishan add to get the freezing point of the solution lowered to -2.8°C . K_f for water is $1.86 \text{ K kg} \cdot \text{mol}^{-1}$. 3
- (ii) What type of deviation from Raoult's law is shown by ethanol and acetone mixture ? Give reason. 2

OR

- (b) (i) Boiling point of water at 750 mm Hg pressure is 99.68°C . How much sucrose (Molar mass = 342 g mol^{-1}) is to be added to 500 g of water such that it boils at 100°C ? (K_b for water = $0.52 \text{ K kg mol}^{-1}$).
- (ii) State Henry's law and write its any one application. 3 + 2
32. (a) An organic compound (A) with the molecular formula $\text{C}_9\text{H}_{10}\text{O}$ forms 2, 4-DNP derivative, reduces Fehling solution and undergoes Cannizzaro reaction. On vigorous oxidation, it gives 1, 2-benzene dicarboxylic acid.
- (i) Identify the compound (A) and write its IUPAC name.
- (ii) Write the reaction of compound (A) with
- (1) 2, 4-Dinitrophenyl hydrazine and
- (2) Fehling solution
- (iii) Write the equation of compound (A) when it undergoes Cannizzaro reaction. 2 + 2 + 1

OR





(b) (i) Account for the following : 1 × 2

(1) The alpha (α)-hydrogens of aldehydes and ketones are acidic in nature.

(2) Oxidation of aldehydes is easier than ketones.

(ii) Arrange the following in : 1 × 2

(1) Decreasing reactivity towards nucleophilic addition reaction propanal, acetone, benzaldehyde.

(2) Increasing order of boiling point :

Propane, Ethanol, Dimethylether, Propanal

(iii) Give simple chemical test to distinguish between Benzoic acid and Benzaldehyde. 1

33. Attempt any **five** of the following : 1 × 5

(a) Ce(III) is easily oxidised to Ce(IV). Comment.

(b) $E^\circ(\text{Mn}^{2+}/\text{Mn})$ is -1.18 V. Why is this value highly negative in comparison to neighbouring d block elements ?

(c) Which element of 3d series has lowest enthalpy of atomisation and why ?

(d) What happens when sodium chromate is acidified ?

(e) Zn, Cd and Hg are soft metals. Why ?

(f) Why is permanganate titration not carried out in the presence of HCl ?

(g) The lower oxides of transition metals are basic whereas the highest are amphoteric/acidic. Give reason.

