CBSE

Additional Practice Questions
Subject: Chemistry Theory (043)
Class: XII 2023-24

Max. marks: 70 **Time: 3 hours**

General Instructions:

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

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

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

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

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

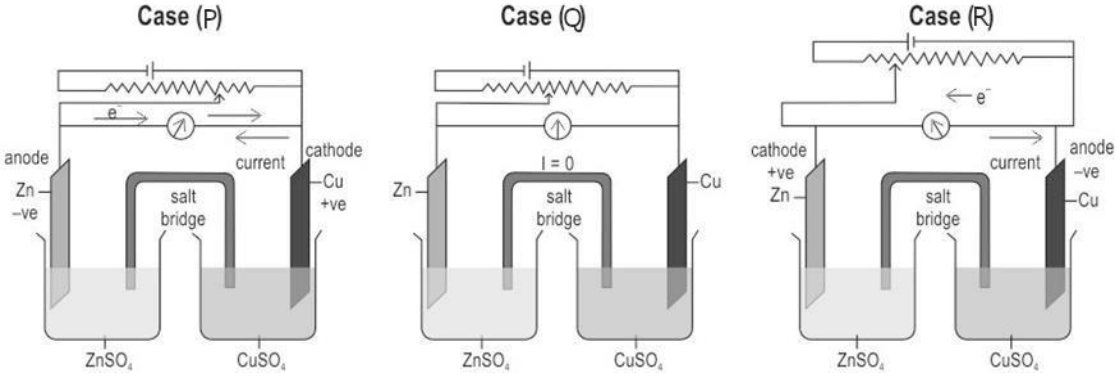
(f) **SECTION E** comprises **3** long answer questions carrying 5 marks each.

(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	Sunita set up three cells as shown below:  She applied external potential in all the three cells. The potential is increased slowly, till the opposing voltage reaches the value of 1.1 V.

Which of the following statements is INCORRECT?
(a) Electrons flow from Zn rod to Cu rod hence current flows from Cu to Zn in case (P).
(b) The chemical reaction takes place in case (Q) till the opposing voltage reaches 1.1 V.
(c) Zinc is deposited at the zinc electrode and copper dissolves at copper electrode in case (P).
(d) Electrons flow from Cu to Zn and current flows from Zn to Cu in case (R).

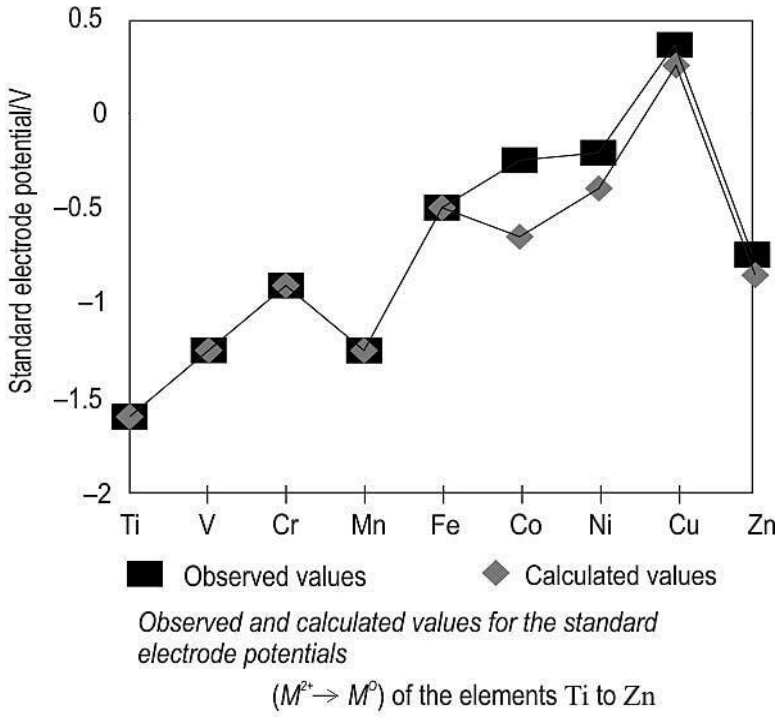
2 Two compounds M and N have the general formula $C_nH_{2n}O$ but different structural formulae.
i) Compound N belongs to that homologous series where the first member contains 3 carbon atoms.
ii) Compound M reacts with one equivalent of monohydric alcohol in the presence of dry hydrogen chloride to yield a hemiacetal.

Identify the homologous series to which compounds M and N belong to?
(a) Both the compounds are aldehydes.
(b) Compound M is an aldehyde and compound N is a ketone.
(c) Both the compounds are ketones.
(d) Compound N is an aldehyde and compound M is a ketone.

3 During a quiz competition, team A and team B have to answer a tie question on the characteristics of RNA.
Their responses are as follows:

Name	**Team**	**Response**
Adrika	**A**	Different RNA molecules of a cell are involved in the synthesis of proteins.
Shaakho	**A**	The single-stranded helix of RNA folds upon itself to form the secondary structure.
Rounak	**B**	The C-2 atom of the pentose sugar for a ribose nucleotide contains an -OH group.
Ritama	**B**	The message for the synthesis of a particular protein is present only in the RNA.

What is the expected result of the quiz and why?
(a) Team A wins the quiz as both the responses are correct.
(b) Team B wins the quiz as both the responses are correct.
(c) Team A loses the quiz as Adrika's response is incorrect.
(d) Team B loses the quiz as Rounak's response is incorrect.

<table>
<tr><td>4</td><td>What will be the change in the hybridisation of C when a nucleophile attacks the electrophilic centre of the carbonyl group?
(a) sp^2 to sp
(b) sp^3 to sp^2
(c) sp^3 to sp
(d) sp^2 to sp^3</td></tr>
<tr><td>5</td><td>Four compounds, CH_3Cl, CH_3Br, C_2H_5Br and C_3H_7I are represented by the letters M, N, O and P in the table below (<u>in random order</u>). The boiling points are also given on the table.
<table><tr><td>Boiling points(BP)</td><td>-24.2°C</td><td>38°C</td><td>3.56° C</td><td>101.6°C</td></tr><tr><td>Compound</td><td>M</td><td>N</td><td>O</td><td>P</td></tr></table>
Which of the four compounds does 'N' most likely represent?
(a) CH_3Cl
(b) CH_3Br
(c) C_2H_5Br
(d) C_3H_7I</td></tr>
<tr><td>6</td><td>Study the graph given below.
 

Observed and calculated values for the standard electrode potentials
($M^{2+} \rightarrow M^0$) of the elements Ti to Zn

Based on the graph given, which element will MOST LIKELY be involved in the</td></tr>
</table>

following reaction?

Metal + conc. sulphuric acid $\rightarrow$ Metal sulphate + sulphur dioxide + water

(a) Cu
(b) Co
(c) Ti
(d) Zn

7 The table given below shows the results of three experiments on the rate of the reaction between compounds P and Q at a constant temperature.

Experiment	The initial concentration of P (mol dm^{-3})	The initial concentration of Q (mol dm^{-3})	Initial rate (mol dm^{-3} s^{-1})
1	0.1	0.2	1.10×10^{-4}
2	0.3	0.2	9.91×10^{-4}
3	0.3	0.1	4.96×10^{-4}

Based on the data, what will be the rate equation for the reaction between P and Q?

(a) $k[P]^2[Q]$
(b) $k[P][Q]^2$
(c) $k[P][Q]$
(d) $k[P]$

8 The table below shows the K_H values for some gasses at 293 K and at the same pressure.

K_H values (kbar)	144.97	69.16	76.48	34.86
Gas	Helium	Hydrogen	Nitrogen	Oxygen

In which of the following are the gases arranged in their decreasing order of solubility (from left to right)?

(a) Helium > Nitrogen > Hydrogen > Oxygen
(b) Hydrogen > Helium > Nitrogen > Oxygen
(c) Nitrogen > Hydrogen > Oxygen > Helium
(d) Oxygen > Hydrogen > Nitrogen > Helium

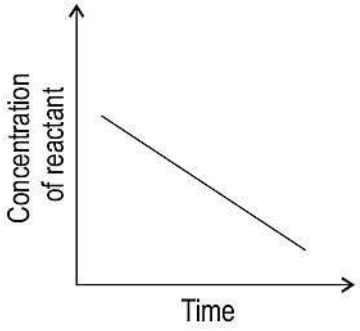
9 Sampriti took 4 acids. Help her to arrange the acids from left to right, in the increasing order of their acidity:
2, 4, 6 - Trinitrophenol, acetic acid, phenol, and benzoic acid.

	(a) 2, 4, 6 - Trinitrophenol, acetic acid, benzoic acid, phenol (b) phenol, acetic acid, benzoic acid, 2, 4, 6 - Trinitrophenol (c) 2, 4, 6 - Trinitrophenol, benzoic acid, acetic acid, phenol (d) phenol, benzoic acid, acetic acid, 2, 4, 6 – Trinitrophenol
10	An archeologist found that the percentage of carbon-14 in a wooden artifact was 20% of what carbon-14 would have been in the wood when it was cut from the tree. What would be the approximate age of this wooden artifact? *(Given the half-life of carbon-14= 5730 years)* (a) 5,790 years (b) 12,060 years (c) 13,300 years (d) 38,000 years
11	Sourima was having a severe headache. She took a medicine to relieve her pain. The medicine is industrially prepared by: (a) mononitration of phenyl methanoate (b) acetylation of salicylic acid in presence of an acid (c) hydrogenation of anisole with Br_2 in ethanoic acid (d) nitration of anisole with a mixture of concentrated sulphuric and nitric acids
12	Which of the following options give the correct arrangement of the atomic radii of the 3d, 4d, and 5d transition series of elements? (a) atomic radii of 3d < atomic radii of 4d < atomic radii of 5d (b) atomic radii of 3d < atomic radii of 4d ≈ atomic radii of 5d (c) atomic radii of 3d ≈ atomic radii of 4d > atomic radii of 5d (d) atomic radii of 3d > atomic radii of 4d > atomic radii of 5d
13	Two statements are given below - one labelled Assertion (A) and the other labelled Reason (R). Assertion (A): 2-Methoxy-2-methyl propane reacts with hydrogen iodide to form methyl alcohol and 2-Iodo-2-methylpropane. Reason (R): The reaction given in (A) follows S_N2 mechanism. Which of the following is correct? (a) Both A and R are true, and R is a 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.
14	Two statements are given below - one labeled Assertion (A) and the other labeled Reason (R). Assertion (A): In acetaldehyde, the carbonyl carbon acts as a Lewis acid and the carbonyl oxygen acts as a Lewis base.

	Reason (R): Carbonyl compounds have substantial dipole moments. Which of the following is correct? (a) Both A and R are true, and R is a 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.
15	Two statements are given below - one labelled Assertion (A) and the other labelled Reason (R). Assertion (A)**:** Denaturation of protein does not change the primary structure of proteins. Reason (R): The bonding between the carbon and hydrogen atoms during denaturation of proteins remains intact. Which of the following is correct? (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.
16	Two statements are given below - one labelled Assertion (A) and the other labelled Reason (R). Assertion (A): Copper does not form copper (II) sulphate on reaction with dil. sulphuric acid. Reason (R): The standard potential for Cu^{+2}|Cu electrode is negative. Which of the following is correct? (a) Both A and R are true, and R is a 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.

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.

<table>
<tr><td>17</td><td>Given below is a graph of concentration of reactant vs time for a reaction.
 

(a) Based on the graph above draw a rate of reaction vs concentration of reactant graph for the same reaction.
(b) What will be the order of this reaction? Justify.</td></tr>
<tr><td>18</td><td>'Colligative properties help in determining the molar masses of the solutes.'
The method based on which colligative property is preferred over others for determining molar masses of biomolecules and why?</td></tr>
<tr><td>19</td><td>In which of the two compounds $CH_3CH_2CH_2Cl$ or C_6H_5Cl will the C-Cl bond be longer? Why?</td></tr>
<tr><td>20</td><td>Correctly match the items in the 'Reactants' column with those in the 'Product' column.
<table><tr><th>Reactants</th><th>Products</th></tr><tr><td>(a) Cyclohexene heated in the presence of $KMnO_4$ and H_2SO_4</td><td>(i) Butanal</td></tr><tr><td>(b) Propanenitrile hydrolysed after reduction in the presence of stannous chloride and hydrochloric acid</td><td>(ii) 2-Chloro-2-phenylacetic acid</td></tr><tr><td></td><td>(iii) Adipic acid</td></tr><tr><td></td><td>(iv) Propiophenone</td></tr></table>
OR
Aqueous hydrogen cyanide is allowed to react separately with propanone and ethanal. In which case will the rate of reaction be faster and why?</td></tr>
<tr><td>21</td><td>Glucose does not give a positive result with the Schiff's reagent in the Schiff's test. Based on the above information
(a) Give a reason for the observation.
(b) What type of carbonyl group is present in a glucose molecule?</td></tr>
</table>

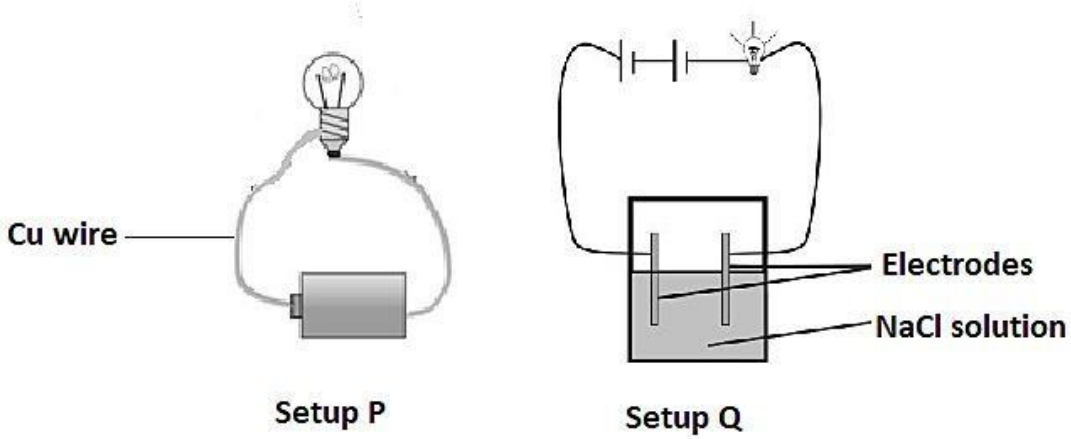
Section C

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 metal (M) forms two different compounds O and P with two different ligands. Ligand present in compound O is Cl^- and that in compound P is CN^-. The metal M has 4 electrons in the d orbital. Complete the table given below based on the above information:

	Compound O	Compound P
Field strength of the ligands		
Electronic configuration for metal M in the complex		
Type of complex that will be formed(High spin/low spin)		

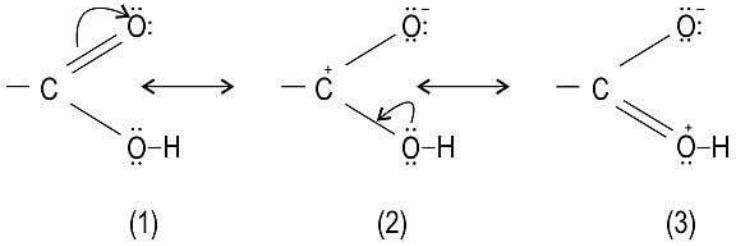
23 Abhisrija arranged two setups P and Q as shown below.



Both experiments are carried out at 25°C.

(a) Name the current carriers in setup P and Q.
(b) What is the effect of an increase in temperature on the conductivity of NaCl solution and Cu wire?
(c) What happens to the chemical composition of NaCl and Cu wire when current is passed through both setups for a prolonged period of time?

24 Draw the structure of:

	(a) 3-Methylphenol (b) 2,4,6-Trinitrophenol (c) Benzene-1,3-diol
25	(a) If acetaldehyde, propane, propanone, acetic acid, and ethyl alcohol are arranged in the increasing order of their boiling points, which two compounds are expected to be at the third and the fourth position? (b) The resonance structures of the carboxylic acid group are shown below, which of them is the most stable and why?  (1) (2) (3)
26	(a) Write a balanced equation for the reaction between glucose and hydrogen cyanide. What inference can we draw from it? (b) Samta reacted glucose with acetic anhydride. Will the reaction help her to determine the number of secondary alcoholic groups and the number of primary alcoholic groups that are present in a glucose molecule? Justify your answer.
27	Three sets of pairs (i) and (ii) of S_N1 reactions are given below. For each set of reactions state which reaction (i) or (ii) is expected to be slower? Justify your answer. (a) (i) $(CH_3)_3CCl + CH_3CH_2O^- \rightarrow (CH_3)_3COCH_2CH_3 + Cl^-$ [In presence of ethanol] (ii) $(CH_3)_3CCl + 2\ CH_3CH_2O^- \rightarrow (CH_3)_3COCH_2CH_3 + Cl^-$ [In presence of ethanol] (b) (i) $(CH_3)_3CCl + H_2O \rightarrow (CH_3)_3COH + HCl$ (ii) $(CH_3)_3CBr + H_2O \rightarrow (CH_3)_3COH + HBr$ (c)(i) $(CH_3)_3CCl + H_2O \rightarrow (CH_3)_3COH + HCl$ (ii) $C_6H_5Cl + H_2O \rightarrow C_6H_5OH + HCl$
28	(a) Write any four methods to increase the rate of a reversible reaction in the forward direction. (b) What is the unit for rate of reaction in SI units?

Section D

The following questions are case -based questions. Each question has an internal choice and carries 4 marks.

29 One of the most distinctive properties of transition metal complexes is their wide range of colours. This means that some of the visible spectrum is being removed from white light as it passes through the sample, so the light that emerges is no longer white. The colour of the complex is complementary to that which is absorbed. The complementary colour is the colour generated from the wavelength left over; for example, if green light is absorbed by the complex, the complex appears red.

The colour of a co-ordination compound depends on two factors:
- presence of ligands: For example, anhydrous $CuSO_4$ is white, but $CuSO_4.5H_2O$ is blue in colour.

- influence of ligands: If ligands like 'en' are added to $[Ni(H_2O)_6]^{2+}$ in the molar ratios en: Ni, 1:1, 2:1, 3:1 a series of reactions and their associated colour changes occur.

(a) Give an example of another complex that shows properties similar to those shown in the compound of Cu mentioned above.
What is the geometry of the central metal atom of this complex?

(b) What is the type of ligand added above to $[Ni(H_2O)_6]^{2+}$ to demonstrate the influence of ligand on colours of complex compounds?

(c) Complete the table given below:

en:Ni	Colour absorbed
2:1	
3:1	

OR

en:Ni	Formula of the ion formed
1:1	
3:1	

30 Conductivity measurements are used routinely in many industrial and environmental applications as a fast, inexpensive and reliable way of measuring the ionic content in a solution.

	For example, the measurement of conductivity is a typical way to monitor and continuously trend the performance of water purification systems. In many cases, conductivity is linked directly to the total dissolved solids (TDS). High quality deionized water has a conductivity of about 5×10^{-6} S/m at STP, typical drinking water is in the range of 0.02–0.08 S/m, while sea water is about 5 S/m. According to research, the TDS in a sample of fresh water can be calculated as TDS (mg/L) = $10^4 \times 0.65 \times$ conductivity (S/m). The conductivity of a sample of water taken from a borewell is given as 0.13 S/m at STP. A conductivity cell is created using the water above. The resistance of the cell is found to be 10 ohms. (a) What is the cell constant of the cell given above? (b) What is the amount of TDS in the sample of water taken? (c) According to some studies TDS of 250 mg/L represents a good source of drinking water. What would the conductivity of such a sample of water be? If such water was made by diluting the sample of water given above, what would be the resistance of a conductivity cell made using that? **OR** If the resistance of a cell made from diluting the sample of water taken above was found to be 79 ohms, calculate the TDS of the new sample.

Section E

The following questions are long answer type and carry 5 marks each. All questions have an internal choice.	
31	Answer any **five** questions with respect to the series of ions given below: Sc^{+3}, Ti^{+4}, V^{+4}, V^{+2}, Cr^{+2}, Fe^{+3}, Ni^{+2},Cu^{+2}, Zn^{+2} (a) Which of these ions are isoelectronic? (b) Why do Sc^{+3}, Ti^{+4}, and Zn^{+2} form colourless aqueous solution? (c) Which ion(s) from the list is/are not transition element(s) and why? (d) Cr forms two types of oxides - Cr^{+2} and Cr^{+3}. Which of them is expected to turn red litmus blue? (e) Arrange the following ions in the increasing order of their magnetic moments: Sc^{+3}, V^{+2}, V^{+4}, Ni^{+2}. (f) Why are alloys mostly prepared from transition metals? (g) Which ion can also has a +1 oxidation state?

[Atomic number of: Sc =21, Ti =22, V =23, Cr=24, Fe=26, Ni=28, Cu=29, Zn=30]

32 The following table contains osmotic pressure data for three compounds dissolved in various solvents.

Compound	Concentration, C (g/L)	Osmotic pressure (atm)
Cellulose	12.5	0.0021
Protein	28.5	0.0026
Haemoglobin	5	0.0018

(R = 0.083 L bar mol^{-1} K^{-1})

(a) If the concentration of protein is doubled keeping all other variables constant, what will be the osmotic pressure of the new solution?
(b) When one litre of cellulose solution was heated to 315 K, its osmotic pressure changed to 0.00248 atm. What is the molecular mass of the cellulose in the solution?
(c) A solution of 10 g of protein in a litre of solvent was found to be isotonic to the haemoglobin solution given above in the table, at the same temperature. If the molecular weight of the protein is 130,000 g/mol, what is the molecular weight of haemoglobin.

OR

The relation between the osmotic pressure of three solutions A, B, and C is:
$\pi_B < \pi_C$
$\pi_C > \pi_A$
$\pi_A > \pi_B$
The three solutions have the same molarity and are at the same temperature.
(a) For which of the solutions is the value of 'i' expected to be the greatest? Give a reason.

(b) Which of the solutions is MOST LIKELY to be glucose, potassium sulphate, and sodium chloride?

(c) Which of the solutions is expected to give a vapour pressure-mole fraction graph similar to that of an acetone-chloroform mixture? Give reason.

33 The compound $C_6H_5NHCOCH_3$ is obtained when compound A reacts with acetic anhydride in presence of pyridine. This compound A does not undergo Friedel-Crafts reaction.
(a) Write the reaction showing the formation of $C_6H_5NHCOCH_3$ from compound A.
(b) The pH of the aq. solution of A is less than 7. Is this statement true? Give reason.
(c) State what type of functional group can be introduced into compound A, that will:
(i) increase the pH of the aqueous solution

	(ii) decrease the pH of the aqueous solution (d) What do you observe when compound A reacts with bromine water at room temperature? **OR** Parul was given two test tubes. One of the test tubes contained ethyl amine and the other contained aniline. To distinguish between the two compounds, she adds a reagent X to both the test tubes. She observes that in only one of the test tubes a yellow dye is formed. (a) Identify the reagent X. (b) Describe how this reagent is prepared and give a reason why it is not readily available in a laboratory. (c) Which of the two compounds forms the yellow dye? (d) Draw the structure of the yellow dye formed.