

Candidate Name

Candidate Number

Centre Name

Centre Number

Paper 2: Chemistry

Model Paper

(2 hours)

It is necessary to respond on the answer sheets provided alongside this question paper. Additionally, it would help if you had 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 Questions

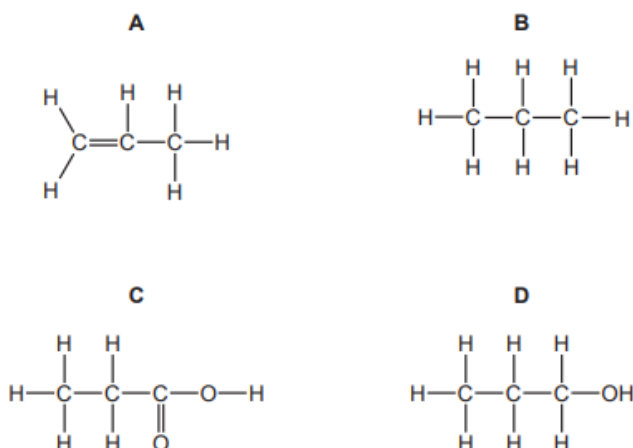
Total Marks: 25

1. Which of the following statements are accurate regarding ethanoic acid?

- a) It contains a carbon-oxygen double bond.
- b) It contains two carbon atoms.
- c) It decolorizes bromine water.
- d) It contains an -OH group.

2. There are three main types of organic compounds: alkanes, alkenes, and alcohols.

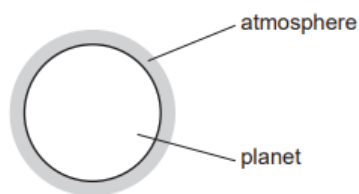
Which structure does not fall into any of these three categories?



3. Which air pollutant does not impact respiration?

- a) Carbon monoxide
- b) Lead compounds
- c) Oxides of nitrogen
- d) Sulfur dioxide

4. A recent discovery of a planet has led to the analysis of its atmosphere.



The table shows the composition of its atmosphere.

Gas	Percentage
Nitrogen	72
Oxygen	24
Carbon Dioxide	4

Which gases are present in the planet's atmosphere at a higher percentage compared to Earth's atmosphere?

- a) Carbon dioxide and oxygen
- b) Carbon dioxide only
- c) Nitrogen and oxygen
- d) Nitrogen only

5. The following substances can be produced when petrol is burned in a car engine. Which substance is primarily responsible for causing acid rain?

- a) Carbon
- b) Carbon monoxide
- c) Nitrogen dioxide
- d) Water

6. Carbon monoxide is a contaminant released into the air when petrol is combusted in a car engine. What is the reason carbon monoxide is classified as an air pollutant?

- a) It contributes to climate change.
- b) It leads to the deterioration of structures.
- c) It serves as a prominent greenhouse gas.
- d) It is toxic.

7. A farmer relocates his cows into a concrete shelter for safety. Once the door is shut, there is limited fresh air circulation. Which gases would accumulate in the shelter?

- a) Carbon dioxide and carbon monoxide
- b) Carbon dioxide and methane
- c) Carbon monoxide and oxygen
- d) Methane and oxygen

8. Which gas is absent in clean air?

- a) Carbon dioxide
- b) Carbon monoxide
- c) Nitrogen
- d) Oxygen

9. Oxygen exhibits reactivity.

Which row indicates the beneficial reactions involving oxygen?

	Fuel Combustion	Rusting	Steel Manufacture
A	yes	no	Yes
B	no	no	Yes
C	yes	yes	No
D	no	yes	No

10. Which technique is not employed for preventing rust?

- a) Coating the working parts of industrial machinery with oil
- b) Covering gardening wire with plastic
- c) Immersing gardening tools in water for storage
- d) Painting car bodies

11. Which process entails oxidation?

- a) Heating hydrated copper (II) sulfate in the air
- b) Polymerization of ethene

- c) Rusting of iron
- d) Thermal decomposition of calcium carbonate

12. Which air pollutant impacts a bodily system other than the lungs and bloodstream?

- a) Lead compounds
- b) Nitrogen
- c) Nitrogen oxides
- d) Sulfur dioxide

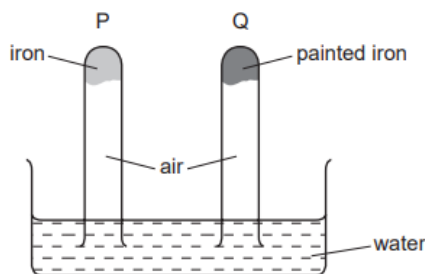
13. A man inflates a balloon. What is the estimated makeup of the air he exhales into the balloon?

	oxygen	Carbon dioxide	Nitrogen
A	20	0.03	79
B	79	0.03	20
C	16	4	79
D	20	4	75

14. Which airborne pollutant is not generated during coal combustion in a power station?

- a) carbon monoxide
- b) lead compounds
- c) nitrogen oxides
- d) sulfur dioxide

15. The diagram depicts an experiment examining the impact of paint on the corrosion of iron.



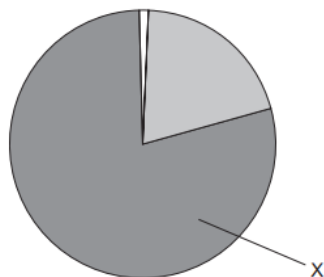
What occurs to the water level in tubes P and Q?

	Tube P	Tube Q
A	No change	Rises
B	rises	Falls
C	falls	Rises
D	Rises	No change

16. Coal is categorized as a fossil fuel. Which gas is not produced during coal combustion?

- a) carbon dioxide
- b) carbon monoxide
- c) methane
- d) sulfur dioxide

17. The diagram illustrates the volume-based composition of air.



What does X represent?

- a) argon
- b) carbon dioxide
- c) nitrogen
- d) Oxygen

18. Which compound present in polluted air can harm stonework and cause tree mortality?

- a) carbon dioxide
- b) carbon monoxide
- c) lead compounds
- d) sulfur dioxide

19. Which statements are accurate?

- i. Carbon monoxide contributes to the formation of 'acid rain'.
 - ii. Oxides of nitrogen are found in car exhaust emissions.
 - iii. Sulfur dioxide can be generated through the burning of fossil fuels.
- a) 1 and 2 only
 - b) 1 and 3 only
 - c) 2 and 3 only
 - d) 1, 2

20. The formulas of four compounds, W, X, Y, and Z, are provided.

Compound	Formula
W	FeSO ₄
X	(NH ₄) ₃ PO ₄
Y	KNO ₃
Z	NaCl

Which combination of compounds forms a comprehensive fertilizer?

- a) W and X
- b) W and Z
- c) X and Y
- d) Y and Z

21. Carbon dioxide and methane are considered 'greenhouse gases' that contribute to global warming. Which activity does not exacerbate global warming?

- a) burning fossil fuels
- b) decomposition of organic waste
- c) raising cattle for beef production
- d) cultivating crops such as sugar cane

22. Which combination of compounds would constitute an N, P, K fertilizer?

- a) ammonium sulfate and potassium phosphate
- b) calcium hydroxide and ammonium nitrate
- c) calcium phosphate and potassium chloride
- d) potassium nitrate and ammonium sulfate

23. Farmers apply calcium oxide (lime) and ammonium salts to their fields.

These compounds are not simultaneously added because they undergo a reaction with each other. Which gas is generated in this reaction?

- | | |
|-------------------|-------------|
| a) ammonia | c) hydrogen |
| b) carbon dioxide | d) Nitrogen |

24. Fertilizers are utilized to supply three essential elements required for enhancing crop yield. Which two compounds, when combined, would supply all three of these elements?

- a) ammonium nitrate and calcium phosphate
- b) ammonium nitrate and potassium sulfate
- c) potassium nitrate and calcium phosphate
- d) potassium nitrate and potassium sulfate

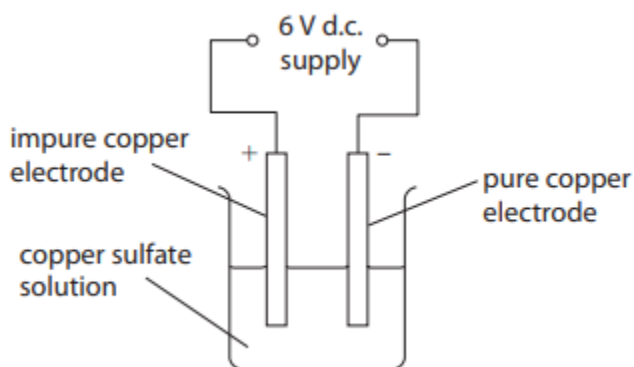
25. Which element is not included in a fertilizer?

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|--------------|---------------|
| a) aluminium | c) phosphorus |
| b) nitrogen | d) potassium |

Theoretical Questions

Total Marks: 45

Q1: (a) Impure copper undergoes purification via electrolysis utilizing the depicted apparatus.



(i) Explain the alterations each electrode will undergo by the end of the electrolysis process. [3]

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(ii) Copper sulfate solution serves as the electrolyte utilized in this electrolysis procedure. Describe how copper sulfate solution conducts electricity. [3]

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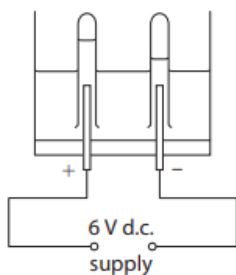
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(b) Sodium sulfate solution is electrolyzed in the apparatus shown. [6]



Sodium sulfate solution comprises sodium ions, Na^+ , sulfate ions, SO_4^{2-} , hydrogen ions, H^+ , and hydroxide ions, OH^- .

Hydrogen is generated at one electrode while oxygen is generated at the other electrode.

Describe the formation of these products from the ions during the electrolysis process, detailing how you would discern the products.

You may include ionic equations in your response.

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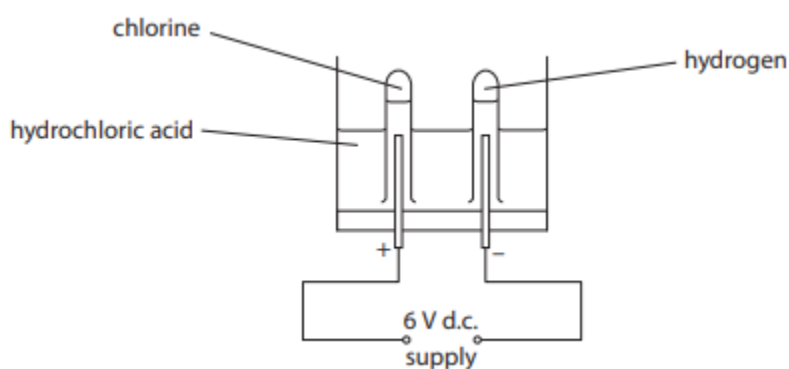
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{Total Marks 12}

Q2: (a) Hydrochloric acid undergoes electrolysis to produce chlorine and hydrogen. The depicted apparatus is used for this process.



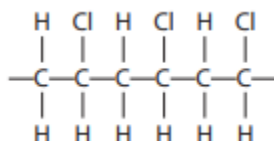
(i) Clarify the meaning of electrolysis. [4]

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(ii) Explain the procedure for conducting a test to confirm the presence of chlorine gas. [5]

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(iii) Chlorine is utilized in the production of a polymer. [3]
A portion of this polymer molecule is

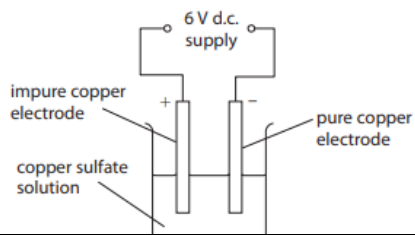


State the name of the polymer.

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{Total Marks 12}

Q3: (a) The purification of impure copper is achieved through electrolysis employing the apparatus depicted.



- (i) Explain the alterations that occur to each electrode once the electrolysis process is completed. [2]

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- (ii) Copper sulfate solution is the electrolyte used in this electrolysis process.
Describe how copper sulfate solution enables the conduction of electricity. [4]

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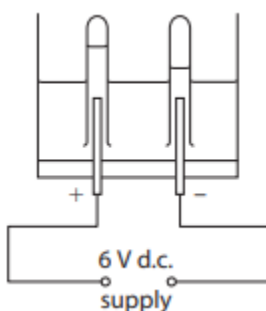
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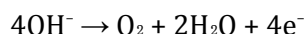
- (b) Electrolysis is performed on a sodium sulfate solution using the depicted apparatus. [7]



In a sodium sulfate solution, hydrogen ions (H^+) and hydroxide ions (OH^-) are formed from the dissociation of water. At the cathode (negative electrode), hydrogen ions (H^+) are reduced to form hydrogen gas (H_2) according to the following half-equation:



At the anode (positive electrode), hydroxide ions (OH^-) are oxidized to form oxygen gas (O_2) and water (H_2O) according to the following half-equation:



To identify these products, you can perform tests. Hydrogen gas can be tested by placing a burning splint near the gas; if it ignites with a "pop" sound, it confirms the presence of hydrogen. Oxygen gas can be tested by placing a glowing splint near the gas; if it relights, it indicates the presence of oxygen.

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{Total Marks 13}

Q4: Electrodes are immersed in three distinct solutions, labeled J, K, and L. A 6V direct current source is connected to the electrodes. Any resulting products at the electrodes are subsequently identified. The outcomes are presented in Figure.

solution	solution conducts electricity	product at cathode	product at anode
J	yes	copper	chlorine
K	yes	hydrogen	oxygen
L	no	none	none

(a) Describe which solutions act as electrolytes. [4]

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(b) What material is best suited for making the electrodes used in the electrolysis of a dilute acid?
[4]

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- 1) zinc
- 2) sulfur
- 3) iron
- 4) graphite

{Total Marks 8}

Practical Questions

Total Marks: 30

Q1: (a) Lithium carbonate breaks down upon heating.

The equation depicts the decomposition of lithium carbonate:

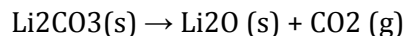
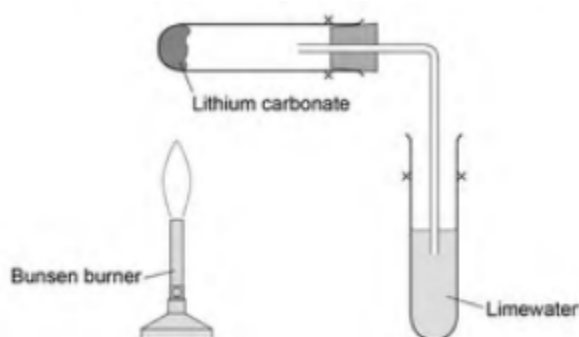


Figure 4 illustrates the apparatus employed by a student to decompose lithium carbonate.



What causes the limewater to bubble? [3]

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(b) The student experimented again using potassium carbonate.

However, there were no bubbles observed in the limewater. Propose a reason for the absence of bubbles in the limewater. [3]

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{Total Marks 6}

Q2: In a school laboratory, a container of washing soda was discovered.

The chemical name for washing soda is sodium carbonate.



A student experimented to confirm that the substance was sodium carbonate.

(a) To demonstrate that washing soda is a sodium compound, the student performed a flame test. The student utilized a clean wire to introduce the washing soda into the flame. Why is it important for the wire to be clean when conducting a flame test? [4]

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(b) To confirm that washing soda was a carbonate, the student employed dilute hydrochloric acid, resulting in the release of carbon dioxide gas. Explain the visual observation when a gas is emitted. [6]

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(c) Instrumental methods are employed for chemical identification.

Provide two benefits of instrumental methods over chemical tests, taking into account:

- the duration required to conduct a test
- the quantity of chemicals utilized. [4]

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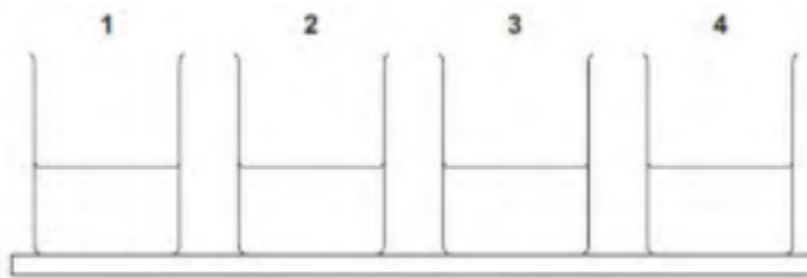
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{Total Marks 14}

Q3: In this assessment, your proficiency in employing clear English, organizing information effectively, and employing specialized terminology as necessary will be evaluated.

A cohort of students possessed four distinct colourless solutions in beakers 1, 2, 3, and 4, as depicted in the figure below.



The students were aware that the solutions consisted of:

- Sodium chloride
- Sodium iodide
- Sodium carbonate
- Potassium carbonate

However, they were uncertain about which solution corresponded to each beaker.

The teacher instructed the class to devise a procedure to determine the identity of each solution.

She provided the students with the following reagents:

- Dilute nitric acid
- Silver nitrate solution.

The teacher proposed employing a flame test to discern the positive ions.

Outline a procedure the students could employ to identify the four solutions.

Ensure to include the outcomes of the tests you delineate.

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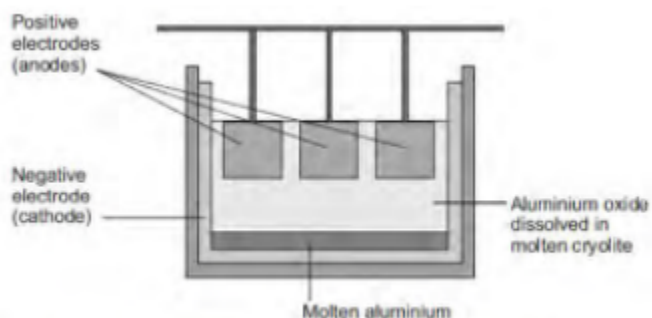
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{Total Marks 5}

Q4: Aluminum is obtained through electrolysis, as illustrated in the figure.



Clarify why aluminium is produced at the negative electrode during electrolysis.

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{Total Marks 5}