Series : ZYWX1

SET ~ 3

रोल नं.
Roll No.

1 4 6 0 8 0 6 0

प्रश्न-पत्र कोड
Q.P. Code **56/1/3**

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 / NOTE

(I) कृपया जाँच कर लें कि इस प्रश्न-पत्र में मुद्रित पृष्ठ **23** हैं ।
Please check that this question paper contains **23** printed pages.

(II) कृपया जाँच कर लें कि इस प्रश्न-पत्र में **33** प्रश्न हैं ।
Please check that this question paper contains **33** questions.

(III) प्रश्न-पत्र में दाहिने हाथ की ओर दिए गए प्रश्न-पत्र कोड को परीक्षार्थी उत्तर-पुस्तिका के मुख-पृष्ठ पर लिखें ।
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) **कृपया प्रश्न का उत्तर लिखना शुरू करने से पहले, उत्तर-पुस्तिका में यथा स्थान पर प्रश्न का क्रमांक अवश्य लिखें ।**
Please write down the serial number of the question in the answer-book at the given place before attempting it.

(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 ।
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.

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रसायन विज्ञान (सैद्धांतिक)
CHEMISTRY (Theory)

निर्धारित समय : 3 घण्टे
Time allowed : 3 hours

अधिकतम अंक : 70
Maximum Marks : 70

P.T.O.

SECTION – A

(16 × 1 = 16)

Questions No. **1** to **16** are Multiple Choice type questions carrying **1** mark each.

1. Standard electrode potential for Sn^{4+}/Sn^{2+} couple is +0.15 V and that for the Cr^{3+}/Cr couple is –0.74 V. The two couples in their standard states are connected to make a cell. The cell potential will be

(A) +1.19 V (B) +0.89 V

(C) +0.18 V (D) +1.83 V

2. The magnetic moment is associated with its spin angular momentum and orbital angular momentum. Spin only magnetic moment value of Cr^{3+} ion (Atomic no. : Cr = 24) is _____.

(A) 2.87 B.M. (B) 3.87 B.M.

(C) 3.47 B.M. (D) 3.57 B.M.

3. In case of association, abnormal molar mass of solute will

(A) increase (B) decrease

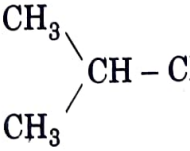
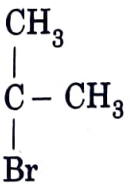
(C) remain same (D) first increase and then decrease

4. Alkyl halides undergoing nucleophilic bimolecular substitution reaction involve

(A) retention of configuration (B) formation of racemic mixture

(C) inversion of configuration (D) formation of carbocation

5. Arrange the following compounds in increasing order of their boiling points :

(i)  (ii) $CH_3CH_2CH_2CH_2Br$ (iii) 

The correct order is

(A) (ii) < (i) < (iii) (B) (i) < (ii) < (iii)

(C) (iii) < (i) < (ii) (D) (iii) < (ii) < (i)

6. The correct IUPAC name of $[Pt(NH_3)_2Cl_2]^{2+}$ is

(A) Diamminedichloridoplatinum (II)

(B) Diamminedichloridoplatinum (IV)

(C) Diamminedichloridoplatinum (O)

(D) Diamminedichloridoplatinate (IV)

7. The acid formed when propyl magnesium bromide is treated with CO_2 followed by acid hydrolysis is :

(A) C_3H_7COOH (B) C_2H_5COOH

(C) CH_3COOH (D) C_3H_7OH

8. Acidified $KMnO_4$ oxidises sulphite to

(A) $S_2O_3^{2-}$ (B) $S_2O_8^{2-}$

(C) $SO_2(g)$ (D) SO_4^{2-}

9. Which is the correct order of acid strength from the following ?

(A) $C_6H_5OH > H_2O > ROH$ (B) $C_6H_5OH > ROH > H_2O$

(C) $ROH > C_6H_5OH > H_2O$ (D) $H_2O > C_6H_5OH > ROH$

10. An unripe mango placed in a concentrated salt solution to prepare pickle, shrivels because _____.

(A) it gains water due to osmosis

(B) it loses water due to reverse osmosis

(C) it gains water due to reverse osmosis

(D) it loses water due to osmosis

11. The best reagent for converting propanamide into propanamine is _____.

(A) excess H_2

(B) Br_2 in aqueous NaOH

(C) iodine in the presence of red phosphorus

(D) $LiAlH_4$ in ether

12. Which of the following statements is not true about glucose ?

(A) It is an aldohexose.

(B) On heating with HI it forms n-hexane.

(C) It exists in furanose form.

(D) It does not give Schiff's test.

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 the 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)** : All naturally occurring α-amino acids except glycine are optically active.

Reason (R) : Most naturally occurring amino acids have L-configuration.

14. **Assertion (A)** : The boiling point of ethanol is higher than that of methoxymethane.

Reason (R) : There is intramolecular hydrogen bonding in ethanol.

15. **Assertion (A)** : The boiling points of alkyl halides decrease in the order : RI > RBr > RCl > RF.

Reason (R) : The boiling points of alkyl chlorides, bromides and iodides are considerably higher than that of the hydrocarbon of comparable molecular mass.

16. **Assertion (A)** : $[Cr(H_2O)_6]Cl_2$ and $[Fe(H_2O)_6]Cl_2$ are examples of homoleptic complexes.

Reason (R) : All the ligands attached to the metal are the same.

SECTION – B

17. Would you expect benzaldehyde to be more reactive or less reactive in nucleophilic addition reactions than propanal ? Justify your answer. **2**

18. Complete and balance the following chemical equations : **2**

(a) $8MnO_4^- + 3S_2O_3^{2-} + H_2O \longrightarrow$

(b) $Cr_2O_7^{2-} + 3\ Sn^{2+} + 14H^+ \longrightarrow$

19. (A) Give reasons : **(1 + 1 = 2)**

(a) Cooking is faster in pressure cooker than in an open pan.

(b) On mixing liquid X and liquid Y, volume of the resulting solution decreases. What type of deviation from Raoult's law is shown by the resulting solution ? What change in temperature would you observe after mixing liquids X and Y ?

OR

(B) Define Azeotrope. What type of Azeotrope is formed by negative deviation from Raoult's law ? Give an example. **2**

20. Identify A and B in each of the following reaction sequence : **(1 + 1 = 2)**

(a) $CH_3CH_2Cl \xrightarrow{NaCN} A \xrightarrow{H_2/Ni} B$

(b) $C_6H_5NH_2 \xrightarrow[0-5\,^\circ C]{NaNO_2/HCl} A \xrightarrow[H^+]{C_6H_5NH_2} B$

21. What are the hydrolysis products of : **2**

(a) Sucrose

(b) Lactose

SECTION – C

22. Henry's law constant for CO_2 in water is 1.67×10^8 Pa at 298 K. Calculate the number of moles of CO_2 in 500 m*l* of soda water when packed under 2.53×10^5 Pa at the same temperature. **3**

23. Calculate $\Delta_r G^\circ$ and $\log K_C$ of the reaction. **3**

$2Cr(s) + 3Cd^{2+}(aq) \longrightarrow 2Cr^{3+}(aq) + 3Cd(s)$

Given $E^\circ_{Cr^{3+}/Cr} = -0.74$ V

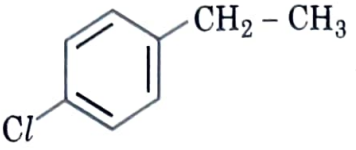
$E^\circ_{Cd^{2+}/Cd} = -0.40$ V

[R = 8.314 J K^{-1} mol^{-1}, F = 96500 C mol^{-1}]

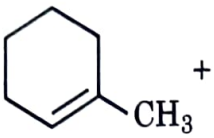
24. The rate of a reaction quadruples when the temperature changes from 293 K to 313 K. Calculate the energy of activation of the reaction assuming that it does not change with temperature. **3**

[Given : log 4 = 0.602, log 2 = 0.301, R = 8.314 J K^{-1} mol^{-1}]

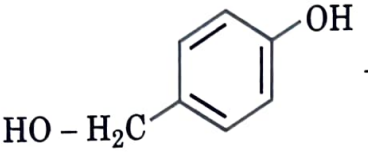
25. (A) Draw the structure of the major monohalo product for each of the following reaction : **(1 + 1 + 1 = 3)**

(a) 

$\xrightarrow{Br_2,\ Heat}$?

(b) 

$+ HBr \longrightarrow$?

(c) 

$\xrightarrow{HCl,\ Heat}$?

OR

(3 × 1 = 3)

(B) How do you convert :

(a) Chlorobenzene to biphenyl

(b) Propene to 1-Iodopropane

(c) 2-bromobutane to but-2-ene.

26. The elements of 3d transition series are given as : **(1 + 1 + 1 = 3)**

Sc, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Zn

Answer the following :

(a) Copper has exceptionally positive $E^{\circ}_{M^{2+}/M}$ value, why ?

(b) Which element is a strong reducing agent in +2 oxidation state and why ?

(c) Zn^{2+} salts are colourless. Why ?

27. (a) Arrange the following compounds in increasing order of their boiling point : **(1 + 2 = 3)**

$(CH_3)_2NH$, $CH_3CH_2NH_2$, CH_3CH_2OH.

(b) Give plausible explanation for each of the following :

(i) Aromatic primary amines cannot be prepared by Gabriel Phthalimide synthesis.

(ii) Amides are less basic than amines.

Define the following terms :

(a) Native protein

(b) Nucleotide

(c) Essential amino acid

SECTION – D

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

The rate of a chemical reaction is expressed either in terms of decrease in the concentration of reactants or increase in the concentration of a product per unit time. Rate of the reaction depends upon the nature of reactants, concentration of reactants, temperature, presence of catalyst, surface area of the reactants and presence of light. Rate of reaction is directly related to the concentration of reactant. Rate law states that the rate of reaction depends upon the concentration terms on which the rate of reaction actually depends, as observed experimentally. The sum of powers of the concentration of the reactants in the Rate law expression is called order of reaction while the number of reacting species taking part in an elementary reaction which must collide simultaneously in order to bring about a chemical reaction is called molecularity of the reaction.

Answer the following questions :

(a) (i) What is a rate determining step ? **(1 + 1 = 2)**

(ii) Define complex reaction.

(b) What is the effect of temperature on the rate constant of a reaction ? 1

OR

(b) Why is molecularity applicable only for elementary reactions whereas order is applicable for elementary as well as complex reactions ? 1

(c) The conversion of molecule X to Y follows second order kinetics. If concentration of X is increased 3 times, how will it affect the rate of formation of Y ? 1

30. Phenols undergo electrophilic substitution reactions readily due to the strong activating effect of OH group attached to the benzene ring. Since, the OH group increases the electron density more to o– and p– positions therefore OH group is ortho, para-directing. Reimer-Tiemann reaction is one of the examples of aldehyde group being introduced on the aromatic ring of phenol, ortho to the hydroxyl group. This is a general method used for the ortho-formylation of phenols.

Answer the following questions : 2

(a) What happens when phenol reacts with

(i) Br_2/CS_2

(ii) Conc. HNO_3 1

(b) Why phenol does not undergo protonation readily ? 1

(c) Which is a stronger acid – phenol or cresol ? Give reason. 1

OR

(c) Write the IUPAC name of the product formed in the Reimer-Tiemann reaction. 1

SECTION – E

(2 + 3 = 5)

31. (A) (a) Carry out the following conversions :

(i) Ethanal to But-2-enal

(ii) Propanoic acid to ethane

(b) An alkene A 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.

OR

31. (B) An organic compound (A) (molecular formula $C_8H_{16}O_2$) was hydrolysed with dilute sulphuric acid to get a carboxylic acid (B) and an alcohol (C). Oxidation of (C) with chromic acid produced (B). (C) on dehydration gives But-1-ene. Identify (A), (B) and (C) and write chemical equations for the reactions involved. **5**

32. (A) In the following complex ions, explain the type of hybridisation, shape and magnetic property : **(2½ × 2 = 5)**

(a) $[Fe(H_2O)_6]^{2+}$

(b) $[NiCl_4]^{2-}$

(At. Nos. : Fe = 26, Ni = 28)

OR

32. (B) (a) Write IUPAC names of the following : **(3 + 2 = 5)**

(i) $[Co(H_2O)(CN)(en)_2]^{2+}$

(ii) $[PtCl_4]^{2-}$

(iii) $[Cr(NH_3)_4Cl(ONO)]^{+}$

(b) What is spectrochemical series ? Write the difference between a strong field ligand and a weak field ligand.

33. (A) (a) Write the cell reaction and calculate the e.m.f. of the following cell at 298 K : **(3 + 2 = 5)**

$Sn(s) \mid Sn^{2+}$ (0.004 M) $\mid\mid H^+$ (0.02 M) $\mid H_2(g)$ (1 Bar) $\mid Pt$ (s)

(Given : $E^\circ_{Sn^{2+}/Sn} = -0.14$ V, $E^\circ_{H^+ \mid H_2(g),\, Pt} = 0.00$V)

P.T.O.

(a) Account for the following :

(i) On the basis of E° values, O_2 gas should be liberated at anode but it is Cl_2 gas which is liberated in the electrolysis of aqueous NaCl.

(ii) Conductivity of CH_3COOH decreases on dilution.

OR

33. (B) (a) Write the anode and cathode reactions and the overall cell reaction occurring in a lead storage battery during its use. **(2 + 3 = 5)**

(b) Calculate the potential for half-cell containing 0.01 M $K_2Cr_2O_7(aq)$, 0.01 M $Cr^{3+}(aq)$ and 1.0×10^{-4} M $H^+(aq)$.

The half cell reaction is

$$Cr_2O_7^{2-}(aq) + 14H^+(aq) + 6e^- \longrightarrow 2Cr^{3+}(aq) + 7H_2O(l)$$

and the standard electrode potential is given as $E^\circ = 1.33$ V.

[Given : log 10 = 1]