



Series : ZYWX1

रोल नं.  
Roll No.

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SET ~ 1

प्रश्न-पत्र कोड  
Q.P. Code 56/1/1

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.



रसायन विज्ञान (सैद्धांतिक)  
CHEMISTRY (Theory)



निर्धारित समय : 3 घण्टे  
Time allowed : 3 hours

अधिकतम अंक : 70

Maximum Marks : 70

56/1/1

730-1

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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) This question paper is divided into five sections – Section A, B, C, D and E.
- (iii) Section A – questions number 1 to 16 are multiple choice type questions. Each question carries 1 mark.
- (iv) Section B – questions number 17 to 21 are very short answer type questions. Each question carries 2 marks.
- (v) Section C – questions number 22 to 28 are short answer type questions. Each question carries 3 marks.
- (vi) Section D – questions number 29 and 30 are case-based questions. Each question carries 4 marks.
- (vii) Section E – questions 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.

You may use the following values of physical constants wherever necessary :

$$c = 3 \times 10^8 \text{ m/s}$$

$$h = 6.63 \times 10^{-34} \text{ Js}$$

$$e = 1.6 \times 10^{-19} \text{ C}$$

$$\mu_0 = 4\pi \times 10^{-7} \text{ T m A}^{-1}$$

$$\epsilon_0 = 8.854 \times 10^{-12} \text{ C}^2 \text{ N}^{-1} \text{ m}^{-2}$$

$$\frac{1}{4\pi\epsilon_0} = 9 \times 10^9 \text{ N m}^2 \text{ C}^{-2}$$

$$\text{Mass of electron } (m_e) = 9.1 \times 10^{-31} \text{ kg.}$$

$$\text{Mass of neutron} = 1.675 \times 10^{-27} \text{ kg.}$$

$$\text{Mass of proton} = 1.673 \times 10^{-27} \text{ kg.}$$

$$\text{Avogadro's number} = 6.023 \times 10^{23} \text{ per gram mole}$$

$$\text{Boltzmann's constant} = 1.38 \times 10^{-23} \text{ JK}^{-1}$$



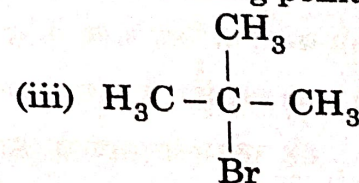
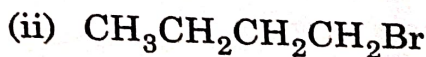
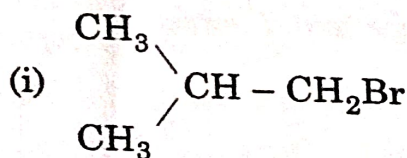


SECTION - A

(16 × 1 = 16)

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

1. In case of association, abnormal molar mass of solute will  
(A) increase (B) decrease  
(C) remain same (D) first increase and then decrease
2. Standard electrode potential for  $\text{Sn}^{4+}/\text{Sn}^{2+}$  couple is +0.15 V and that for the  $\text{Cr}^{3+}/\text{Cr}$  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
3. The magnetic moment is associated with its spin angular momentum and orbital angular momentum. Spin only magnetic moment value of  $\text{Cr}^{3+}$  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.
4. Acidified  $\text{KMnO}_4$  oxidises sulphite to  
(A)  $\text{S}_2\text{O}_3^{2-}$  (B)  $\text{S}_2\text{O}_8^{2-}$   
(C)  $\text{SO}_2(\text{g})$  (D)  $\text{SO}_4^{2-}$
5. The correct IUPAC name of  $[\text{Pt}(\text{NH}_3)_2\text{Cl}_2]^{2+}$  is  
(A) Diamminedichloridoplatinum (II)  
(B) Diamminedichloridoplatinum (IV)  
(C) Diamminedichloridoplatinum (O)  
(D) Diamminedichloridoplatinate (IV)
6. Arrange the following compounds in increasing order of their boiling points :



The correct order is

- (A) (ii) < (i) < (iii) (B) (i) < (ii) < (iii)  
(C) (iii) < (i) < (ii) (D) (iii) < (ii) < (i)





7. 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
8. 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)  $H_2O > C_6H_5OH > ROH$
9. 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)  $C_3H_7OH$
10. 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
11. 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.
12. 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



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)** :  $[\text{Cr}(\text{H}_2\text{O})_6]\text{Cl}_2$  and  $[\text{Fe}(\text{H}_2\text{O})_6]\text{Cl}_2$  are examples of homoleptic complexes.

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

14. **Assertion (A)** : The boiling points of alkyl halides decrease in the order :  $\text{RI} > \text{RBr} > \text{RCl} > \text{RF}$ .

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

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

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

16. **Assertion (A)** : All naturally occurring  $\alpha$ -amino acids except glycine are optically active.

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





### SECTION - B

17. (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 ?

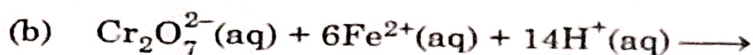
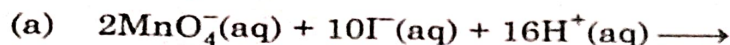
OR

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

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18. Complete and balance the following chemical equations :

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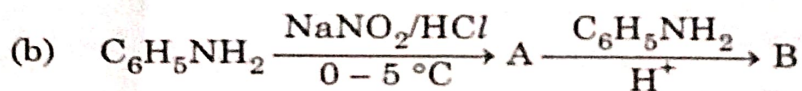
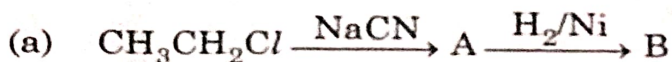


19. Would you expect benzaldehyde to be more reactive or less reactive in nucleophilic addition reactions than propanal ? Justify your answer.

2

20. Identify A and B in each of the following reaction sequence :

(1 + 1 = 2)



21. Write the reactions involved when D-glucose is treated with the following reagents :

(1 + 1 = 2)

(a) HCN

(b)  $\text{Br}_2$  water

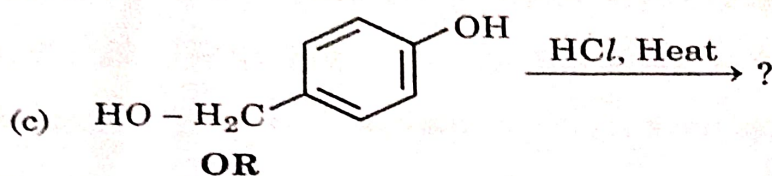
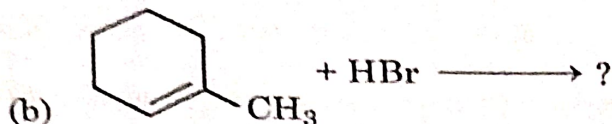
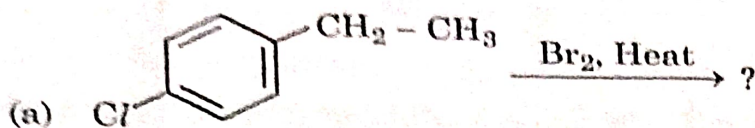


### SECTION - C

22. A solution of glucose (molar mass =  $180 \text{ g mol}^{-1}$ ) in water has a boiling point of  $100.20^\circ\text{C}$ . Calculate the freezing point of the same solution. Molal constants for water  $K_f$  and  $K_b$  are  $1.86 \text{ K kg mol}^{-1}$  and  $0.512 \text{ K kg mol}^{-1}$  respectively. 3
23. (a) State the following : 3
- (i) Kohlrausch law of independent migration of ions and
  - (ii) Faraday's first law of electrolysis.
- (b) Using  $E^\circ_{\text{values}}$  of X and Y given below, predict which is better for coating the surface of iron to prevent corrosion and why ?
- Given  $E^\circ_{\text{X}^{2+}/\text{X}} = -2.36 \text{ V}$ ,  
 $E^\circ_{\text{Y}^{2+}/\text{Y}} = -0.14 \text{ V}$ ,  
 $E^\circ_{\text{Fe}^{2+}/\text{Fe}} = -0.44 \text{ V}$
24. A certain reaction is 50% complete in 20 minutes at 300 K and the same reaction is 50% complete in 5 minutes at 350 K. Calculate the activation energy if it is a first order reaction. 3
- [ $R = 8.314 \text{ J K}^{-1} \text{ mol}^{-1}$ ;  $\log 4 = 0.602$ ]
25. 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  $E^\circ_{\text{M}^{2+}/\text{M}}$  value, why ?
  - (b) Which element is a strong reducing agent in +2 oxidation state and why ?
  - (c)  $\text{Zn}^{2+}$  salts are colourless. Why ?



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



- (B) How do you convert : (3 × 1 = 3)

- (a) Chlorobenzene to biphenyl
- (b) Propene to 1-Iodopropane
- (c) 2-bromobutane to but-2-ene.

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

$(\text{CH}_3)_2\text{NH}$ ,  $\text{CH}_3\text{CH}_2\text{NH}_2$ ,  $\text{CH}_3\text{CH}_2\text{OH}$ .

- (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.

28. (a) What is the difference between native protein and denatured protein ? (1 + 1 + 1 = 3)

- (b) Which one of the following is a disaccharide ?

Glucose, Lactose, Amylose, Fructose

- (c) Which vitamin is responsible for the coagulation of blood ?



### SECTION - D

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

29. 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

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 :

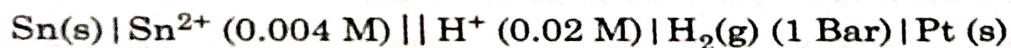
- (a) What happens when phenol reacts with 2
- (i)  $\text{Br}_2/\text{CS}_2$
- (ii) Conc.  $\text{HNO}_3$
- (b) Why phenol does not undergo protonation readily ? 1
- (c) Which is a stronger acid – phenol or cresol ? Give reason. 1

OR

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

### SECTION – E

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



(Given :  $E^\circ_{\text{Sn}^{2+}/\text{Sn}} = -0.14 \text{ V}$ ,  $E^\circ_{\text{H}^+|\text{H}_2(\text{g}), \text{Pt}} = 0.00\text{V}$ )

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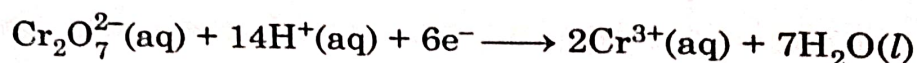
(b) Account for the following :

- (i) On the basis of  $E^\circ$  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

31. (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  $1.0 \times 10^{-4}$  M  $H^+(aq)$ .

The half cell reaction is



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

[Given :  $\log 10 = 1$ ]

32. (A) Answer the following :

5

- (a) Low spin tetrahedral complexes are not known.
- (b)  $Co^{2+}$  is easily oxidised to  $Co^{3+}$  in the presence of a strong ligand [At. No. of Co = 27]
- (c) What type of isomerism is shown by the complex  $[Co(NH_3)_6][Cr(CN)_6]$  ?
- (d) Why a solution of  $[Ni(H_2O)_6]^{2+}$  is green while a solution of  $[Ni(CN)_4]^{2-}$  is colourless. (At. No. of Ni = 28)
- (e) Write the IUPAC name of the following complex :  $[Co(NH_3)_5(CO_3)]Cl$

OR

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32. (B) (a) What is meant by 'Chelate effect'? Give an example. (2 + 2 + 1 = 5)  
(b) Write the hybridization and magnetic behaviour of  $[\text{Fe}(\text{CN})_6]^{4-}$ .  
(Atomic number : Fe = 26)  
(c) If  $\text{PtCl}_2 \cdot 2\text{NH}_3$  does not react with  $\text{AgNO}_3$ , what will be its formula?
33. (A) (a) Carry out the following conversions : (2 + 3 = 5)  
(i) Ethanal to But-2-enal  
(ii) Propanoic acid to ethane  
(b) An alkene A with molecular formula  $\text{C}_6\text{H}_{10}$  on ozonolysis gives a mixture of two compounds B and C. Compound B gives positive Fehling test and also reacts with iodine and  $\text{NaOH}$  solution. Compound C does not give Fehling solution test but forms iodoform. Identify the compounds A, B and C.

OR

33. (B) An organic compound (A) (molecular formula  $\text{C}_8\text{H}_{16}\text{O}_2$ ) 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.

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1 b 7 B 12 d  
3 A 8 A 13 c  
4 B 9 A  
5 A 10 B  
6 A 11 d