



SET-2

Series PP4QQ/4

प्रश्न-पत्र कोड
Q.P. Code 56/4/2

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

56/4/2/21

226 B

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

16 × 1 = 16

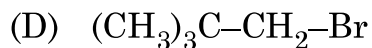
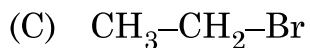
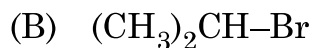
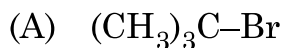
Question No. 1 to 16 are Multiple Choice type questions carrying 1 mark each.

1. The molar ionic conductivities of Mg^{2+} and SO_4^{2-} are $106.0 \text{ S cm}^2 \text{ mol}^{-1}$ and $160.0 \text{ S cm}^2 \text{ mol}^{-1}$ respectively. The value of limiting molar conductivity of MgSO_4 will be :
(A) $266 \text{ S cm}^2 \text{ mol}^{-1}$ (B) $622 \text{ S cm}^2 \text{ mol}^{-1}$
(C) $288 \text{ S cm}^2 \text{ mol}^{-1}$ (D) $822 \text{ S cm}^2 \text{ mol}^{-1}$
2. From the elements of 3d series given below, which element shows the maximum number of oxidation states ?
(A) Scandium (B) Manganese
(C) Chromium (D) Titanium





3. Which alkyl halide from the given options will undergo S_N1 reaction faster ?



4. Which of the following acids represents Vitamin C ?

(A) Saccharic acid

(B) Gluconic acid

(C) Ascorbic acid

(D) Benzoic acid

5. Rosenmund reduction is used for the preparation of Aldehydes. The catalyst used in this reaction is

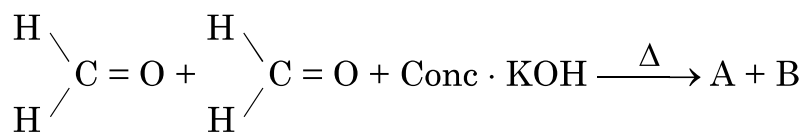
(A) $Pd - BaSO_4$

(B) Anhydrous $AlCl_3$

(C) Iron (III) oxide

(D) $HgSO_4$

6. Consider the following reaction :



Identify A and B from the given options :

(A) A – Methanol, B – Potassium formate

(B) A – Ethanol, B – Potassium formate

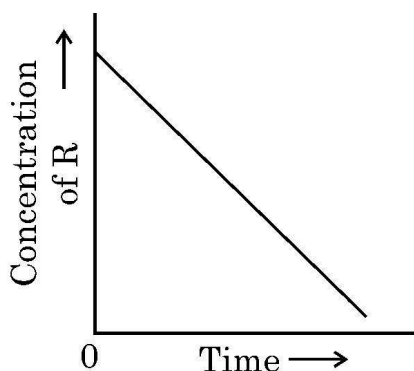
(C) A – Methanal, B – Ethanol

(D) A – Methanol, B – Potassium acetate





7. In effective collisions the colliding molecules must have :
- (A) Proper orientation only
(B) A certain minimum amount of activation energy.
(C) Threshold energy only.
(D) Threshold energy and proper orientation both.
8. Identify the secondary amine from the given options :
- (A) $(\text{CH}_3)_2\text{CHNH}_2$ (B) $\text{CH}_3\text{NHCH}(\text{CH}_3)_2$
(C) $(\text{CH}_3)_3\text{CNH}_2$ (D) $\text{CH}_3(\text{CH}_2)_2\text{NH}_2$
9. In a given graph of zero order reaction, the slope and intercept are :



- (A) Slope = k , Intercept = $[\text{R}]_0$
(B) Slope = $-k$, Intercept = $[\text{R}]_0$
(C) Slope = $k/2.303$, Intercept = $\ln[\text{R}]_0$
(D) Slope = $-k/2.303$, Intercept = $\ln A$
10. The general electronic configuration of d-block elements is :
- (A) $(n-1) d^{1-10} ns^{1-2}$ (B) $(n-1) d^{10} ns^{1-2}$
(C) $(n-1) d^{10} ns^{2-3}$ (D) $(n-1) d^0 ns^{1-2}$



11. Nucleophilic addition of Grignard reagent to ketones followed by hydrolysis with dilute acids forms :

- (A) Alkene (B) Primary alcohol
(C) Tertiary alcohol (D) Secondary alcohol

12. Match the reagents required for the given reactions :

- I. Oxidation of primary alcohols to aldehydes (p) NaBH_4
II. Butan-2-one to Butan-2-ol (q) 85% phosphoric acid at 440 K
III. Bromination of Phenol to 2, 4, 6-Tribromophenol (r) PCC
IV. Dehydration of propan-2-ol to propene (s) Bromine water
- (A) I – (r), II – (p), III – (s), IV – (q) (B) I – (q), II – (r), III – (p), IV – (s)
(C) I – (s), II – (q), III – (p), IV – (r) (D) I – (p), II – (s), III – (r), IV – (q)

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)** : Bromination of Phenol can be carried out even in the absence of Lewis acid.

Reason (R) : – OH group of Phenol has the high activation effect.

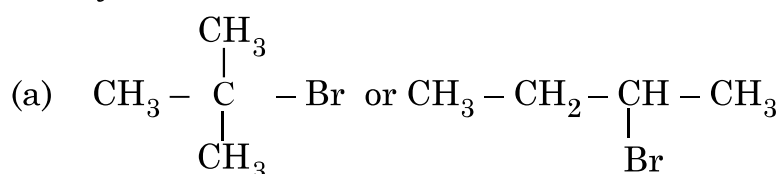




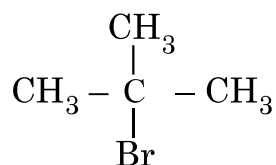
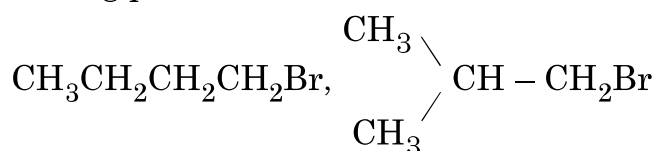
14. **Assertion (A) :** Fructose is a reducing sugar.
Reason (R) : Fructose does not reduce Fehling solution and Tollen's reagent.
15. **Assertion (A) :** For a Daniell cell, $\text{Zn}/\text{Zn}^{2+}(1\text{M}) \parallel \text{Cu}^{2+}(1\text{M})/\text{Cu}$ with $E^\circ_{\text{cell}} = 1.1 \text{ V}$, if the external opposing potential is more than 1.1 V, the electrons flow from Cu to Zn.
Reason (R) : Cell acts like a galvanic cell.
16. **Assertion (A) :** Benzoic acid does not undergo Friedel – Crafts reaction.
Reason (R) : Carboxyl group is deactivating and the catalyst aluminium chloride gets bonded to the carboxyl group.

SECTION – B

17. Define the following terms : 2
 (a) Molecularity of reaction
 (b) Complex reaction
18. Calculate the molar mass of a compound when 6.3 g of it is dissolved in 27 g of chloroform to form a solution that has a boiling point of 68.04 °C. The boiling point of pure chloroform is 61.04 °C and K_b for chloroform is 3.63 °C kg mol⁻¹. 2
19. Which of the following compounds will react more rapidly by S_N2 reaction & why ?



- (b) Arrange the following compounds in the increasing order of their boiling points :



1 × 2



20. (a) Write the stepwise mechanism of nucleophilic addition reactions in the carbonyl compounds. 2

OR

- (b) How will you convert the following :

(i) Toluene to benzoic acid.

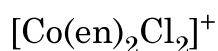
(ii) Ethanol to 3-Hydroxybutanal 1 × 2

21. (a) What happens when Glucose reacts with HI ? Write chemical equation.

- (b) Which type of bond holds a DNA double helix together ? 1 × 2

SECTION – C

22. (a) Draw the geometrical isomers of the given complex :



- (b) Write the electronic configuration of d^4 ion if $\Delta_0 > P$.

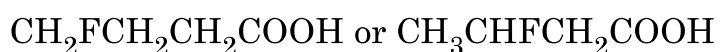
- (c) What is a didentate ligand ? Give one example. 1 × 3

23. (a) Give chemical tests to distinguish between the following pairs of compounds :

(i) Phenol and Benzoic acid

(ii) Propanal and Propanone

- (b) Which one of the given compounds is a stronger acid and why ?



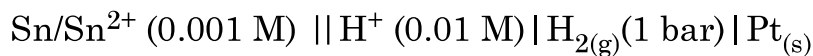
2 + 1

24. Show that the time required for 99.9% completion in a first order reaction is 10 times of half-life ($t_{1/2}$) of the reaction [$\log 2 = 0.3010$, $\log 10 = 1$]. 3





25. Calculate emf of the following cell at 25 °C :



Given : $E^\circ(\text{Sn}^{2+}/\text{Sn}) = -0.14 \text{ V}$, $E^\circ \text{H}^+/\text{H}_2 = 0.00 \text{ V}$ ($\log 10 = 1$)

3

26. Define the following terms :

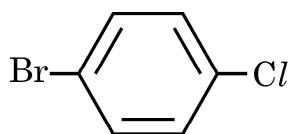
(a) Non essential amino acids.

(b) Monosaccharides

(c) Anomers

1 × 3

27. (a) Write the IUPAC name of the given compound :



(b) Why are haloalkanes more reactive towards nucleophilic substitution reactions than haloarenes ?

(c) What happens when ethyl chloride is treated with aqueous KOH ? **1 × 3**

28. Write chemical equations for the following reactions : (Do any **three**)

(a) Hydroboration – oxidation reaction

(b) Williamson Synthesis

(c) Friedel-Crafts Alkylation of Anisole

(d) Reimer-Tiemann Reaction

1 × 3





SECTION – D

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

29. In a galvanic cell, chemical energy of a redox reaction is converted into electrical energy, whereas in an electrolytic cell the redox reaction occurs on passing electricity. The simplest galvanic cell is in which Zn rod is placed in a solution of ZnSO_4 and Cu rod is placed in a solution of CuSO_4 . The two rods are connected by a metallic wire through a voltmeter. The two solutions are joined by a salt bridge. The difference between the two electrode potentials of the two electrodes is known as electromotive force. In the process of electrolysis, the decomposition of a substance takes place by passing an electric current. One mole of electric charge when passed through a cell will discharge half a mole of a divalent metal ion such as Cu^{2+} . This was first formulated by Faraday in the form of laws of electrolysis.

Answer the following questions :

- (a) What is the function of a salt bridge in a galvanic cell ? 1
- (b) When does galvanic cell behave like an electrolytic cell ? 1
- (c) Can copper sulphate solution be stored in a pot made of zinc ?
Explain with the help of the value of E° cell.
- ($E^\circ \text{Cu}^{2+} / \text{Cu} = 0.34 \text{ V}$)
- ($E^\circ \text{Zn}^{2+} / \text{Zn} = - 0.76 \text{ V}$) 2

OR

- (c) How much charge in terms of Faraday is required for the following :
- (i) 1 mol of MnO_4^- to Mn^{2+}
- (ii) 1 mol of H_2O to O_2 2





30. The nature of bonding, structure of the coordination compound can be explained to some extent by valence bond theory. The central metal atom/ion makes available a number of vacant orbitals equal to its coordination number. The appropriate atomic orbitals (s, p and d) of the metal hybridise to give a set of equivalent orbitals of definite geometry such as square planar, tetrahedral, octahedral and so on. A strong covalent bond is formed only when the orbitals overlap to the maximum extent. The d-orbitals involved in the hybridisation may be either inner d-orbitals i.e. (n-1) d or outer d-orbitals i.e. nd. The complexes formed are called inner orbital complex (low spin complex) and outer orbital complex (high spin complex) respectively. Further, the complexes can be paramagnetic or diamagnetic in nature. The drawbacks of this theory are that this involves number of assumptions and also does not explain the colour of the complex.

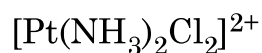
Answer the following questions :

- (a) Predict whether $[\text{CoF}_6]^{3-}$ is diamagnetic or paramagnetic and why ?

[Atomic number : Co = 27] 1

- (b) What is the coordination number of Co in $[\text{Co}(\text{en})_2 \text{Cl}_2]^+$? 1

- (c) (i) Write the IUPAC name of the given complex :



- (ii) Explain $[\text{Co}(\text{NH}_3)_6]^{3+}$ is an inner orbital or outer orbital complex. 1 + 1

OR

- (c) Using valence bond theory, deduce the shape and hybridisation of $[\text{Ni}(\text{NH}_3)_6]^{2+}$ [Atomic number of Ni = 28] 2





SECTION – E

31. (a) (i) Define reverse osmosis.
- (ii) Why are aquatic species more comfortable in cold water in comparison to warm water ?
- (iii) A solution containing 2 g of glucose ($M = 180 \text{ g mol}^{-1}$) in 100 g of water is prepared at 303 K. If the vapour pressure of pure water at 303 K is 32.8 mm Hg, what would be the vapour pressure of the solution ? 1 + 1 + 3

OR

- (b) (i) Predict whether Van't Hoff factor will be less or greater than one, when Ethanoic acid is dissolved in benzene.
- (ii) Define ideal solution.
- (iii) Calculate the mass of CaCl_2 (molar mass = 111 g mol^{-1}) to be dissolved in 500 g of water to lower its freezing point by 2K, assuming that CaCl_2 undergoes complete dissociation. 1 + 1 + 3
- (K_f for water = $1.86 \text{ K kg mol}^{-1}$)

32. (a) An amide 'A' with molecular formula $\text{C}_7\text{H}_7\text{ON}$ undergoes Hoffmann Bromamide degradation reaction to give amine 'B'. 'B' on treatment with nitrous acid at 273-278 K form 'C' and on treatment with chloroform and ethanolic potassium hydroxide forms 'D'. 'C' on treatment, with ethanol gives 'E'. Identify 'A', 'B', 'C' 'D' and 'E.' and write the sequence of chemical equations. 5

OR

- (b) (i) (1) What is Hinsberg's reagent ?
- (2) Arrange the following compounds in the increasing order of their basic strength in gaseous phase :
- $\text{C}_2\text{H}_5\text{NH}_2$, $(\text{C}_2\text{H}_5)_3\text{N}$, $(\text{C}_2\text{H}_5)_2\text{NH}$





(ii) Give reasons for the following :

- (1) Methyl amine is more basic than aniline.
- (2) Aniline readily reacts with bromine water to give 2, 4, 6-tribromoaniline.
- (3) Primary amines have higher boiling points than tertiary amines.

2 + 3

33. Attempt any **five** of the following :

- (a) Why Zinc is not regarded as a transition element ?
- (b) What is Lanthanoid contraction ?
- (c) Why is first ionization enthalpy of chromium lower than that of Zn ?
- (d) Why are transition elements good catalysts ?
- (e) Compounds of transition metals are generally coloured. Give reason.
- (f) Out of KMnO_4 and K_2MnO_4 , which one is paramagnetic and why ?
- (g) Complete the following ionic equation :



1 × 5
