

CBSE Class 12 Chemistry Question Paper 2021



Series 1HKPQ6/C

Set~1

Code No. 56/1/1

Roll No.

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Candidates must write the Code on the title page of the answer-book.

- Please check that this question paper contains **10** printed pages.
- Code number 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 **33** 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.



CHEMISTRY (Theory)



Time allowed : 3 hours

Maximum Marks : 70

General Instructions :

Read the following instructions very carefully and strictly follow them :

- This question paper comprises **four** Sections – A, B, C and D. There are **33** questions in the question paper. **All** questions are compulsory.*
- Section A** – Questions no. **1** to **16** are very short answer type questions, with each question/part carrying **1** mark. Answer these questions in one word or one sentence.*
- Section B** – Questions no. **17** to **25** are short answer type questions, carrying **2** marks each.*
- Section C** – Questions no. **26** to **30** are long answer type-I questions, carrying **3** marks each.*
- Section D** – Questions no. **31** to **33** are long answer type-II questions, carrying **5** marks each.*
- There is no overall choice in the question paper. However, an internal choice has been provided in 7 questions/parts of one mark, 3 questions of two marks, 2 questions of three marks and all the 3 questions of five marks. You have to attempt only one of the choices in such questions.*
- In addition to this, separate instructions are given with each section and question, wherever necessary.*
- Use of calculators and log tables is **not** permitted.*



SECTION A

1. Read the passage given below and answer the following questions :

4×1=4

Amines can be considered as derivatives of ammonia and are usually formed from nitriles, nitro, halides, amides, etc. They show hydrogen bonding which influences their physical properties. In aromatic amines, electron releasing and withdrawing groups respectively increase and decrease their basic character.

Hinsberg test is used for the identification and distinction between primary, secondary and tertiary amines.

The following questions are multiple choice questions :

- (i) Ethyl amine can be prepared by the action of LiAlH_4 on :
- (A) CH_3NO_2
(B) $\text{CH}_3 - \text{CN}$
(C) $\text{CH}_3 - \text{NC}$
(D) $\text{CH}_3 - \text{CH}_2 - \text{CONH}_2$
- (ii) Which of the following reagents is used for the Hinsberg test of amines ?
- (A) $\text{C}_6\text{H}_5\text{COCl}$
(B) CH_3COCl
(C) $\text{C}_6\text{H}_5 - \text{SO}_3\text{H}$
(D) $\text{C}_6\text{H}_5 - \text{SO}_2\text{Cl}$
- (iii) Out of the following, the strongest base in aqueous solution is :
- (A) $(\text{CH}_3)_2\text{NH}$
(B) $(\text{CH}_3)_3\text{N}$
(C) $\text{CH}_3 - \text{NH}_2$
(D) $\text{C}_6\text{H}_5 - \text{NH}_2$
- (iv) The reaction of ammonia with a large excess of $\text{CH}_3 - \text{Cl}$ will give mainly :
- (A) C_2H_6
(B) $(\text{CH}_3)_2\text{NH}$
(C) $(\text{CH}_3)_4\text{N}^+\text{Cl}^-$
(D) $\text{CH}_3 - \text{NH}_2$

OR

Among the following amines, which one is expected to have the lowest boiling point ?

- (A) $\text{C}_2\text{H}_5 - \text{NH}_2$
(B) $(\text{C}_2\text{H}_5)_3\text{N}$
(C) $(\text{C}_2\text{H}_5)_2\text{NH}$
(D) $\text{CH}_3 - \text{NH}_2$



2. Read the passage given below and answer the following questions :

4×1=4

Colloidal solutions are intermediate between true solutions and suspensions based on particle size. A colloidal system consists of two phases — the dispersed phase and the dispersion medium. Based on the nature of interaction between the dispersed phase and dispersion medium, colloids are of two types — Lyophobic and Lyophilic colloids. The colloidal particles always carry an electric charge. The colloidal solutions are purified by dialysis.

In the following questions (Q. No. 2 (i) – (iv)), a statement of assertion followed by a statement of reason is given. Choose the correct answer out of the following choices.

- (A) Assertion and Reason both are correct statements and Reason is the correct explanation of the Assertion.
- (B) Assertion and Reason both are correct statements, but Reason is **not** the correct explanation of the Assertion.
- (C) Assertion is a correct statement, but Reason is a wrong statement.
- (D) Assertion is a wrong statement, but Reason is a correct statement.
- (i) *Assertion :* True solution shows scattering of light.
Reason : In true solution, size of solute particles is much smaller than the wavelength of light used.
- (ii) *Assertion :* Lyophilic sols are more stable than Lyophobic sols.
Reason : Lyophilic sols are highly solvated in the solution.
- (iii) *Assertion :* Colloidal solutions are purified by dialysis.
Reason : Colloidal particles pass through a suitable membrane in dialysis.
- (iv) *Assertion :* A positively charged sol is obtained when KI is added to AgNO₃.
Reason : This is due to preferential adsorption of Ag⁺ ions.

OR

- Assertion :* Colloidal solution shows Brownian Movement.
Reason : Colloid is not a substance but a state of substance.

The following questions (Q. No. 3 to 11) are multiple choice questions :

3. The helix structure of proteins is stabilized by :

1

- (A) peptide bond
(B) hydrogen bond
(C) disulphide bond
(D) van der Waals forces

OR

Nucleic acids are polymers of :

1

- (A) nucleosides
(B) D-ribose
(C) amino acids
(D) nucleotides



4. Which of the following is a strong oxidising agent ? 1
(At. No. Mn = 25, Zn = 30, Cr = 24, Sc = 21)
- (A) Mn^{3+}
(B) Zn^{2+}
(C) Cr^{3+}
(D) Sc^{3+}

5. A compound formed by elements P and Q crystallizes in a cubic structure where P atoms are at the corners of a cube and Q atoms are at the face centres. The formula of the compound is : 1
- (A) P_2Q_2
(B) PQ_3
(C) PQ
(D) P_3Q

6. Nitrogen is unable to form pentahalides because of : 1
- (A) the presence of s and p orbitals.
(B) the absence of both p and d orbitals.
(C) the absence of d orbitals.
(D) all of the above

OR

- Which of the following hydrogen halides is most volatile ? 1
- (A) $\text{H} - \text{F}$
(B) $\text{H} - \text{I}$
(C) $\text{H} - \text{Br}$
(D) $\text{H} - \text{Cl}$

7. The oxidation number of Co in $[\text{Co}(\text{en})_3]_2(\text{SO}_4)_3$ is : 1
- (A) +2
(B) +3
(C) +4
(D) +6

8. Which of the following ligands form a 'chelate' complex with metal ion ? 1
- (A) H_2O
(B) CN^-
(C) $\text{C}_2\text{O}_4^{2-}$
(D) Cl^-

OR

- The coordination number of Cr in $[\text{CrCl}_2(\text{ox})_2]^{3-}$ is : 1
- (A) 6
(B) 5
(C) 4
(D) 3

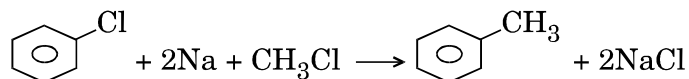


9. The formula of the coordination compound tetraamminechloridonitrito-N-cobalt(III)chloride is :

1

- (A) $[\text{Co}(\text{NH}_3)_4\text{Cl}(\text{ONO})]\text{Cl}_2$
 (B) $[\text{Co}(\text{NH}_3)_4\text{Cl}_2(\text{NO}_2)]\text{Cl}$
 (C) $[\text{Co}(\text{NH}_3)_4\text{Cl}(\text{NO}_2)]\text{Cl}$
 (D) $[\text{Co}(\text{NH}_3)_4(\text{NO}_2)]\text{Cl}_3$

10. The reaction given below :



is called :

1

- (A) Wurtz reaction
 (B) Wurtz – Fittig reaction
 (C) Fittig reaction
 (D) None of the above

OR

Which of the following reactions will be the fastest under identical conditions ?

1

- (A) $\text{C}_2\text{H}_5\text{OH} + \text{HI} \longrightarrow \text{C}_2\text{H}_5\text{I} + \text{H}_2\text{O}$
 (B) $\text{C}_2\text{H}_5\text{OH} + \text{HCl} \longrightarrow \text{C}_2\text{H}_5\text{Cl} + \text{H}_2\text{O}$
 (C) $\text{C}_2\text{H}_5\text{OH} + \text{HBr} \longrightarrow \text{C}_2\text{H}_5\text{Br} + \text{H}_2\text{O}$
 (D) $\text{C}_2\text{H}_5\text{OH} + \text{HF} \longrightarrow \text{C}_2\text{H}_5\text{F} + \text{H}_2\text{O}$

11. Cubic close packing of equal sized spheres is described by :

1

- (A) ACB ACB ACB ...
 (B) AB AB AB ...
 (C) ABC ABC ABC ...
 (D) AB AC AC AB ...

In the following questions (Q. No. 12 – 16) a statement of assertion followed by a statement of reason is given. Choose the correct answer out of the following choices.

- (A) Assertion and Reason both are correct statements and Reason is the correct explanation of the Assertion.
 (B) Assertion and Reason both are correct statements, but Reason is **not** the correct explanation of the Assertion.
 (C) Assertion is a correct statement, but Reason is a wrong statement.
 (D) Assertion is a wrong statement, but Reason is a correct statement.

12. **Assertion :** Ortho-nitrophenol is more acidic than phenol.

Reason : Nitro group is electron donating group and therefore stabilizes ortho-nitrophenoxide ion.

1

13. **Assertion :** F – F bond has lower bond dissociation enthalpy than Cl – Cl bond.

Reason : Fluorine forms only one oxoacid.

1

OR



Assertion : Noble gases form compounds mainly with Fluorine and Oxygen.

Reason : Fluorine and Oxygen are the most electronegative elements. 1

14. *Assertion :* Iron on reaction with HCl gives FeCl_3 and not FeCl_2 .

Reason : Hydrogen gas produced from the reaction prevents the oxidation of FeCl_2 to FeCl_3 . 1

15. *Assertion :* Glucose is a reducing sugar.

Reason : Despite having an aldehydic group, glucose does not give 2,4-DNP test. 1

16. *Assertion :* Benzoic acid does not give Friedel-Crafts reaction.

Reason : The carboxyl group is deactivating and gets bonded to Lewis acid AlCl_3 . 1

SECTION B

The following questions (Q. No. 17 to 25) are short answer type and carry 2 marks each : 9×2=18

17. (a) Write structures of the products formed when : 2×1=2

(i) Propan-2-ol is heated with Cu at 573 K.

(ii) Salicylic acid is treated with $(\text{CH}_3\text{CO})_2\text{O}/\text{H}^+$.

OR

(b) Carry out the following conversions : 2×1=2

(i) Phenol to Anisole

(ii) Aniline to Phenol

18. What type of deviation from Raoult's law is observed by mixing chloroform and acetone ?

Why is a decrease in vapour pressure observed on mixing chloroform and acetone ? 2

19. (a) Write the hybridisation and magnetic behaviour of the following complex : 2×1=2

(i) $[\text{CoF}_6]^{3-}$

(ii) $[\text{Ni}(\text{CN})_4]^{2-}$

[Atomic number of Co = 27, Ni = 28]

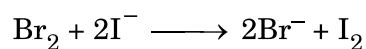
OR

(b) (i) Write the IUPAC name of $[\text{Mn}(\text{H}_2\text{O})_6]\text{SO}_4$.

(ii) Why is $[\text{Fe}(\text{CN})_6]^{4-}$ diamagnetic while $[\text{FeF}_6]^{3-}$ is paramagnetic ?

[At. No. Fe = 26] 2×1=2

20. The following reaction was carried out in water :



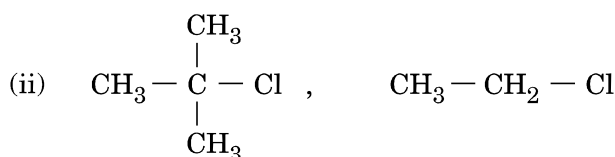
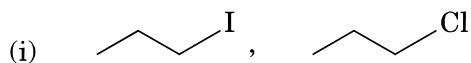
The initial concentration of I^- was 0.30 M and the concentration after 10 minutes reduced to 0.28 M. Calculate the rate of disappearance of I^- and production of I_2 . 2



21. (a) Account for the following : 2×1=2
- (i) Transition metals form large number of complex compounds.
- (ii) Cr^{2+} is a strong reducing agent.

OR

- (b) Why do transition elements show variable oxidation states ? How are transition metals different from p-block elements in terms of variability of oxidation states ? 2
22. Write the equations involved in the following reactions : 2×1=2
- (i) Carbylamine reaction
- (ii) Hoffmann bromamide degradation reaction
23. In the following pairs of halogen compounds, which would undergo $\text{S}_{\text{N}}2$ reaction faster ? Give reason in support of your answer. 2×1=2



24. Write equations of the following reactions : 2×1=2
- (i) Friedel-Crafts reaction — alkylation of anisole
- (ii) Nitration of Phenol with concentrated nitric acid
25. An element with molar mass 27 g mol^{-1} forms a cubic unit cell with edge length 300 pm. If its density is 6.6 g cm^{-3} , identify the nature of cubic unit cell. 2

SECTION C

Q. No. 26 to 30 are long answer type-I questions carrying 3 marks each. 5×3=15

26. (a) Why is $E^\circ(\text{Cu}^{2+}|\text{Cu})$ exceptionally positive ? Although Cu^+ ion has $3d^{10}$ configuration, yet it is unstable in an aqueous solution. Why ? What is the reason for the stability of Cu^{2+} over Cu^+ ion ? 3

OR

- (b) Give reasons for the following : 3×1=3
- (i) Transition metals form alloys.
- (ii) Zinc has lowest enthalpy of atomization.
- (iii) Manganese shows higher oxidation state of +4 with Fluorine but shows +7 with Oxygen.

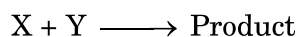


27. (a) Differentiate the following : 3×1=3
- (i) Fibrous protein and Globular protein
 - (ii) Essential amino acids and Non-essential amino acids
 - (iii) DNA and RNA

OR

- (b) Write the reaction of Glucose with : 3×1=3
- (i) HCN
 - (ii) Br₂
 - (iii) HI

28. Following data were obtained for the given reaction :



Exp.	[X]/M	[Y]/M	Initial Rate M min ⁻¹
1	0.1 M	0.2 M	0.05
2	0.2 M	0.2 M	0.10
3	0.1 M	0.1 M	0.05

- (i) Find the order of reaction with respect to X and Y.
 - (ii) Write the rate law expression.
 - (iii) Find the rate constant. 3×1=3
29. Vapour pressure of water at 293 K is 17.536 mm Hg. Calculate the vapour pressure of aqueous solution when 20 g of glucose (Molar mass = 180 g mol⁻¹) is dissolved in 500 g of water. 3
30. Give reasons for the following : 3×1=3
- (i) Electrophilic substitution in haloarenes occurs slowly.
 - (ii) Sulphuric acid is not used during the reaction of alcohols with KI.
 - (iii) Alkyl halides give nitrile with KCN and isonitrile with AgCN.

SECTION D

Q. No. 31 to 33 are long answer type-II questions carrying 5 marks each. 3×5=15

31. (a) (i) Account for the following :
- (I) Tendency to show -2 oxidation state decreases from Oxygen to Polonium in Group-16.
 - (II) Among the noble gases, only Xenon is known to form chemical compounds.
 - (III) Axial Br – F bonds are slightly bent in the structure of BrF₃.



- (ii) Draw the structures of XeF_6 and XeF_2 .

3+2=5

OR

- (b) (i) When MnO_2 is heated with conc. HCl a pungent coloured gas (A) is evolved. (A) reacts with excess NH_3 to give a colourless gas (B). However, when excess (A) is reacted with NH_3 it gives an explosive (C). Identify (A), (B), (C), with equations.

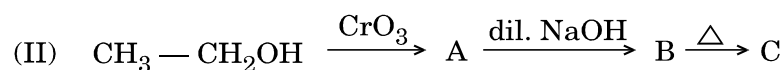
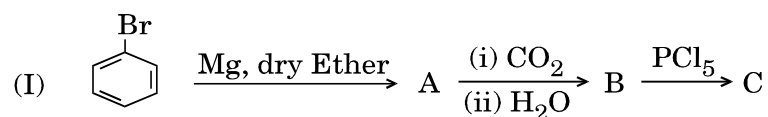
- (ii) Arrange the following in the increasing order of the property indicated :

(I) Xe, Kr, Ar, Ne, He — Boiling point

(II) HF, HCl, HBr, HI — Thermal stability

3+2=5

32. (a) (i) Identify A, B and C in the following reactions :



- (ii) By what tests will you distinguish between :

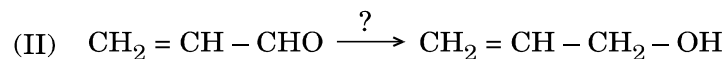
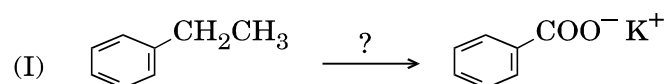
(I) Ethanol and Benzaldehyde

(II) Acetone and Acetic acid

3+2=5

OR

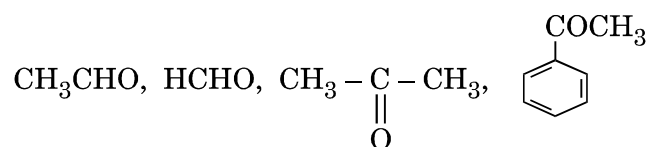
- (b) (i) Name the reagents used in the following reactions :



- (ii) Write the structure of oxime of propanal.

- (iii) Why does carboxylic acid not give reactions of aldehydes and ketones ?

- (iv) Arrange the following in the increasing order of their reactivity towards nucleophilic addition reaction :



2+1+1+1=5



33. (a) (i) Calculate emf of the following cell at 298 K :



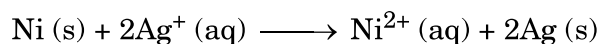
Given : $E_{\text{cell}}^{\circ} = 2.00 \text{ V}$ ($\log 10 = 1$)

- (ii) Define molar conductivity. On dilution, why does the molar conductivity of HCOOH increase drastically, while that of HCOONa increases gradually ?

3+2=5

OR

- (b) (i) The electrical resistance of a column of 0.02 M NaOH solution of diameter 1.40 cm and length 44 cm is 5.00×10^3 ohm. Calculate its resistivity, conductivity and molar conductivity.
- (ii) Depict the galvanic cell in which the reaction takes place :



Further show :

- (I) Which of the electrodes is positively charged ?
- (II) The carriers of the current in the outer circuit.

3+2=5