Sample paper -1 Class 12, Chemistry

[*Maximum Marks:* 70

Time Allowed: 3 hours]

General Instructions:

Read the following instructions carefully.

(*a*) There are **33** questions in this question paper with internal choice.

(*b*) SECTION A consists of 16 multiple-choice questions carrying 1 mark each.

(*c*) SECTION B consists of 5 short answer questions carrying 2 marks each.

(*d*) SECTION C consists of 7 short answer questions carrying 3 marks each.

(*e*) SECTION D consists of 2 case-based questions carrying 4 marks each.

(*f*) SECTION E consists of 3 long answer questions carrying 5 marks each.

(*g*) **All questions are compulsory.**

(*h*) **Use of log tables and calculators is not allowed.**

SECTION – A

The following questions are multiple-choice questions with one correct answer. Each question carries 1 mark. There is no internal choice in this section.

1. Which of the following is most reactive towards sodium metal?

(*a*) CH_3OH

(*b*) C_2H_5OH

(*c*) $CH_3-\underset{\displaystyle OH}{\underset{|}{CH}}-CH_3$

(*d*) $CH_3-\underset{\displaystyle CH_3}{\underset{|}{\overset{\displaystyle OH}{\overset{|}{C}}}}-CH_3$

2. Which one of the following is most reactive towards S_N2 reaction?

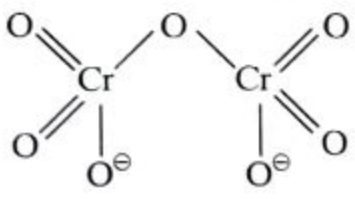
(*a*) $CH_3CH_2CH_2CH_2Br$

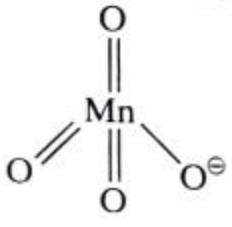
(*b*) $CH_3\underset{\displaystyle Br}{\underset{|}{CH}}-CH_2-CH_3$

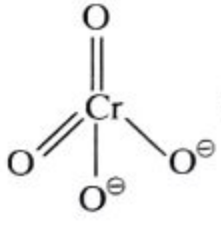
(*c*) $CH_3-\underset{\displaystyle CH_3}{\underset{|}{CH}}-CH_2Br$

(*d*) $CH_3-\underset{\displaystyle CH_3}{\underset{|}{\overset{\displaystyle Br}{\overset{|}{C}}}}-CH_3$

3. Which of the following is/are correct structure of oxo anions?

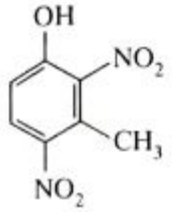
(*a*) 

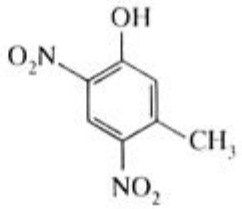
(*b*) 

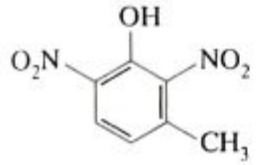
(*c*) 

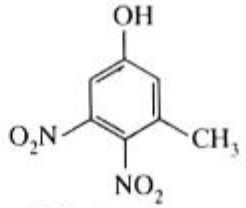
(*d*) All of these

4. Which of the following isotope has highest value of decay constant (k)?
   (*a*) U – 238($t_{1/2}$ = 4.5 × 10^9 years) (*b*) ^3_1H($t_{1/2}$ = 12.4 years)
   (*c*) C – 14 ($t_{1/2}$ = 5730 years) (*d*) Fr – 223($t_{1/2}$ = 22 min)
5. The product of electrolysis of aq. NaCl solution using inert electrodes at anode will be:
   (*a*) H_2 (*b*) O_2 (*c*) Cl_2 (*d*) Na
6. Activation energy can be lowered by:
   (*a*) Increasing temperature (*b*) Decreasing temperature
   (*c*) Adding catalyst (*d*) Increasing concentration
7. Which of the following will convert ethanamide to ethanamine?
   (*a*) Br_2/KOH (*b*) (*i*) $LiAlH_4$, (*ii*) H_2O (*c*) Br_2/NaOH (*d*) None of these
8. The linkage isomer of $[Co(NH_3)_5NO_2]Cl_2$ is
   (*a*) $[Co(NH_3)_5Cl]NO_2$ (*b*) $[Co(NH_3)_5ONO]Cl_2$
   (*c*) $[Co(NH_3)_4ONO]Cl_2$ (*d*) $[Co(NH_3)_6ONO]Cl_2$
9. Dinitration of 3-methyl phenol gives:

   (*a*) 

   (*b*) 

   (*c*) 

   (*d*) 

10. Aniline reacts with benzoyl chloride in presence of pyridine to give:
    (*a*) $C_6H_5NHCOCH_3$ (*b*) $C_6H_5NHCOC_6H_5$
    (*c*) $C_6H_5COC_6H_5$ (*d*) $C_6H_5CH_2NHCOC_6H_5$
11. HCHO and CH_3COOH can be distinguished by:
    (*a*) Iodoform test (*b*) $NaHCO_3$ test (*c*) Tollen's reagent test (*d*) Both (*b*) and (*c*)
12. The rate of gaseous reaction is halved when the volume of vessel is doubled. The order of reaction is
    (*a*) 0 (*b*) 1 (*c*) 2 (*d*) 3

In the **following questions (Q. No. 13 – 16), a statement of assertion followed by statement of a reason** is given. **Choose the correct answer out of the following choices.**

(*a*) Both A and R are true and R is the correct explanation of A.
(*b*) Both A and R are true but R is not the correct explanation of A.
(*c*) A is true but R is false.
(*d*) A is false but R is true.

13. **Assertion (A):** Sodium tert. butoxide reacts with ethyl chloride to form tert. butyl ethyl ether.
    Reason (R): It is nucleophilic elimination reaction.
14. **Assertion (A):** Alanine is optically active amino acid.
    Reason (R): Amino acids are colourless, high melting solids and water soluble.
15. **Assertion (A):** MnO_4^- will oxidise $\begin{matrix}COO^-\\|\\COO^-\end{matrix}$ (oxalate ions) to CO_2 acidic medium.
    Reason (R): MnO_4^- are colourless.
16. **Assertion (A):** Benzyl amine reacts with HNO_2 to form $C_6H_5CH_2OH$ and N_2 gas.
    Reason (R): Benzyl amine forms diazonium salt with $NaNO_2$ + HCl at 0–5°C.

SECTION – B

This section contains 5 questions with internal choice in one question. The following questions are very short answer type and carry 2 marks each.

17. For the reaction $2A + B \longrightarrow 3C + D$. The rate, $\frac{-d[A]}{dt}$ is 4×10^{-3} Ms^{-1}. What is the value of $\frac{-d[B]}{dt}$ and $\frac{d[C]}{dt}$?

18. Give two observations which lead to conclusion that glucose has cyclic structure.

19. (*a*) Why does chlorobenzene undergo electrophilic substitution at *o* and *p*-position?

(*b*) Why do alkyl halides have higher boiling points than corresponding hydrocarbons?

OR

A compound 'X'(C_5H_{12}) reacts with Cl_2 in the presence of sunlight and gives four mono chloro products. Identify 'X' and write the chemical reaction involved.

20. The E° cell of following cell is 1.10 V. What will be the value of log K_c?

$Zn(s) + Cu^{2+}(aq) \longrightarrow Zn^{2+}(aq) + Cu(s)$ [1 F = 96500 C mol^{-1}]

21. Why does rate of reaction become almost double for every 10° rise in temperature? Explain.

SECTION – C

This section contains 7 questions with internal choice in one question. The following questions are short answer type and carry 3 marks each.

22. (*a*) Why is Mohr's salt a double salt and not a complex compound?

(*b*) Calculate spin only magnetic moment of $[CoF_6]^{3-}$ [Atomic No. of Co = 27].

(*c*) Arrange the following in decreasing order of wavelength of light absorbed:
$[Ni(NO_2)_6]^{4-}$, $[Ni(H_2O)_6]^{2+}$, $[Ni(NH_3)_6]^{2+}$

23. (*a*) What happens when:

(*i*) Cyclohexanone reacts with hydroxyl amine

(*ii*) Benzaldehyde is heated with conc NaOH.

Write the chemical reactions involved.

(*b*) Write aldol condensation between benzaldehyde and acetophenone in presence of dil. NaOH.

24. How will you carry out following conversions:

(*i*) Ethanol to methanol

(*ii*) Phenol to salicyclic acid

(*iii*) Benzene sulphonic acid to Phenol

25. (*a*) Write electronic configuration of d^5 ion according to CFT (Crystal Field Theory) when $\Delta_0 < P$.

(*b*) Is $[Co(NH_3)_6]^{3+}$ paramagnetic or diamagnetic? Give reason. (Atomic number of Co = 27)

(*c*) Which is more stable out of $[Fe(CN)_6]^{4-}$ or $[Fe(CN)_6]^{3-}$? Give reason. [Atomic No. of Fe = 26]

26. (*a*) Why does vapour pressure of sea water less than river water?

(*b*) 2.175 g of solute dissolved in 90 g benzene leads to decrease in vapour pressure by 40 mm Hg. Calculate molar mass of solute if vapour pressure of pure benzene is 640 mm Hg, assuming solution is very dilute.

27. Answer the following questions: (*Any 2*)

(*a*) Aniline becomes coloured on long standing. Give reason. Why is aniline more reactive towards electrophilic substitution reaction?

(*b*) Amines have lower boiling point than alcohols. Give reason. Out of ethyl amine and ethyl alcohol, which is more soluble in water?

(*c*) *p*-Toluidine is more basic than Aniline. Give reason. Write chemical reaction of *p*-Toluidine with HCl.

28. (*a*) Write IUPAC name of $CH_2=CH-CH_2Br$.

(*b*) Suggest a possible mechanism for the following reaction:

$$n\text{-BuBr} + KCN \xrightarrow{EtOH,\ H_2O} n\text{-BuCN}$$

SECTION – D

The following questions are case-based questions. Each question has an internal choice and carries 4 (1+1+2) marks each. Read the passage carefully and answer the questions that follow.

29. Vitamins are vital for life. A, D, E, K are fat soluble vitamins where as B_1, B_2, B_3, B_5, B_6, B_7, B_9, C are water soluble vitamins. Vitamin A helps in improving eye sight. Vitamin C prevents scurvy and increases immunity. Vitamin D helps in strong bones and teeth. Our requirement of Vitamin D is 15 mcg. We get Vitamin D from sunlight. Eggs, dairy products, orange, oats and mushroom etc. Citrus fruits contains Vitamin C. Carrot contains Vitamin A. We should include chick pea flour (basan) in our diet to prevent inflammation. It has phytonutrients and fibres which have anti-inflammatory properties. It prevents accumulation of fats. It contains Fe, Cu, Mg, fibre, K which are essential to control our weight. It increases our immune system. It contains proteins, amino acids, Mg, Vitamin B and phosphorous. Pomegranates are good source of Vitamin C which our body needs to make collagen. It is rich source of B-complex, Vitamin B_5, folates, pyridoxine and Vitamin K. It contains essential minerals like Ca, Cu, Mg and Mn. Pomegranates are rich source of insoluble fibres which help us to keep fuller for longer time and regulate bowel function.

Answer the following questions:

(*a*) Why should Vitamin B and C must be taken regularly in diet?

(*b*) Which vitamin deficiency causes pernicious anaemia? Is it fat or water soluble?

(*c*) (*i*) What is meant by vitamin B-compex?

(*ii*) What is deficiency disease and source of Vitamin E?

OR

(*c*) (*i*) Which Vitamin deficiency leads to bleeding for long time? What is its source?

(*ii*) What is the role of fibre in our body?

30. Rajesh prepared 10% aqueous solution of each, sucrose, glucose, NaCl and $MgBr_2$. He determined freezing point of solution and recorded in the following table.

[K_f for H_2O = 1.86 K Kg mol^{-1}]

S.No.	Solution (conc.)	Solute	Molar mass	ΔT_f
1.	10% by mass	Sucrose	342 g mol^{-1}	0.60 K
2.	10% by mass	Glucose	180 g mol^{-1}	1.15 K
3.	10% by mass	NaCl	58.5 g mol^{-1}	7.06 K
4.	10% by mass	$MgBr_2$	184 g mol^{-1}	3.37 K

Observe the table carefully and answer the questions that follow:

(*a*) Why is ΔT_f of 10% glucose and 10% sucrose solution different?

OR

Why is ΔT_f of 10% NaCl highest?

(*b*) When 2.56 g of sulphur was dissolved in 100 g of CS_2, the freezing point lowered by 0.383 K. Calculate the formula of sulphur (S_x).

(K_f for CS_2 = 3.83 K kg mol^{-1}, Atomic mass of S = 32 u)

(*c*) 3.9 g of benzoic acid is dissolved in 49 g of benzene shows ΔT_f = 1.62 K. Calculate degree of association of benzoic acid.

[Molar mass of benzoic acid = 122 g/mol, K_f for benzene = 4.9 K kg mol^{-1}]

SECTION – E

The following questions are long answer type and carry 5 marks each. All questions have an internal choice.

31. (*a*) Explain the mechanism of nucleophilic attack on carbonyl group of an aldehyde or a ketone.

(*b*) A compound 'X' (C_4H_8O) does not reduce Tollen's reagent but gives 2,4-DNP test and forms yellow ppt. of 'Y' with NaOI. 'X' on reduction with $LiAlH_4$ gives 'Z'. Identify 'X', 'Y' and 'Z' and write all the chemical reactions involved.

(*c*) Why is α-hydrogen of aldehydes acidic in nature?

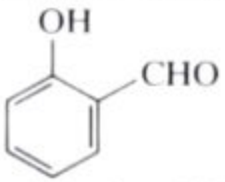
OR

(*a*) Illustrate the following:

(*i*) Decarboxylation reaction of sodium benzoate.

(*ii*) HVZ reaction of Propanoic acid.

(*b*) Write the structure of 2, 4-DNP derivative of benzaldehyde.

(*c*) Write IUPAC name of 

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(*d*) Why is HCOOH more acidic than CH_3COOH?

32. (*a*) Calculate emf of the following cell at 298K:

$2Cr(s) + 3Fe^{2+}(0.1\ M) \longrightarrow 2Cr^{3}(0.01\ M) + 3\ Fe(s)$

[Given: $E^{\circ}_{Cr^{3+}/Cr} = -0.74V$, $E^{\circ}_{Fe^{2+}/Fe} = -0.44V$, $\log 10^{-1} = -1.00$]

(*b*) Define electrochemical cell. What happens if external potential applied becomes equal to E°_{cell} of electrochemical cell?

OR

(*a*) The conductivity of 0.1 M solution of NaCl is 1.06×10^{-2} S cm^{-1}. Calculate its Λ_m and degree of dissociation (α).

[Given: $\lambda^{\circ}_{Na^+} = 50.1$, $\lambda^{\circ}_{Cl^-} = 76.5$ S cm^2 mol^{-1}]

(*b*) What is the difference between primary battery and secondary battery? Give one example of each type.

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

(*a*) Why is Sc^{3+} colourless in aqueous solution whereas Ti^{3+} is coloured?

(*b*) Convert Na_2CrO_4 to $Na_2Cr_2O_7$.

(*c*) Why do transition metals form coloured compounds?

(*d*) Yb^{2+} is strong reducing agent, why?

(*e*) MnO is basic while Mn_2O_7 is acidic in nature. Give reason.

(*f*) Why is Fe^{3+} more stable than Fe^{2+} in aqueous solution?

(*g*) Out of Fe and Cu, which has higher density and why?

Time Allowed: 3 hours] **Sample paper -2 Class 12, Chemistry**

[Maximum Marks: 70

General Instructions:

Read the following instructions carefully.

(*a*) There are **33** questions in this question paper with internal choice.

(*b*) SECTION A consists of 16 multiple-choice questions carrying 1 mark each.

(*c*) SECTION B consists of 5 short answer questions carrying 2 marks each.

(*d*) SECTION C consists of 7 short answer questions carrying 3 marks each.

(*e*) SECTION D consists of 2 case-based questions carrying 4 marks each.

(*f*) SECTION E consists of 3 long answer questions carrying 5 marks each.

(*g*) **All questions are compulsory.**

(*h*) **Use of log tables and calculators is not allowed.**

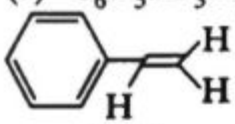
SECTION – A

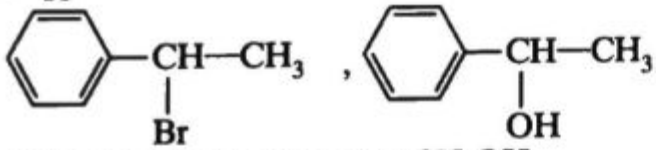
The following questions are multiple-choice questions with one correct answer. Each question carries 1 mark. There is no internal choice in this section.

1.  $\xrightarrow[\text{conc.}]{\text{Oleum } (H_2SO_4 + SO_3)}$ 'X' $\xrightarrow[(ii)\ H^+]{(i)\ NaOH}$ 'Y', 'X' and 'Y' respectively are:

   (*a*) $C_6H_5SO_3H$, C_6H_5OH (*b*) $C_6H_5SO_3H$, C_6H_6

   (*c*) $C_6H_5SO_3H$, $C_6H_5CH_2OH$ (*d*) $C_6H_5SO_3H$, C_6H_5ONa

2.  $\xrightarrow{HBr}$ 'X' $\xrightarrow{KOH(aq)}$ 'Y', 'X' and 'Y' respectively are:

   (*a*) 

   (*b*) $C_6H_5CH_2CH_2Br$, $C_6H_5CH_2CH_2OH$

   (*c*) $C_6H_5CH_2CH_2Br$, $C_6H_5CH{=}CH_2$

   (*d*) $C_6H_5\underset{\displaystyle Br}{\underset{|}{C}}H{-}CH_3$, $C_6H_5CH_2CH_2OH$

3. Which of the following is strong oxidising agent?

   (*a*) Ce^{4+} (*b*) Cr^{2+} (*c*) Eu^{2+} (*d*) Mn^{2+}

4. $\Lambda^\circ_{NaCl} = 126\ Scm^2\ mol^{-1}$, $\Lambda^\circ_{HCl} = 426\ Scm^2\ mol^{-1}$, $\lambda^\circ_{Na^+} = 50\ Scm^2\ mol^{-1}$, $\Lambda^\circ_{H_2O} = 550\ S\ cm^2\ mol^{-1}$ what is Λ°_m of OH^-?

   (*a*) $500\ Scm^2\ mol^{-1}$ (*b*) $400\ Scm^2\ mol^{-1}$ (*c*) $200\ Scm^2\ mol^{-1}$ (*d*) $600\ Scm^2\ mol^{-1}$

5. Which of the following has order equal to 1.5?

(*a*) $CHCl_3 + Cl_2 \longrightarrow CCl_4 + HCl$

(*b*) $CH_3COOC_2H_5 + H_2O \longrightarrow CH_3COOH + C_2H_5OH$

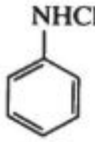
(*c*) $CH_3COOC_2H_5 + NaOH \longrightarrow CH_3COOH + C_2H_5OH$

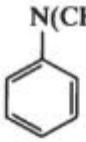
(*d*) $2NO + O_2 \longrightarrow 2NO_2$

6. For the reaction R $\longrightarrow$ P, concentration of a reactant changes from 0.03 M to 0.02 M in 25 minutes. The average rate of reaction units of time in seconds is

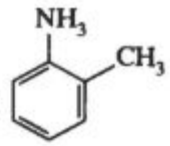
(*a*) $4 \times 10^{-6}\ Ms^{-1}$ (*b*) $3.3 \times 10^{-6}\ Ms^{-1}$ (*c*) $6.66 \times 10^{-6}\ Ms^{-1}$ (*d*) $5 \times 10^{-6}\ Ms^{-1}$

7. The final alkylation product of aniline with excess of methyl iodide in presence of sodium carbonate solution is

(*a*) 

(*b*) 

(*c*) 

(*d*) 

8. The oxidation number of cobalt in $K[Co(CO)_4]$ is

(*a*) +1 (*b*) +3 (*c*) −1 (*d*) −3

9. Phenol, on being heated with conc. H_2SO_4 and then with conc. HNO_3 gives

(*a*) *o*-nitro phenol (*b*) 2,4,6-trinitro phenol

(*c*) *p*-nitro phenol (*d*) *m*-nitro phenol

10. Which of the following is not correct for amines?

(*a*) Benzyl amine is more basic than N-methyl aniline.

(*b*) NH_3 is more basic than aniline.

(*c*) Secondary amines are more soluble in water than primary amines.

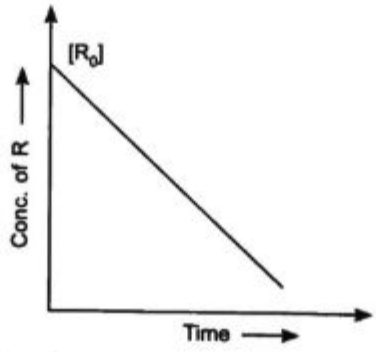
(*d*) Aromatic diazonium salts are stable at 273-278 K.

11. Cyclohexene, on heating with $KMnO_4/H_2SO_4$ gives:

(*a*) Cyclohexanone (*b*) Cyclohexane carboxylic acid

(*c*) Hexane-1, 6-dioic acid (*d*) Succinic acid

12. The following graph is plotted the variation of Concentration Vs Time.



The unit of rate constant '*k*' for above graph is

(*a*) mol $L^{-1}\ s^{-1}$ (*b*) s^{-1} (*c*) L $mol^{-1}\ s^{-1}$ (*d*) $L^2\ mol^{-2}\ s^{-1}$

In the following questions (Q. No. 13 – 16), a statement of assertion followed by statement of a reason is given. Choose the correct answer out of the following choices.

(*a*) Both A and R are true and R is the correct explanation of A.

(*b*) Both A and R are true but R is not the correct explanation of A.

(c) A is true but R is false.

(d) A is false but R is true.

13. **Assertion (A):** Alcohols react both as nucleophiles as well as electrophiles.
Reason (R): Protonated alcohols act as electrophiles.

14. **Assertion (A):** DNA is chemical basis of heredity.
Reason (R): DNA is exclusively responsible for maintaining the identity of different species of organisms over million of years.

15. **Assertion (A):** Many trivalent lanthanoid ions are coloured both in solid state and in aqueous solution.
Reason (R): La^{3+} and Lu^{3+} are coloured.

16. **Assertion (A):** IUPAC name of allylamine is prop-2-en-1-amine.
Reason (R): Double bond is preferred over $—NH_2$ group.

SECTION – B

This section contains 5 questions with internal choice in one question. The following questions are very short answer type and carry 2 marks each.

17. Given below is decomposition of hydrogen peroxide in alkaline medium, which is catalysed by iodide ions.

$$2H_2O_2 \xrightarrow[\text{alkaline medium}]{I^-} 2H_2O + O_2$$

The above reaction takes place in two steps.

I. $H_2O_2 + I^- \longrightarrow H_2O + IO^-$ (slow)

II. $H_2O_2 + IO^- \longrightarrow H_2O + I^- + O_2$ (fast)

Write its rate law and molecularity of step I and II.

18. Explain the following:

(a) Amino acids behave like salts rather than simple amines or carboxylic acid.

(b) Fructose reacts with excess of HI to give *n*-hexane.

OR

(a) Name the type of bonding which stabilises α-helix in proteins.

(b) Name the products of hydrolysis of lactose.

19. Give reason:

(a) Tertiary butyl bromide reacts faster towards S_N1 as compared to *n*-butyl bromide.

(b) *p*-nitro chlorobenzene is more reactive towards nucleophilic substitution than chlorobenzene.

20. Calculate $\Delta_r G^\circ$ for the reaction:

$Mg(s) + Cu^{2+}(aq) \longrightarrow Mg^{2+}(aq) + Cu(s)$

[Given: $E^\circ_{cell} = 2.71$ V, 1 F = 96500 C]

21. Define the following terms:

(a) Order of reaction

(b) Activation energy

SECTION – C

This section contains 7 questions with internal choice in one question. The following questions are short answer type and carry 3 marks each.

22. Explain the following:

(a) Nickel does not form low spin octahedral complex.

(*b*) $[Pt(NH_3)_2Cl_2]$ shows geometrical isomerism.

(*c*) $[MnBr_4]^{2-}$ has spin only magnetic moment equate to 5.92 BM and has tetrahedral shape.

23. Complete the following:

(*a*) $CH_3-\underset{\displaystyle CH_3}{\underset{|}{CH}}-COOH \xrightarrow[(ii)\ H_2O]{(i)\ Br_2/Red\ P_4}$

(*b*) $CH_3-CH_2C{\equiv}N \xrightarrow[H_3O^+]{CH_3MgBr}$ 'A' $\xrightarrow{LiAlH_4}$ 'B'

(*c*) $CH_3COOH \xrightarrow{PCl_5}$ 'A' $\xrightarrow[\Delta]{H_2/Pd\text{-}BaSo_4}$ 'B'

24. (*a*) Arrange the following in increasing order of acidic character:

Benzoic acid, Phenol, Cresol

(*b*) An aromatic compound 'A' on treatment with $CHCl_3$ and KOH gives two compounds which gave same product when distilled with zinc dust. Oxidation of 'B' gives 'C' with molecular formula $C_7H_6O_2$. Sodium salt of 'C' on heating with soda lime gives 'D' which may be obtained by distilling 'A' with zinc dust. Identify 'A', 'B', 'C' and 'D'.

25. (*a*) State Raoult's law for solution containing volatile components.

(*b*) Calculate the boiling point elevation for a solution prepared by adding 10 g of $CaCl_2$ in 200 g of water assuming complete ionisation.

[K_b for Water = 0.512 K kg mol^{-1}, Molar mass of $CaCl_2$ = 111 g/mol]

26. (*a*) When a coordination compound $CrCl_3.6H_2O$ is mixed with $AgNO_3$, two moles of AgCl are precipitated per mole of compound. What is structural formula of the coordination compound?

(*b*) Out of $[CoF_6]^{3-}$ and $[Co(en)_3]^{3+}$, which one complex is

(*i*) paramagnetic

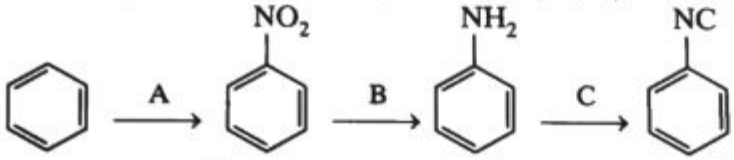
(*ii*) more stable

(*iii*) inner orbital complex and

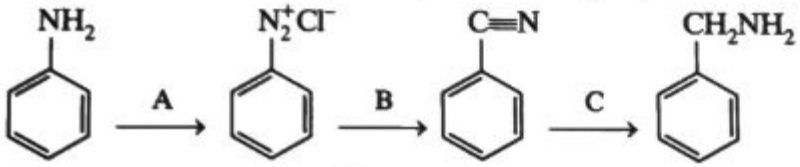
(*iv*) high spin complex.

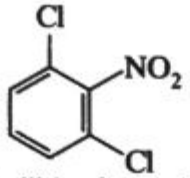
[Atomic number of Co = 27]

27. Write the reagent for the following reactions: (*Any 2*)

(*a*) 

(*b*) $CH_3COOH \xrightarrow{A} CH_3CONH_2 \xrightarrow{B} CH_3NH_2 \xrightarrow{C} CH_3OH$

(*c*) 

28. (*a*) Write IUPAC name of 

.

(*b*) Predict all alkene that will be formed by dehydrohalogenation of 2-bromo pentane.

(*c*) Arrange the following in order of increasing S_N2 reactivity:

CH_3Cl, CH_3CH_2Cl, $(CH_3)_2CHCl$

SECTION – D

The following questions are case-based questions. Each question has an internal choice and carries 4 (1+1+2) marks each. Read the passage carefully and answer the questions that follow.

29. Gene Therapy for Cardiovascular Heart Disease (CVD)

[Source: Front Cardiovasc, Med. 05 Nov. 2021, sec. Cardiovascular Therapeutics; Genmao Cao, Xuezhen Xuan, Ruijing Zhang, Jie Hu, Honglin Dong]

In early years, scientists used homologous recombination technology to establish gene knock out and gene knock in animal models, then appeared the second-generation gene editing technology, Zinc-Finger Nucleases (ZFNs) and transcription activator—like effector nucleases (TALENs) that relied on nucleic acid binding proteins and endonucleases and the third generation gene editing technology that function through protein–nucleic acids complexes – CRISPR/CAS9 system. This holds another promise for refractory and genetic diseases. CVD has always been the focus of clinical research due to high incidence and high disability rate affecting long-term survival and quality of life of heart patients. Some inherited CVD do not respond well to drug and surgical treatments, therefore, gene therapy is being used in atherosclerosis and inheritable CVD, in stent restenosis and delivering systems.

Answer the following questions:

(*a*) Is there a gene for heart disease?

OR

What is most likelihood cause of developing heart disease?

(*b*) How is gene therapy used to treat heart diseases?

(*c*) What are nucleic acids? Which generation gene editing is best for CVD?

30. Rajni carried out experiments to investigate effect of adding solutes like glucose, urea, NaCl and $MgCl_2$ in water and keeping mole fraction of each 0.01, observed vapour pressure of solution in each case and recorded the following observations at 298 K.

S.No.	Solute	Molar mass	Solvent	x_B	p_A°	p_A
1.	Glucose	180 g/mol	H_2O	0.01	760 mm	752.4 mm
2.	Urea	60 g/mol	H_2O	0.01	760 mm	752.4 mm
3.	NaCl	58.5 g/mol	H_2O	0.01	760 mm	744.8 mm
4.	$MgCl_2$	95.0 g/mol	H_2O	0.01	760 mm	737.2 mm

Observe the table carefully and answer the following questions assuming NaCl and $MgCl_2$ are completely ionised in aqueous solution.

(*a*) Why is vapour pressure of solution containing urea and glucose same in spite of different molar mass?

(*b*) Why is vapour pressure of solution containing $MgCl_2$ lowest?

(*c*) The vapour pressure of a solution of glucose is 750 mm Hg at 100 °C. Calculate the mole fraction of solute. [Vapour pressure of water at 373 K = 760 mm Hg]

OR

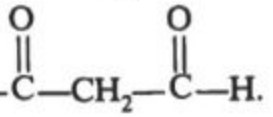
(*c*) The vapour pressure of pure benzene at a certain temperature is 0.850 bar. A non-volatile, non-electrolyte solid weighing 0.5 g. When added to 39 g of benzene (molar mass 78 g mol^{-1}), Vapour pressure of solution is 0.845 bar. What is molar mass of solid substance?

SECTION – E

The following questions are long answer type and carry 5 marks each. All questions have an internal choice.

31. An organic compound contains 69.77% carbon, 11.63% hydrogen and rest oxygen. The molecular mass of the compound is 86. It does not reduce Tollen's reagent but forms an addition compound with $NaHSO_3$ and gives positive iodoform test. On vigorous oxidation, it gives ethanoic and propanoic acid. Write the possible structure of compound.

OR

(*a*) Write IUPAC name of  .

(*b*) Ethanal is soluble in water, why?

(*c*) Complete the following reactions:

(*i*) $CH_3—C\equiv CH + H_2O \xrightarrow[H_2SO_4]{Hg^{2+}}$

(*ii*)  $\xrightarrow{CrO_3}$ 'A' $\xrightarrow{H_2N—NH—\overset{\overset{O}{\|}}{C}—NH_2}$ 'B'

(*iii*) $CH_3COOH \xrightarrow{SOCl_2}$ 'A' $\xrightarrow{NH_3}$ 'B'

32. (*a*) Why is $E^\circ_{Mg^{2+}/Mg}$ negative?

(*b*) Calculate the potential of hydrogen electrode in contact with a solution whose pH is 3. [log 10 = 1, F = 96500 C, $E^\circ_{H^+/H_2} = 0$]

(*c*) What is quantity of electricity in coulombs needed to reduce 1 mole of $Cr_2O_7^{2-}$ in acidic medium?

(*d*) How does Λ_m change on heating? Give reason.

OR

(*a*) Why is 'Li' best reducing agent?

(*b*) $2Fe^{3+} + 2I^-(aq) \longrightarrow 2Fe^{2+} + I_2$ has $E^\circ_{Cell} = 0.236$ V at 298 K. Calculate ΔG° and log K_c of the cell reaction.

(*c*) How is 'α' (degree of dissociation) can be calculated if Λ_m and Λ°_m are given?

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

(*a*) Write electronic configuration of Cr^{3+}. [Atomic number of Cr = 24]

(*b*) Why is Mn^{2+} more stable than Mn^{3+}? [Atomic number of Mn = 25].

(*c*) What are oxidation states exhibited by actinoids?

(*d*) Why does Platinum act as good catalyst?

(*e*) How many moles of oxalate ions are oxidised by 1 mole of MnO_4^- in acidic medium?

(*f*) Write one difference between lanthanoids and actinoids.

(*g*) What happens of basic character of hydroxides of actionids from Thorium to Lawrencium and why?

Sample paper -3 Class 12, Chemistry

[*Maximum Marks:* 70

General Instructions:

Read the following instructions carefully.

(*a*) There are **33** questions in this question paper with internal choice.

(*b*) SECTION A consists of 16 multiple-choice questions carrying 1 mark each.

(*c*) SECTION B consists of 5 short answer questions carrying 2 marks each.

(*d*) SECTION C consists of 7 short answer questions carrying 3 marks each.

(*e*) SECTION D consists of 2 case-based questions carrying 4 marks each.

(*f*) SECTION E consists of 3 long answer questions carrying 5 marks each.

(*g*) **All questions are compulsory.**

(*h*) **Use of log tables and calculators is not allowed.**

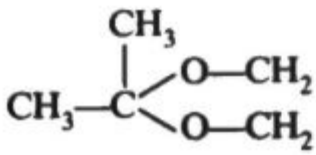
SECTION – A

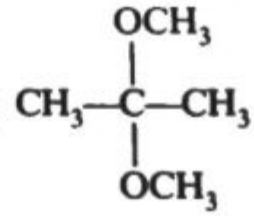
The following questions are multiple-choice questions with one correct answer. Each question carries 1 mark. There is no internal choice in this section.

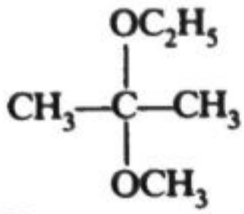
1. $t_{½}$ of reaction is inversely proportional to $[R_0]$, the order of reaction will be

(*a*) 0 (*b*) 1 (*c*) 2 (*d*) 3

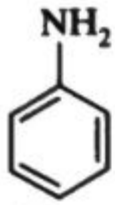
2. Acetone reacts with one equivalent of dihydric alcohol, ethylene glycol to give

(*a*) 

(*b*) 

(*c*) 

(*d*) None of these

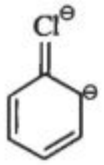
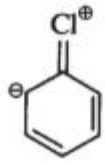
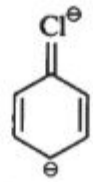
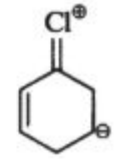
3.  $\xrightarrow[\text{Pyridine}]{(CH_3CO)_2O}$ 'A' $\xrightarrow[\text{conc. } H_2SO_4]{\text{conc. } HNO_3}$ 'B' $\xrightarrow{H_3O^+}$ 'C', 'C' as major product is

(*a*) *o*-nitro aniline (*b*) *p*-nitro aniline (*c*) *m*-nitroaniline (*d*) All of these

4. Which of the following is most stable complex?

(*a*) $[Ni(NH_3)_6]^{2+}$ (*b*) $[Fe(CN)_6]^{3-}$ (*c*) $[Co(en)_3]^{3+}$ (*d*) $[Ni(H_2O)_6]^{2+}$

5. Identify the correct resonance structure of chlorobenzene.

(a)  (b)  (c)  (d) 

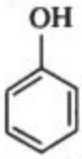
6. Which of following is most reactive towards S_N1 mechanism?

(a) Diethyl ether (b) Methyl ethyl ether

(c) Phenyl methyl ether (d) Tert. butyl methyl ether

7. Among V_2O_3, V_2O_5, V_2O_4 calculate the magnetic moment of the most basic oxide.

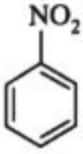
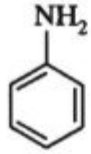
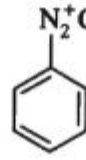
(a) $2\sqrt{2}$ (b) $\sqrt{2}$ (c) $2\sqrt{3}$ (d) 2

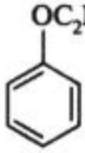
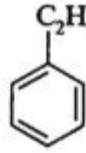
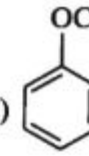
8.  $\xrightarrow[\text{(ii) } CO_2,\ 140°C]{\text{(i) NaOH}}$ 'A' $\xrightarrow{H^+/H_2O}$ 'B' $\xrightarrow{(CH_3CO)_2O}$ 'C' (Product)

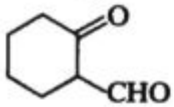
The final product (c) is

(a) Salicyldehyde (b) Salicylic acid

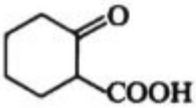
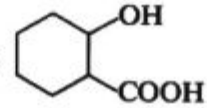
(c) Aspirin (d) Ethyl Salicylate

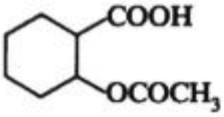
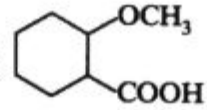
9.  $\xrightarrow{Sn/HCl}$  $\xrightarrow[NaNO_2\text{-}HCl]{0\text{-}5°C}$  $\xrightarrow{CH_3CH_2OH}$ 'X' $\xrightarrow[AlCl_3]{C_2H_5Cl}$ 'Y', 'Y' is

(a)  (b)  (c)  (d) 

10.  $\xrightarrow[\text{(ii) } NaBH_4/H_2O]{\text{(i) } [Ag(NH_3)_2]^+ \text{ followed by } H_3O^+}$ 'A' is

(iii) $(CH_3CO)_2O/H_3O^+$

(a)  (b) 

(c)  (d) 

11. $C_{12}H_{22}O_{11} + \underset{\text{(excess)}}{H_2O} \xrightarrow{H^+} C_6H_{12}O_6 + C_6H_{12}O_6$

The molecularity and order of reaction of the above reaction respectively are:

(a) 2, 1 (b) 1, 2 (c) 2, 2 (d) 1, 1

12. The first order reaction has 'k' = $4.9 \times 10^{-3}\ s^{-1}$. How long will it take 4 g of this reactant to reduce to 3g ?

[log 4 = 0.6021; log 3 = 0.4771]

(a) 60 s (b) 58.75 s (c) 62 s (d) 50

In the following questions (Q. No. 13 – 16), a statement of assertion followed by statement of a reason is given. Choose the correct answer out of the following choices.

(*a*) Both A and R are true and R is the correct explanation of A.

(*b*) Both A and R are true but R is not the correct explanation of A.

(*c*) A is true but R is false.

(*d*) A is false but R is true.

13. Assertion (*a*): Phenol reacts with $Br_2(aq)$ to form 2,4,6-tribromophenol.

Reason (R): Phenol undergoes nucleophilic substitution reaction.

14. Assertion (*a*): Glycine and alanine are amphoteric.

Reason (R): They have one $—NH_2$ (basic) and one —COOH (Acidic group).

15. Assertion (*a*): Ce^{4+} is good oxidising agent.

Reason (R): Ce^{4+} has noble gas configuration.

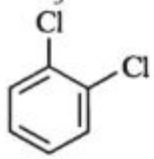
16. Assertion (*a*): Aniline, on reaction with conc. HNO_3 gives 51% *p*, 47% *m* and 2% *o*-nitro aniline.

Reason (R): Aniline becomes coloured on long standing due to reduction.

SECTION – B

This section contains 5 questions with internal choice in one question. The following questions are very short answer type and carry 2 marks each.

17. (*a*) $CH_3Cl + KCN \longrightarrow ?$

(*b*)  $+ CH_3Cl \xrightarrow{AlCl_3} ?$

OR

Write chemical equation when

(*a*) methyl chloride is treated with $AgNO_2$.

(*b*) bromobenzene is treated with CH_3COCl in the presence of anhydrous $AlCl_3$.

18. 75% of reaction is completed in 30 minutes. Calculate the time taken for 90% completion of the reaction. [log 4 = 0.6021; log 10 = 1]

19. A solution having two components A and B, If vapour pressure of pure 'A' is 100 *kPa* and B is 50 *kPa* and the mole fraction of 'B' in liquid phase is 0.6, calculate the mole fraction of 'A' and 'B' in vapour phase.

20. Define the following and give one example:

(*a*) Reducing sugar

(*b*) Globular proteins

21. The reaction $SO_2Cl_2 \longrightarrow SO_2 + Cl_2$; is first order gas reaction with $k = 2.2 \times 10^{-5}\ s^{-1}$ at 573 K. What per cent of SO_2Cl_2 is decomposed on heating at 573 K for 90 min?

[Antilog of 0.05158 = 1.127]

SECTION – C

This section contains 7 questions with internal choice in one question. The following questions are short answer type and carry 3 marks each.

22. (*a*) Write IUPAC name of $[Co(en)_3][Cr(C_2O_4)_3]$.

(*b*) Predict the shape and magnetic behaviour of:
$[Cr(H_2O)_6]^{3+}$ [Atomic number of Cr = 24]

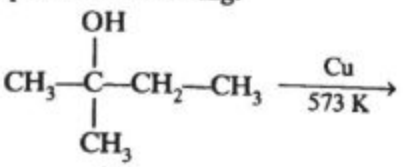
(*c*) How many unpaired electrons are present in
(*i*) $[Ni(C_2O_4)_3]^{4-}$ (*ii*) $[NiCl_4]^{2-}$ [Atomic number of Ni = 28]

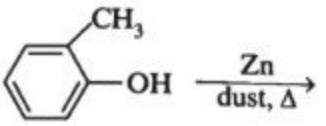
23. (*a*) Calculate E_{H^+/H_2} in contact with a solution whose pH = 10. [log 10^{10} = 10]

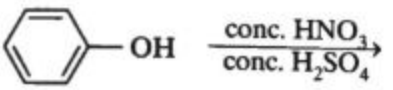
(*b*) How will you calculate $\Lambda^\circ_{mNH_4OH}$, if $\Lambda^\circ_{mNH_4Cl}$ = 129.8, Λ°_{NaOH} = 217.4 Λ°_{NaCl} = 108.9 S am^2 mol^{-1} at 291K.

24. Convert: (*i*) Acetaldehyde to 2-Butanol
(*ii*) Benzene to Benzophenone
(*iii*) Ethanal to But-2-enoic acid.

25. Complete the following:

(*a*) 

(*b*) 

(*c*) 

26. Answer the following questions: (*Any 2*)

(*a*) What is hybridisation in $[Fe(CO)_5]$ and shape? [At No. Fe = 26]. Write IUPAC name also.

(*b*) Discuss its magnetic behaviour, type of complex (inner or outer). Calculate its magnetic moment.

(*c*) What is hybridisation of $[Ni(H_2O)_6]^{2-}$ and discuss its magnetic behaviour? [At. No. of Ni = 28). Write its IUPAC name also.

27. Convert:

(*a*) Benzene to *m*-nitroaniline.

(*b*) 4-Nitrotoluene to 2-Bromobenzoic acid.

(*c*) Aniline to nitrobenzene

28. When benzene reacts with CH_3Cl in the presence of $AlCl_3$ to give 'A' (C_7H_8). 'A' reacts with 1 mole of Cl_2 in the presence of sunlight to form 'B' (C_7H_7Cl). 'B' on reaction with KCN forms 'C'. 'C' on hydrolysis gives 'D'. 'C' on reduction with Na and C_2H_5OH gives 'E'. Identify 'A' to 'E' and explain the reactions.

SECTION – D

The following questions are case-based questions. Each question has an internal choice and carries 4 (1+1+2) marks each. Read the passage carefully and answer the questions that follow.

29. **Primary and secondary structure of DNA**

The sequence of nucleotides in chain of nucleic acid is called its primary structure. The base composition in DNA varies from species to species but amount of A = T, C=G. In other words, A + G = C + T, but the ratio of AT/CG is 1.52 in man and 0.93 in *E.coli*. DNA can replicate. It has double helical structure. The two strands of DNA are held by hydrogen bonds. Thymine can form two H-bonds with Adenine and Cytosine and Guanine can be joined by three H-bonds. It is secondary structure of DNA. The diameter of double helix is 2 nm and the double helix repeats after interval of 3.4 nm

when it completes one turn which involves 10 base pairs. DNA helices can be right handed as well as left handed. The β-conformation of DNA having right handed helices is most stable. On heating, two strands of DNA separate from each other and this process is known as melting. When these two strands are cooled they again hybridise and process is called annealing. The temperature at which the two strands completely separate is known as melting temperature (T_m) which is specific for each specific sequence.

Answer the following questions:

(*a*) Which bonds are stronger between A and T or between G and C and why?

(*b*) A DNA molecule with more number of GC pairs than AT pairs will have higher or lower melting point?

(*c*) In *E.coli* DNA, the AT/GC ratio is 0.93. If number of moles of adenine in its DNA sample is 4,65,000, calculate number of moles of guanine present.

OR

(*c*) If A + T in human being is 5,00,000, what will be amount of guanine?

30. The table shows the values of pK_a of carboxylic acids. Study the table and answer the questions:

Acid	pK_a	Acid	pK_a
HCOOH	3.75	C_6H_5COOH	4.20
CH_3COOH	4.76	*p*-nitro benzoic acid	3.44
FCH_2COOH	2.59	*m*-nitro benzoic acid	3.50
$ClCH_2COOH$	2.87	*o*-nitro benzoic acid	2.17
$BrCH_2COOH$	2.90	*p*-methyl benzoic acid	4.38
ICH_2COOH	3.16	*m*-methyl benzoic acid	4.27
		o-methyl benzoic acid	3.91
$Cl_2CHCOOH$	1.26	salicylic acid	2.98
		m-hydroxy benzoic acid	4.08
Cl_3COOH	0.63	*p*-hydroxy benzoic acid	4.58

(*a*) Which is stronger, CH_2FCH_2COOH or $CH_2FCH_2CH_2COOH$ and why?

(*b*) Which aliphatic and aromatic acids are most acidic from the above table?

(*c*) Convert CH_3COOH to CH_3CH_2COOH.

OR

(*c*) Distinguish between HCOOH and $\underset{\displaystyle Cl}{\overset{\displaystyle |}{CH_2COOH}}$ by suitable chemical test.

SECTION – E

The following questions are long answer type and carry 5 marks each. All questions have an internal choice.

31. (*a*) E°_{cell} for the given redox reaction is 2.71 V.

$Mg(s) + Cu^{2+}(0.01\ M) \longrightarrow Mg^{2+}(0.001\ M) + Cu(s)$

Calculate E_{cell} for the reaction. Write the direction of flow of current when an external opposite potential applied is

(*i*) less than 2.71 V

(*ii*) greater than 2.71 V

(*b*) Write the products of electrolysis of aq. solution of NaCl at cathode and anode giving reasons.

OR

(*a*) The conductivity of 0.001 M acetic acid is 4×10^{-5} S cm^{-1}. Calculate the dissociation constant of an acid, if molar conductivity at infinite dilution for acetic acid is 390 S cm^2 mol^{-1}.

(*b*) Solutions of two electrolytes 'A' and 'B' are diluted. The Λ_m of 'B' increases 1.5 times while that of 'A' increases 25 times. Which of the two is a strong electrolyte? Justify your answer.

32. (*a*) (*i*) Why do transition elements form interstitial compounds?

(*ii*) $E^{\circ}_{Mn^{2+}/Mn}$ is negative whereas $E^{\circ}_{Cu^{2+}/Cu}$ is positive. Why?

(*b*) Describe the cause of the following with respect to transition metals:

(*i*) Tungsten has highest melting point in 5*d* series.

(*ii*) Mn^{3+} is good oxidising agent whereas Fe^{2+} is good reducing agent.

(*iii*) Transition metals have lower reactivity than *s*-block elements.

OR

(*a*) What happen when:

(*i*) MnO_4^{2-} undergoes disproportionation reaction in acidic medium.

(*ii*) Lutetium is heated with sulphur.

(*b*) Explain the following trends in the properties of members of *d* and *f*-block elements.

(*i*) $E^{\circ}_{Ag^+/Ag}$ value of Ag is 0.80 V in contrast with other members of the series.

(*ii*) U^{4+} is green in colour.

(*iii*) CrO_3 is acidic whereas Cr_2O_3 is basic.

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

(*a*) Why is vapour pressure of sea water less than river water?

(*b*) What are ideal solutions?

(*c*) A solution of 2.56 g of solute dissolved in 100 g of naphthalene gave a lowering in freezing point 0.68 °C. Calculate the molar mass of solute. [K_f = 6.8 K kg mol^{-1}]

(*d*) State one method of separation of ideal solutions.

(*e*) What is meant by anoxia?

(*f*) What is cause of edema?

(*g*) Why is cucumber cut from head and rubbed with common salt?