

Candidate Name

Candidate Number

Centre Name

Centre Number

Paper 1: Chemistry

Model Paper

(2 hours)

It is necessary to respond on the answer sheets provided alongside this question paper. Additionally, you must have a soft pencil (preferably of type B or HB), a clean eraser, and a dark blue or black pen.

INSTRUCTIONS:

- You must write your name, candidate number, and centre name on the answer sheets in the designated spaces.
- The objective section consists of 25 questions, and you must attempt all of them.
- Each question has four options labelled A, B, C, and D. Select the option that you think is correct. Mark it on the multiple-choice answer sheet using a soft pencil.
- Attempt all the questions from the subjective section using a dark blue or black pen.
- It is important to follow the instructions provided on the answer sheets.
- Do not use correction fluid.
- Avoid writing on any bar codes.
- You are allowed to use a calculator if needed.

INFORMATION:

- This paper has a total of 100 marks.
- In the objective section, there are 25 questions, each carrying one mark. There is no negative marking for incorrect responses.
- Subjective section comprises 75 marks
- The number of marks assigned for every question or its parts is indicated within brackets ().

- Rough work must be completed on this question paper.

Objective Section

Marks: 25

1- The

elements	Reaction with water	Physical state at room temperature
P	React vigorously	Solid
Q	Does not react with water	Solid
R	Reacts explosively	Solid
S	Dissolves giving a colored solution	Liquid

table
displays
certain

characteristics of four elements: P, Q, R, and S.

Two belong to Group I of the Periodic Table, while the other two belong to Group VII.

Which of the following statements is accurate?

- a) P is positioned below R in Group I.
- b) Q is situated above R in Group I.
- c) Q is positioned below S in Group VII.
- d) R is situated below S in Group VII.

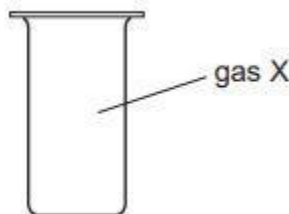
2- Hydrogen and helium have both been used to inflate balloons. What feature of helium makes it the preferred choice over hydrogen?

- a) Its ability to be easily compressed into a gas cylinder.
- b) Its formation of monatomic molecules.
- c) It's lower density.
- d) Its inertness.

3- What is the reason for using argon gas to fill electric lamps?

- a) It conducts electricity.
- b) It emits light when heated.
- c) It has a lower density than air.
- d) It is non-reactive.

4- X is a monatomic gas.



Which statement regarding X is accurate?

- a) X undergoes combustion in the air.
- b) X exhibits a distinct colour.
- c) X demonstrates inertness.
- d) X will replace iodine with potassium iodide.

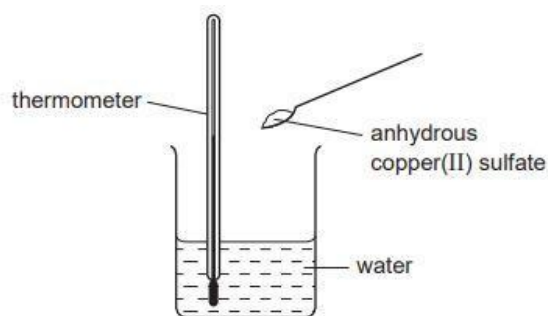
5- What is the explanation for molten zinc chloride being an electrolyte?

- a) It includes mobile molecules.
- b) It possesses a large-scale structure.
- c) It encompasses delocalized electrons.
- d) It comprises ions capable of movement.

6- Which reaction absorbs heat?

- a) Acid-neutralizing alkali resulting in a temperature rise.
- b) Introduction of magnesium into hydrochloric acid.
- c) Decomposition of calcium carbonate upon heating.
- d) Combustion of fossil fuels.

7- When anhydrous copper (II) sulfate is introduced to water, it produces a solution and releases heat.



Which row accurately displays the temperature alteration and the nature of the reaction occurring?

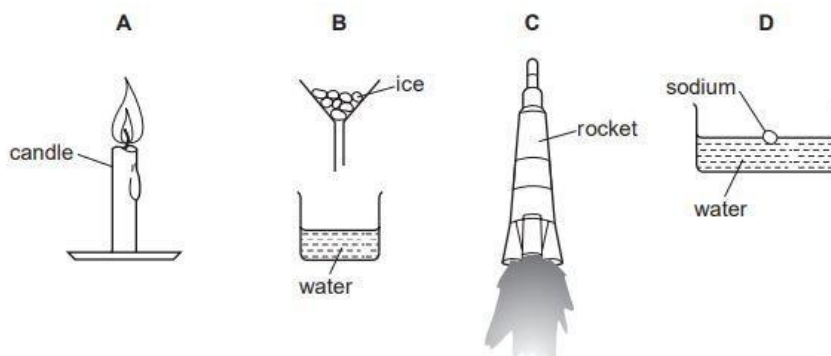
	Temperature Change	Type of reaction
A	decrease	Endothermic
B	decrease	Exothermic
C	Increase	Endothermic
D	increase	Exothermic

8- Acetylene, C₂H₂, is a hydrocarbon. When acetylene and oxygen combine, the resulting hot flame can be utilized for welding steel.

Which statement is accurate?

- a) Acetylene and oxygen undergo an exothermic reaction.
- b) Acetylene is unsaturated.
- c) Oxygen and steel participate in an endothermic reaction.
- d) Oxygen serves as a gaseous fuel.

9- Which diagram depicts a process undergoing an endothermic change?



10- Which process does not release

heat?

- a) Combusting a fossil fuel
- b) Extracting lime from limestone
- c) Radioactive decay of ^{235}U
- d) Reacting hydrogen with oxygen

11- Which process absorbs heat?

- a) Burning hydrogen
- b) Distilling petroleum
- c) Reacting potassium with water
- d) Using petrol in a motor car engine

12- Acetylene, C_2H_2 , is classified as a hydrocarbon. When acetylene and oxygen combine, the resulting hot flame can be utilized for welding steel.

Which statement is accurate?

- a) Acetylene and oxygen undergo an exothermic reaction.
- b) Acetylene is unsaturated.
- c) Oxygen and steel participate in an endothermic reaction.
- d) Oxygen serves as a gaseous fuel.

13- Ink consists of coloured substances dissolved in water.

Which technique is employed to isolate the coloured substances in the ink?

- a) Chromatography
- b) Crystallization
- c) Filtration
- d) Fractional distillation

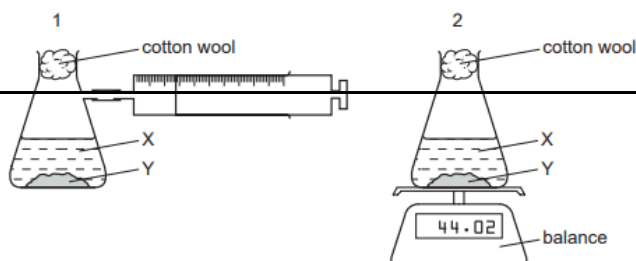
14- This question pertains to gases.

A piece of damp litmus paper is exposed to a gas. The litmus paper loses its colour.

Which gas causes damp litmus paper to bleach?

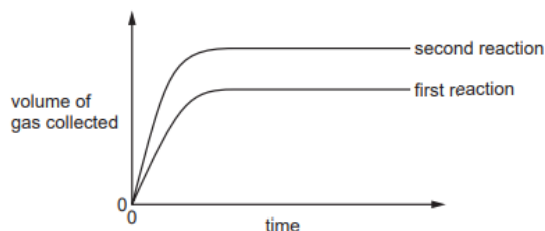
- a) carbon dioxide
- b) chlorine
- c) hydrogen
- d) oxygen

15- A liquid X reacts with solid Y to produce a gas. Which two diagrams depict appropriate methods for studying the rate (speed) of the reaction?



- a) 1 and 3
- b) 1 and 4
- c) 2 and 3
- d) 2 and 4

16- The outcomes of two distinct reactions involving an excess of calcium carbonate and hydrochloric acid are displayed.



Which statement clarifies the disparities between the reactions?

- a) A greater amount of calcium carbonate was utilized in the second reaction.
- b) The second reaction employed the same volume of a more concentrated acid.
- c) The second reaction was permitted to react for an extended duration.
- d) The temperature was elevated in the second reaction.

17- Which of the following modifications reduces the rate of the reaction between magnesium and dilute hydrochloric acid?

1. Diluting the acid

2. Employing larger pieces of magnesium

3. Cooling the mixture

- a) 1, 2
- b) 1 and 2 only
- c) 1 and 3 only
- d) 2 and 3 only

18- Calcium carbonate reacts with hydrochloric acid to produce carbon dioxide. Which modifications would decelerate this reaction?

1. Reducing the concentration of hydrochloric acid

2. Reducing the particle size of calcium carbonate

3. Reducing the temperature

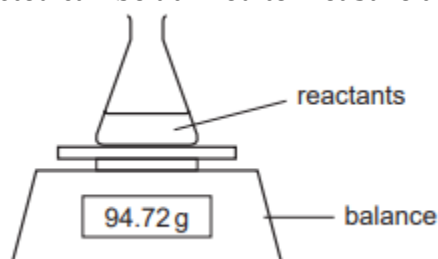
a) 1 and 2 only

b) 1 and 3 only

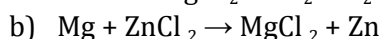
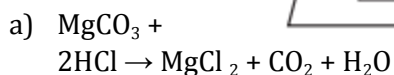
c) 2 and 3 only

d) 1, 2, and 3

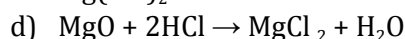
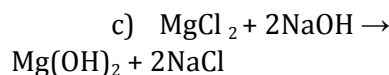
19- The apparatus depicted can be utilized to measure the rates of certain chemical reactions.



For which reaction



is this apparatus appropriate?



20- This question pertains to potassium and zinc.

Which of the following temperatures is most likely to represent the melting point of potassium?

a) -63°C

b) 6.3°C

c) 63°C

d) 630°C

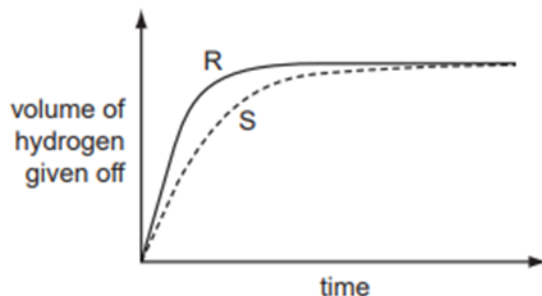
21- This question pertains to certain elements in group 7 of the periodic table.

Which row in the table accurately displays the colours and physical states of the elements at room temperature?

A	Iodine: dark grey solid	Bromine: red-brown liquid
B	Bromine: red-brown liquid	Chlorine: yellow liquid
C	Iodine: purple gas	Bromine: yellow liquid
D	Chlorine: pale green gas	Iodine: brown solid

22- A student examines the rate of reaction between magnesium and an excess of sulfuric acid.

The volume of hydrogen produced during the reaction is recorded over time. The graph depicts the outcomes of two experiments, labelled R and S.



What alteration in conditions would result in the disparity between R and S?

- | | |
|--|---|
| a) A catalyst is introduced in S. | d) The temperature in R is lower than in S. |
| b) The acid is more concentrated in R than in S. | |
| c) The magnesium is less finely powdered in R than in S. | |

23- Which of the depicted compounds belong to the same homologous series?

1. CH_3OH

2. $\text{CH}_3\text{CH}_2\text{OH}$

3. CH_3COOH

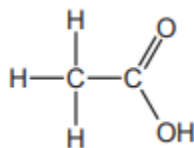
4. $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$

- | | |
|----------------|----------------|
| a) 1, 2, and 3 | c) 1, 3, and 4 |
| b) 1, 2, and 4 | d) 2, 3, and 4 |

24- Which compound is not part of the same homologous series as the other three compounds?

- | | |
|--------------------------------------|---------------------------------------|
| a) CH_3OH | c) $\text{C}_2\text{H}_5\text{OH}$ |
| b) $\text{C}_2\text{H}_5\text{COOH}$ | d) $\text{C}_7\text{H}_{15}\text{OH}$ |

25- The illustration depicts a molecule of an organic compound W.



Which statement is inaccurate?

- A solution of W in water has a pH greater than pH 7.
- A solution of W in water reacts with a sodium hydroxide solution.
- When copper (II) carbonate is added to a solution of W in water, a gas is produced.
- When magnesium is added to a solution of W in water, a gas is produced.

Theoretical Questions

Total Marks: 45

Q1: This question pertains to salts.

(a) Identify the salt generated by the neutralization of hydrochloric acid with potassium hydroxide.
[2]

(b) Compose an ionic equation for the neutralization of hydrochloric acid with potassium hydroxide.
[2]

_____ + _____ → _____

(c) Soluble salts can be generated by reacting dilute hydrochloric acid with an insoluble solid.

Copper, copper carbonate, and copper oxide are insoluble solids.

Which of these insoluble solids can be utilized to produce copper salt by reacting the solid with dilute hydrochloric acid? [2]

Tick (✓) one box.

Copper and copper carbonate exclusively ☐

Copper and copper oxide exclusively ☐

Copper carbonate and copper oxide exclusively ☐

Copper, copper carbonate, and copper oxide ☐

Here's the procedure a student follows to create magnesium sulfate crystals:

1. Pour sulfuric acid into a beaker.
2. Heat the sulfuric acid.
3. Introduce a spatula of magnesium oxide into the beaker.
4. Stir the mixture.
5. Repeat steps 3 and 4 until no more magnesium oxide is left in the beaker.
6. Filter the mixture.
7. Carefully evaporate the filtrate until crystals begin to appear.
8. Allow the solution to complete the crystallization process.

(d) Provide a rationale for: [3]

- Step 2

- Step 5

- Step 6

Step 2: _____

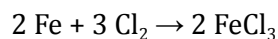
Step 5: _____

Step 6: _____

(e) How should the filtrate be gently evaporated in step 7? [3]

(f) Iron chloride is generated by heating iron in chlorine gas. [3]

The equation representing the reaction is:



Determine the volume of chlorine required to react with 14 g of iron.

You need to calculate:

- The number of moles of iron consumed
- The number of moles of chlorine reacting with 14 g of iron
- The volume of chlorine required.

Relative atomic mass (A_r): Fe = 56

The volume of 1 mole of gas = 24 dm^3

Volume of chlorine = _____ dm^3

(Total Marks 15)

Q2. Potash alum constitutes a chemical compound, comprising potassium ions, aluminium ions, and sulfate ions.

(a) What are the two techniques for detecting the existence of potassium ions in a potash alum solution? [2]

Check (✓) two options.

Flame emission spectroscopy

☐

Flame assay

☐

Solution boiling point determination

☐

Paper chromatography

☐

Utilizing litmus paper

☐

(b) Utilizing sodium hydroxide solution serves to examine certain metal ions. [2]

Upon adding sodium hydroxide solution to the potash alum solution, a precipitate emerges. Finish the sentence. Select the appropriate response from the options provided.

blue	brown	green	white
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The colour of the precipitate formed is _____.

(c) Complete the sentence. Choose the answer from the box. [2]

barium chloride solution	limewater
red litmus paper	silver nitrate solution

Dilute hydrochloric acid can be utilized to detect sulfate ions and _____.

(d) With a concentration of 258 g/dm^3 , determine the mass of potash alum required to prepare 800 cm^3 of a potash alum solution. Present your answer with 3 significant figures. [2]

Mass (3 significant figures) = _____ g.

(Total Marks 8)

Q3. This question pertains to the halogens.

A table displays the melting points and boiling points of various halogens.

Element	Melting Point in °C	Boiling Point in °C
Fluorine	-220	-188
Chlorine	-101	-35
Bromine	-7	59

(a) What is the condition of bromine at 0 °C and 100 °C? [2]

Tick (✓) one box.

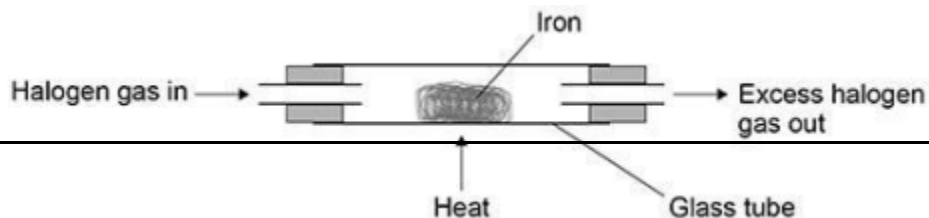
State at 0 °C	State at 100 °C	
Gas	Gas	
Liquid	Gas	
Solid	Gas	
Gas	Liquid	
Liquid	Liquid	
solid	Liquid	

(b) Elaborate on the pattern observed in the boiling points of the halogens as presented in Table. [2]

(c) Why is it inaccurate to assert that the boiling point of an individual bromine molecule is 59°C? [2]

Iron reacts with each of the halogens when they are in their gaseous states.

The illustration below displays the setup employed.



(d) Provide one rationale for conducting this experiment in a fume hood. [2]

(e) Explain why the reactivity of the halogens decreases as you move down the group. [3]

(f) A teacher examined the reaction between iron and chlorine utilizing the apparatus depicted in the diagram above. [4]

The verbal representation of the reaction is as follows:

iron + chlorine \rightarrow iron chloride

The teacher measured:

- the weight of the glass tube
- the combined weight of the glass tube and iron before the reaction
- the combined weight of the glass tube and iron chloride after the reaction.

The table shows the teacher's results.

	Mass in g
Glass tube	51.56
Glass tube and iron	56.04
Glass tube and iron chloride	64.56

Compute the simplest whole number ratio of:

moles of iron atoms: moles of chlorine atoms

Establish the balanced equation for the reaction.

Atomic masses (A_r): Cl = 35.5, Fe = 56

Moles of iron atoms: moles of chlorine atoms = _____: _____

Equation for the reaction _____

{Total Marks 15}

Q4: This question concerns hydrocarbons. The table provides details about four hydrocarbons.

These hydrocarbons represent four consecutive members of a homologous series.

Hydrocarbon	Formula	Boiling point in °C
A	C ₄ H ₁₀	0
B		36
C	C ₆ H ₁₄	69
D	C ₇ H ₁₆	98

(a) What is the formula of hydrocarbon B? [1]

Tick (✓) one box.

☐

☐

☐

☐

(b) What is the most basic ratio of carbon to hydrogen atoms in a molecule of hydrocarbon A?

Ratio = 2 : _____ [1]

(c) Which hydrocarbon exists as a gas at room temperature (25 °C)? [1]

Tick (✓) one box.

A ☐ B ☐ C ☐ D ☐

(d) Which hydrocarbon exhibits the highest flammability? [1]

Tick (✓) one box.

A	<input type="checkbox"/>	B	<input type="checkbox"/>	C	<input type="checkbox"/>	D	<input type="checkbox"/>
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(e) What are the two substances generated when a hydrocarbon undergoes complete combustion in air? [1]

Check (✓) two options.

Carbon ☐

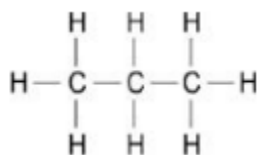
Carbon dioxide ☐

Hydrogen ☐

Sulfur dioxide ☐

Water ☐

The diagram illustrates the structure of a hydrocarbon molecule.



(f) Compute the relative formula mass (M_r) of the hydrocarbon depicted in the diagram above. [2]

Relative atomic masses (A_r): H = 1, C = 12

Relative formula mass (M_r) = _____

{Total Marks 7}

Practical Questions

Total Marks 30

Q1. Rock salt consists of a combination of sand and salt. While salt readily dissolves in water, sand does not exhibit this property. In a laboratory setting, some students undertook the task of separating rock salt, employing the following procedure:

1. Place the rock salt in a beaker.
2. Introduce 100 cm³ of cold water.
3. Allow the sand particles to settle at the bottom of the beaker.
4. Carefully decant the saline solution into an evaporating dish.
5. Apply heat to the contents of the evaporating dish using a Bunsen burner until salt crystals begin to precipitate.

(a) Propose a modification to step 2 to ensure the complete dissolution of all salt particles in the water. [2]

.....

.....

(b) Despite step 4, the saline solution retained minute sand particles. Propose one enhancement to step 4 to eliminate all sand residues. [2]

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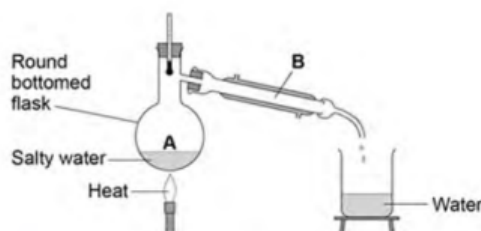
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(c) Recommend one safety measure the students should observe during step 5. [2]

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(d) A different student utilized the apparatus depicted in the figure below to extract water from a saline solution. [2]



Explain the functionality of this method by discussing the processes at points A and B.

.....

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.....
.....
What temperature does the thermometer indicate throughout this procedure?

..... °C.

{Total Marks 8}

Q2. Provide a secure procedure for producing pure copper sulfate crystals from copper carbonate and dilute sulfuric acid. Utilize the details provided in the figure above to assist you. Be sure to identify all the apparatus you intend to employ in your method.

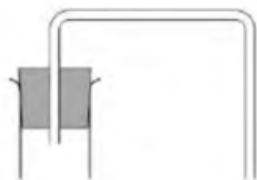
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{Total Marks 6}

Q3:

a) Certain nations produce drinking water from seawater. Use the provided figure to illustrate the distillation process of a salt solution to obtain and collect pure water. Label the following: [3]

- Pure water
- Salt solution



(b) How might one perform a test to confirm the purity of the water? Provide the anticipated outcome of the test for pure water. [3]

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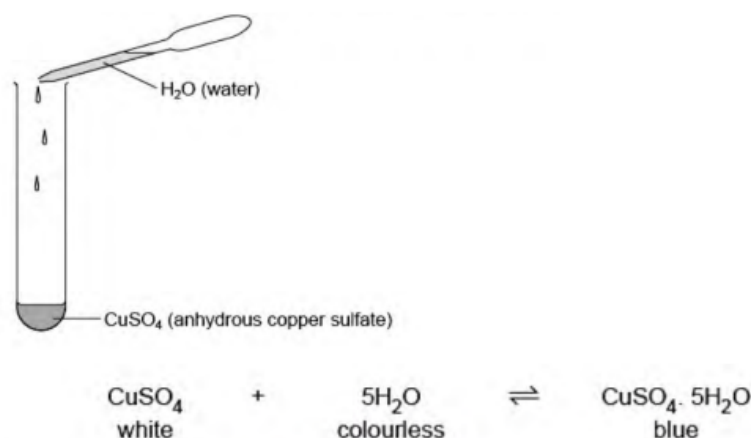
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{Total Marks 6}

Q4: The diagram illustrates the process of using anhydrous copper sulfate to test for the presence of water.



What alteration in colour will occur when water is introduced to the CuSO_4 ? The color will shift from to

{Total Marks 3}

Q5: When hydrated copper sulfate is subjected to heat, it transforms into a white solid known as anhydrous copper sulfate. This process is reversible.

hydrated copper sulphate(blue) + heat energy -> anhydrous copper sulphate(white) + water

(a) Continuous heating is necessary to drive the forward reaction. What type of reaction is this? [3]

.....

.....

.....

(b) When water is introduced to anhydrous copper sulfate, what are the two resulting occurrences?
[4]

1.....

.....

.....

2.....

.....

.....

{Total Marks 7}