# Grade 10 Chemistry Kerala 2024

**Instructions:**

- The first 15 minutes is cool-off time.
- You may use this time to read the questions and plan your answers.
- Answer only on the basis of instructions and questions given.
- Consider score and time while answering.

## Section A

**Answer any 4 questions from 1 to 5. Each question carries 1 score.**　　　$4 \times 1 = 4$

Q1.　f-block elements which belong to $7^{th}$ period are known as _____?

(Transition elements, Lanthanoids, Halogens, Actinoids)

**Solution:**

Actinoids - The f-block elements that belong to the 7th period are known as actinoids.

Q2.　Write the name of the byproduct obtained in the industrial production of Soap.

**Solution:**

Glycerol - The byproduct obtained in the industrial production of soap is glycerol.

Q3.　The ore of a metal is lighter than the impurities. Which method is suitable for its concentration?

(Levigation, Froth floatation, Magnetic Separation, Leaching)

**Solution:**

Levigation - When the ore of a metal is lighter than the impurities, the suitable method for concentration is levigation.

Q4.　When ammonium chloride is heated, a gas with basic nature is obtained. Write the name of the gas.

**Solution:**

Ammonia ($NH_3$) - When ammonium chloride is heated, a gas with basic nature, ammonia, is obtained.

Q5. Which is the product obtained at the cathode when sodium chloride solution is electrolyzed? (Na, $Cl_2$, $O_2$, $H_2$)

**Solution:**

Hydrogen ($H_2$) - The product obtained at the cathode when sodium chloride solution is electrolyzed is hydrogen gas.

# SECTION-B

**Answer any 4 questions from 6 to 10. Each question carries 2 scores.      $4 \times 2 = 8$**

Q6. Stainless steel, Nichrome and Alnico are alloy steels.
(a) Which alloy steel is used for the production of heating coils?
(b) Identify the alloy steels having the same components among these.

**Solution:**

Nichrome - Nichrome is used for the production of heating coils. Alnico - Alnico and stainless-steel share some of the same alloy components.

Q7. (a) Oxidation state of Mn in $MnO_2$ is +4. Find out the oxidation state of Mn in $Mn_2O_3$.
(b) Transition elements show variable oxidation state. Why?
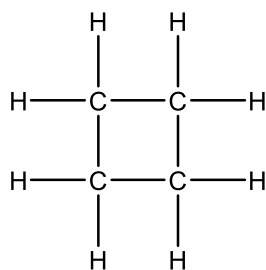
**Solution:**

(a) The oxidation state of Mn in $Mn_2O_3$ is +3.

(b) Transition elements show variable oxidation states due to the involvement of d-electrons, which can lose different numbers of electrons in chemical reactions.

Q8. The molecular formula of a hydrocarbon is $C_4H_8$.
(a) To which category does this hydrocarbon belong? [Alkane, Alkene, Alkyne]
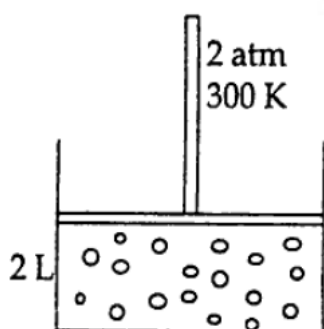(b) Draw the structure of an alicyclic hydrocarbon with the same molecular formula.

**Solution:**

(a) The hydrocarbon with the molecular formula $C_4H_8$ is categorized as an alkene.
(b) An alicyclic hydrocarbon with the same molecular formula ($C_4H_8$) is cyclobutane.

Structure is:



Q9. Analyse the picture and answer the following questions.



(a) What will be the pressure when the volume of this gas is increased to 4 L at 300 K?

(b) Which is the gas law related to this?

**Solution:**

(a) According to Boyle's Law, if the volume of a gas is increased from 2 L to 4 L at 300 K, the pressure will decrease to 1 atm if initially at 2 atm.

(b) The gas law related to this is Boyle's Law.

Q10. Choose the right compounds from the given box to answer the following questions.

(i) $CH_3 - CH_2 - OH$          (ii) $CH_3 - CH_2 - COOH$

(iii) $CH_3 - CH_2 - CO - CH_3$     (iv) $CH_3 - COOH$

(v) $CH_3 - OH$               (vi) $CH_3 - CH_2 - COO - CH_3$

(a) Which among these is an ester?

(b) Which are the compounds required to prepare this ester?

**Solution:**

(a) $CH_3$-$CH_2$-COO-$CH_3$ is the ester.

(b) The compounds required to prepare this ester include an alcohol ($CH_3$-$CH_2$-OH) and a carboxylic acid ($CH_3$-COOH).

**SECTION-C**

**Answer any 4 questions from 11 to 15. Each question carries 3 scores.    4 × 3 = 12**

Q11.  Sulphuric acid is called the king of chemicals.

(a) What is the industrial preparation of sulfuric acid known as _____?

(b) Which is the catalyst used in this process?

(c) When concentrated sulphuric acid is added to sugar, a black substance is formed. Explain the reason for this observation.

**Solution:**

(a) The industrial preparation of sulfuric acid is known as the <u>Contact Process</u>.

(b) The catalyst used in this process is vanadium pentaoxide ($V_2O_5$).

(c) When concentrated sulfuric acid is added to sugar, the acid acts as a dehydrating agent and removes water from the sugar, leading to the formation of carbon, which appears as a black substance.

Q12.  Silver is coated on copper bangle by electroplating.

(a) Which metal is connected to the negative terminal of the battery in this process?

(b) Which is the electrolyte used here?

(c) Write the chemical equation of the reaction that takes place at the positive electrode.

**Solution:**

(a) The metal connected to the negative terminal of the battery in electroplating is copper.

(b) The electrolyte used is usually a solution of silver nitrate ($AgNO_3$).

(c) The chemical equation that takes place at the positive electrode is

$Ag^+ + e^- \rightarrow Ag$.

Q13.  The structural formula of a hydrocarbon is given below:
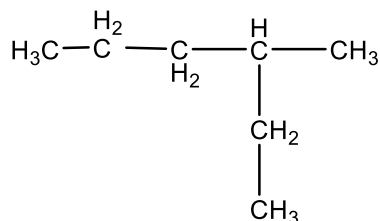
(a) How many carbon atoms are there in the main chain?

(b) Name the branch present in the compound.

(c) Write the IUPAC name of this compound.

**Solution:**

(a) There are 5 carbon atoms in the main chain of the hydrocarbon.

(b) The branch present in the compound is ethyl ($C_2H_5$).

(c) The IUPAC name of the compound is 3-ethylpentane.

Q14. Aluminium is the most abundant metal on the earth's crust.

(a) Which is the ore of aluminium?

(b) Describe the different steps in the concentration of this ore.

**Solution:**

(a) The ore of aluminum is bauxite.

(b) The different steps in the concentration of bauxite include:

- Crushing and grinding the ore.

- Concentrating the ore using the Bayer process, which involves the dissolution of bauxite in sodium hydroxide and separation of aluminum oxide through filtration.

Q15. Complete the following equations.

(a) $\underline{X}$ + $Cl_2$ → $CH_3$−$CH_2Cl$ + HCl

(b) $CH_3$-CH=$CH_2$ + $Cl_2$ → $\underline{Y}$

(c) $CH_3$−$CH_2$−$CH_3$ + Heat → $CH_4$ + $\underline{Z}$

**Solution:**

(a) X + $Cl_2$ → $CH_3$−$CH_2Cl$ + HCl is a substitution reaction where X is propane ($C_3H_8$).

(b) $CH_3$−CH=$CH_2$ + $Cl_2$ → Y is an addition reaction resulting in 1,2-dichloropropane (Y).

(c) $CH_3$−$CH_2$−$CH_3$ + Heat → $CH_4$ + Z where Z is propene ($C_3H_6$).

# SECTION-D

**Answer any 4 questions from 16 to 20. Each question carries 4 scores.     4 × 4 = 16**

Q16.  The subshell electronic configuration of an element is given: $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^6$ $4s^2$

(a) What is the atomic number of this element?

(b) Which subshell among these has the highest energy?

(c) Find out the period number and group number of this element.

**Solution:**

(a) The atomic number of the element is 26 (for Iron, Fe).

(b) The subshell with the highest energy among these is the 3d subshell.

(c) This element is in period 4 and group 6 of the periodic table.

Q17.  The structural formula of an organic compound is given: $CH_3\text{-}CH_2\text{-}O\text{-}CH_3$

(a) The compounds having -O-R as the functional group are called_____?

(b) Write the molecular formula of this compound.

(c) Write the IUPAC name of this compound.

(d) Write the structural formula of the functional isomer of this compound.

**Solution:**

(a) Compounds having -O-R as the functional group are called ethers.

(b) The molecular formula of this compound is $C_3H_8O$.

(c) The IUPAC name of the compound is ethyl methyl ether.

(d) The structural formula of the functional isomer is $CH_3\text{-}CH_2\text{-}CH_2\text{-}OH$ (1-propanol).

Q18.  (a) What is the volume of 1 mol of ammonia gas ($NH_3$) at STP?

(b) Find the volume of 68 g of ammonia gas at STP.

[Hint : Molecular mass of $NH_3 = 17$ ]

(c) Find the number of molecules present in

**Solution:**

(a) The volume of 1 mol of ammonia gas ($NH_3$) at STP is **22.4 L**.

(b) The volume of 68 g of ammonia gas at STP:

68 g ÷ 17 g/mol = 4 moles

Volume = 4 mol × 22.4 L/mol = 89.6 L

(c) The number of molecules in 68 g of ammonia:

4 mol × 6.022 × $10^{23}$ molecules/mol = 2.4088 × $10^{24}$ molecules

Q19. $2NO_{(g)} + O_{2(g)} \rightleftharpoons 2NO_{2(g)} + Heat$

(a) When does a reversible reaction attain equilibrium?

(b) How do the following changes influence the amount of the product?

(i) Increase in temperature

(ii) Increase in pressure

(iii) $NO_2$ is removed from the system.

**Solution:**

(a) A reversible reaction attains equilibrium when the rates of the forward and reverse reactions are equal.

(b) Effects of changes:

(i) **Increase in temperature**: Favors the endothermic direction, potentially increasing the amount of product if the forward reaction is endothermic.

(ii) **Increase in pressure**: Favors the side with fewer gas moles, shifting equilibrium towards that direction if the reaction involves gases.

(iii) **$NO_2$ is removed from the system**: Shifts equilibrium to the right (toward the products) to replace the removed $NO_2$.

Q20. Analyze the order of reactivity of some elements given: Mg > Zn > Fe > Cu > Ag.

(a) Name any one metal that cannot displace hydrogen from dilute hydrochloric acid.

(b) Which metals can displace Fe from $FeSO_4$ solution?

(c) A galvanic cell is constructed using Zn and Fe as electrodes.

(i) Which is the anode of this cell?

(ii) Write the equation of the chemical reaction taking place at the cathode.

**Solution:**

(a) **Silver (Ag)** is one metal that cannot displace hydrogen from dilute hydrochloric acid.

(b) **Magnesium (Mg)** and **Zinc (Zn)** can displace Iron (Fe) from $FeSO_4$ solution.

(c) In a galvanic cell constructed with Zn and Fe:

(i) The anode is **Zinc (Zn)**.

(ii) The chemical reaction taking place at the cathode (Fe) is: $Fe^{2+} + 2e^- \rightarrow Fe$