

Section A: Answer **ALL** questions in this section, using the space provided. This section carries 60 marks.

1a. Draw a dot/cross diagram, showing only the **outer** electron shells, to show the bonding in a **molecule** of hydrogen chloride.

[2]

b. Draw dot/cross diagrams, showing **all** electron shells, to show the electronic structure and charge of:

(i) the **metal ion** in sodium iodide.

[1½]

(ii) the **non-metal ion** in potassium chloride.

[1½]

c. (i) Name the test that can be used to identify the **cations** in potassium chloride and sodium iodide.

(ii) Give the result/observation for each salt.

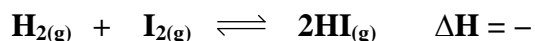
[3]

d. (i) Name the reagent(s) that can be used to identify/distinguish the **anions** in solutions of potassium chloride and sodium iodide.

(ii) Give the observation for each salt.

_____ [4]

2. The following equation represents a system in dynamic equilibrium.



a.(i) What would be the effect of increasing the temperature on the **rate/attainment** of equilibrium?

(ii) Explain your answer to question a.(i) in terms of particle collisions.

[3]

b.(i) What would be the effect of increasing the temperature on the equilibrium position?

(ii) Explain your answer to question b.(i) in terms of Le Chatelier's principle.

[3]

c.(i) What would be the effect of increasing the pressure on the **rate/attainment** of equilibrium?

(ii) Give a reason for your answer to question c.(i).

(iii) Would an increase of pressure have any effect on the equilibrium position?

(iv) Give an explanation for your answer to question c.(iii).

[4]

3. Magnesium and Calcium are both found in Group 2 of the Periodic Table and therefore show similarities in properties.

a. State **one** similarity in their **physical** properties.

_____ [1]

b. Magnesium and calcium can be shown to be chemically similar by reacting both metals with the same reagent.

(i) State the **name** of **one** reagent with which both magnesium and calcium react.

(ii) What would you **observe** during the reactions that shows that both metals have similar chemical properties?

(iii) Write a balanced equation for the reaction that takes place between **one** of the metals and the reagent you named in question b.(i).

_____ [4]

c. Hardness of water is caused by soluble compounds of magnesium and calcium. Limestone is a form of calcium carbonate. Water from limestone districts is usually temporary hard.

(i) State the **name** of the compound formed by the action of rain water on limestone and is responsible for making water **temporary** hard.

(ii) Write an equation to show the formation of temporary hardness by the action of rain water on limestone.

(iii) State the name of **one** compound that causes **permanent** hardness.

(iv) State **one** method that removes **both types** of hardness of water.

_____ [5]

- 4 a. Unless protected, objects made of iron quickly rust.
- (i) Which **two** substances **must** be present for iron to rust?
- _____
- (ii) State **one** method used to prevent rusting.
- _____ [3]
- b. An iron nail is placed in copper (II) sulfate solution. Due to its position in the Activity Series, iron displaces copper.
- (i) State **one** thing that would be **seen** after several hours.
- _____
- (ii) Write an ionic equation, omitting spectator ions, for this reaction.
- _____
- (iii) State whether the iron metal is oxidised or reduced, giving a reason for your answer.
- _____ [5]
5. Sodium hydroxide solution is frequently used in the chemistry laboratory.
- a. Give the name of **one** indicator that can be added to sodium hydroxide solution and state the colour it would give.
- indicator: _____ colour: _____ [2]
- b. Sodium hydroxide solution can be used to prepare salts by reaction with a dilute acid.
- (i) Calculate the molar concentration of sodium hydroxide solution where 2.0g of sodium hydroxide was dissolved in 250cm³ solution.
- _____
- _____
- (ii) What is the name of the **practical method** that is used to react sodium hydroxide solution with dilute acid? _____ [3]
- c. Sodium hydroxide solution is used in Qualitative analysis to identify or distinguish between solutions containing Cu²⁺, Fe²⁺, and Fe³⁺.
- (i) Select **one** of these ions and state the colour of the precipitate that would be given with sodium hydroxide solution. Ion selected _____ colour of precipitate _____
- (ii) Write an **ionic** equation to show the formation of this precipitate.
- _____ [3]
- d. Sodium hydroxide can be used to prepare ammonia gas by reacting it with an ammonium salt. Write a balanced equation for **one** example of this general type of reaction.
- _____ [2]

6. a. Give the **name** of the process by which diesel (gasoline) is obtained from crude oil.

_____ [1]

b. The word equation below represents the process by which ethene is obtained from diesel in industry.



(i) Write the formula equation for this process.

(ii) Name this process _____

[3]

c. In the laboratory, ethene can be obtained from ethanol.

(i) Give the name of this type of reaction. _____

(ii) Give the **name** of a reagent that reacts with ethanol to produce ethene and state **one** important condition for this reaction to occur.

_____ [3]

d. Describe a chemical test for ethene and give an equation for the reaction.

(i) test: _____

(ii) equation: _____ [3]

Section B: Answer any **TWO** questions from this section on the separate sheets provided.
Each question carries 20 marks.

7. Ammonia and sulfuric acid are two very important chemicals used in industry.
- (i) Give an equation for the industrial manufacture of ammonia gas and state the optimum (actual) conditions used in the process.
(ii) Explain why a catalyst is necessary. [7]
 - Sulfuric acid is manufactured from sulfur.
 - Write down two equations to show how sulfur is first converted to sulfur dioxide, and how sulfur dioxide is in turn converted to sulfur trioxide.
 - Give a reason why sulfur trioxide cannot be dissolved directly in water and briefly describe how sulfur trioxide is converted to concentrated sulfuric acid.
(equations are not required) [6]
 - Ammonia and sulfuric acid are used to make fertilizers.
 - Write an equation for the reaction between ammonia and sulfuric acid to produce ammonium sulfate.
 - State one way how fertilisers help in the growth of healthy plants. [3]
 - Show by means of calculations that urea $\text{CO}(\text{NH}_2)_2$ has a higher percentage by mass of nitrogen than ammonium sulfate $(\text{NH}_4)_2\text{SO}_4$. [4]
8. a. Describe the industrial electrolysis of brine (concentrated sodium chloride solution) using a membrane cell. In your answer include a **labelled outline diagram** of the membrane cell, name the **three** products and give equations for the electrode reactions. [12]
- b. State **one large scale** use for each of the three products. [3]
- c. Another important industrial application of electrolysis is the extraction of aluminium.
 - Write the ionic half equation for the discharge of aluminium ions and use it to calculate the number of Faradays required to deposit 1kg of the metal.
 - Give **one** large scale use of aluminium and state the property on which this use depends. [5]

9. The following statements refer to the chemistry of carbon and its compounds.
- a. Methane burns harmlessly in a plentiful supply of air to form two gases but if the air supply is limited, then a poisonous gas or a black solid is produced.
- (i) Explain the difference between these two combustion reactions.
 - (ii) State what would be **seen** in each case and **name** the products described in the statement.
 - (iii) Write an equation for burning methane in a plentiful supply of air. [10]
- b. There is only one hydrocarbon with the molecular formula C_2H_6 but there are two isomers with the molecular formula C_4H_{10} .
- (i) Give the name and structural formula for C_2H_6 .
 - (ii) Give the name for C_4H_{10} and the structural formulae for its two isomers. [5]
- c. Carbon exists in two forms – diamond and graphite, which have different physical properties.
What are these two different forms called?
Describe **two** physical differences between them. [5]

_____ End of Exam Paper _____