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SECTION A

1. Use the Periodic Table on page 2 to help you answer this question.

(a) How many elements are in Period 1?

..... (1)

(b) Identify an element that has a relative atomic mass of 40.

..... (1)

(c) Name an element that forms ions with a charge of -2 .

..... (1)

(d) Give the symbol of an element that does not react.

..... (1)

(e) Identify the element which is in both Period 5 and Group 4.

..... (1)

(Total 5 marks)

Q1



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2. Complete the sentences by selecting words from the box.

Each word may be used once, more than once or not at all.

different	electrons	identical
negative	neutrons	nucleus
positive	protons	shells

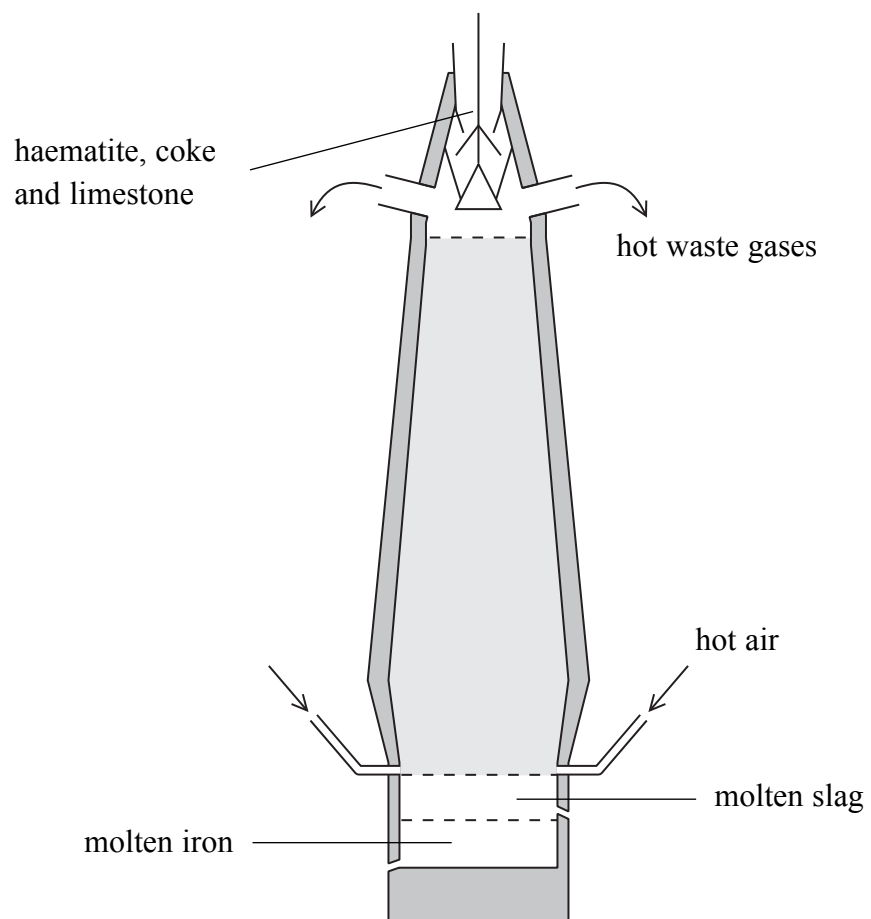
- (a) Atoms are made up of protons, and electrons. (1)
- (b) Protons are found in the of an atom. (1)
- (c) Electrons have a charge. (1)
- (d) The mass number of an atom is the total number of and in the atom. (1)
- (e) Isotopes are atoms with the same number of protons but different numbers of (1)
- (f) Isotopes of the same element have chemical properties. (1)

(Total 6 marks)

Q2



3. The diagram shows how iron is extracted from haematite, a form of iron(III) oxide.



(a) (i) During this extraction process, coke (a form of carbon) burns. The reaction is exothermic.

Write the word equation for this reaction.

..... (1)

(ii) The heat produced by the above reaction causes the calcium carbonate to decompose.

Complete this word equation.

calcium carbonate → calcium oxide + (1)



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(b) (i) Rust is hydrated iron(III) oxide.

Place crosses (☒) in **two** boxes to show what must be present for a sample of iron to rust.

carbon dioxide

nitrogen

oxygen

salt

water

zinc

(2)

(ii) Car bodies are often made from steel, an alloy of iron.

State **one** method used to prevent the rusting of car bodies.

.....

(1)



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(c) Some cars do not rust because they have bodies made of aluminium.
Aluminium has many other uses.

The first box gives some uses of metals.

The second box gives some other properties of aluminium.

Complete the table by selecting **two** uses of aluminium from the first box and the properties on which these uses depend from the second box.

Uses of metals
aircraft bodies
cooking pans
knives
household wiring
overhead power cables
railway tracks

Properties of aluminium
good conductor of electricity
good conductor of heat
low density

Use of aluminium	Property on which that use depends
car bodies	does not corrode

(4) Q3

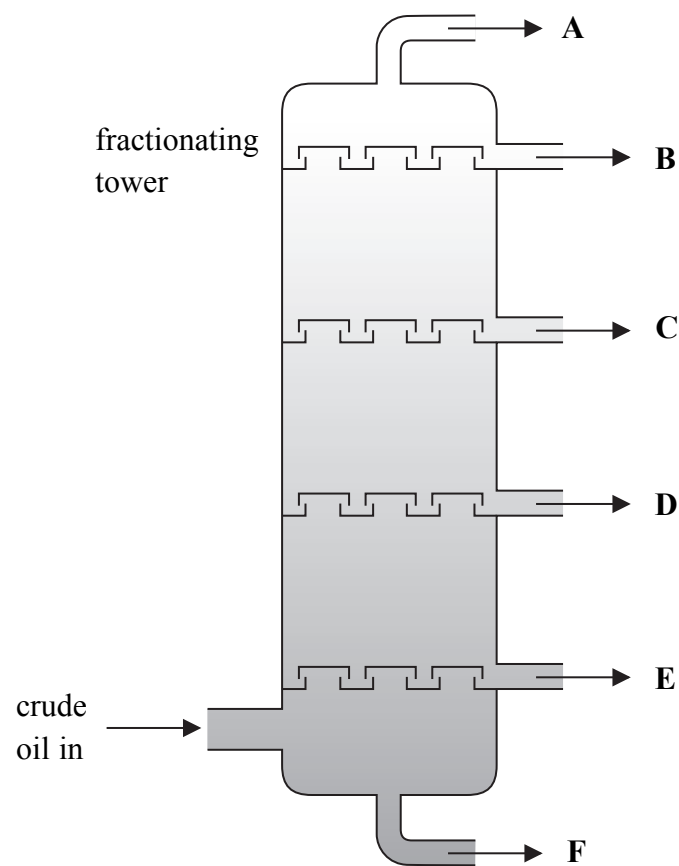
(Total 9 marks)

7

Turn over



4. Crude oil is a complex mixture of hydrocarbons. It is separated into fractions by fractional distillation. The diagram shows a fractionating tower.



- (a) Place a cross (☒) in **one** box to show which statement is correct.

- crude oil is heated before entering the fractionating tower
- each fraction obtained is a single compound
- the temperature is highest at the top of the fractionating tower

(1)



Leave blank

(b) Use the letters **A** to **F** from the diagram to complete these statements.
Each letter may be used once, more than once or not at all.
Place a cross (☒) in the correct box.

(i) The fraction that does not condense in the fractionating tower is

A ☒ **B** ☒ **C** ☒ **D** ☒ **E** ☒ **F** ☒

(1)

(ii) The fraction with the highest boiling point is

A ☒ **B** ☒ **C** ☒ **D** ☒ **E** ☒ **F** ☒

(1)

(iii) The fraction called bitumen is

A ☒ **B** ☒ **C** ☒ **D** ☒ **E** ☒ **F** ☒

(1)

(iv) The liquid fraction with the shortest carbon chains is

A ☒ **B** ☒ **C** ☒ **D** ☒ **E** ☒ **F** ☒

(1)

(c) The fractions of crude oil have many uses.

Complete the table.

Name of fraction	Use
gasoline	
	aviation fuel
bitumen	

(3)





<p>(d) (i) Complete the word equation for the incomplete combustion of gasoline.</p> <p>gasoline + → carbon monoxide +</p> <p style="text-align: right;">(2)</p> <p>(ii) Place a cross (☒) in one box to show which statement about carbon monoxide is correct.</p> <p style="padding-left: 100px;">it causes acid rain ☒</p> <p style="padding-left: 80px;">it has a pungent smell ☒</p> <p style="padding-left: 100px;">it is poisonous ☒</p> <p style="padding-left: 50px;">it is the gas mainly responsible for global warming ☒</p> <p style="text-align: right;">(1)</p> <p style="text-align: right;">(Total 11 marks)</p>	<p>Leave blank</p> <p style="text-align: center;">Q4</p>



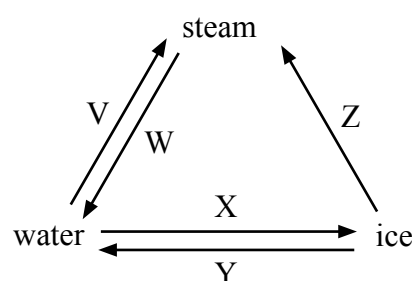
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Turn over for Question 5



5. The three states of matter are solid, liquid and gas.

The diagram shows the relationships between ice, water and steam.



(a) (i) What is the name given to the change of state indicated by **Y**?

..... (1)

(ii) Which letter indicates sublimation?

..... (1)

(iii) What must be provided for the change of state indicated by **V** to occur?

..... (1)

(b) In which state are water molecules **not** free to move around?

..... (1)

(c) Water can be represented by the formula $H_2O(l)$.

Give the formula, including state symbols, of:

(i) ice

..... (1)

(ii) steam.

..... (1)



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blank

(d) Water can be obtained from an aqueous solution of sodium chloride by distillation.

(i) Which state symbol is used to show that sodium chloride is aqueous?

.....
(1)

(ii) Name the **two** changes of state that occur during this distillation.

First change of state

Second change of state
(2)

(e) Water can be reacted with a metal to form hydrogen.

(i) Complete this word equation.

..... + water → sodium hydroxide + hydrogen
(1)

(ii) The hydrogen gas was collected in a test tube.

What happens when a burning splint is placed at the mouth of the test tube?

.....
.....
(1)

(iii) What colour is universal indicator in sodium hydroxide solution?

.....
(1)

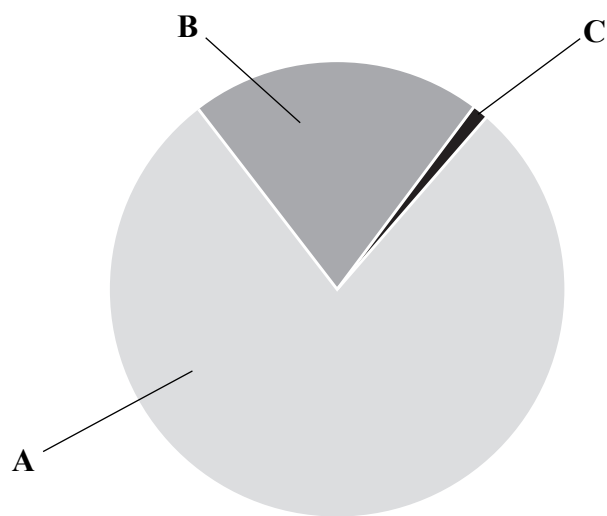
Q5

(Total 12 marks)



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6. (a) The pie chart shows the proportion by volume of the three most abundant gases in dry air.



- (i) Which letter represents nitrogen?

A B C

(1)

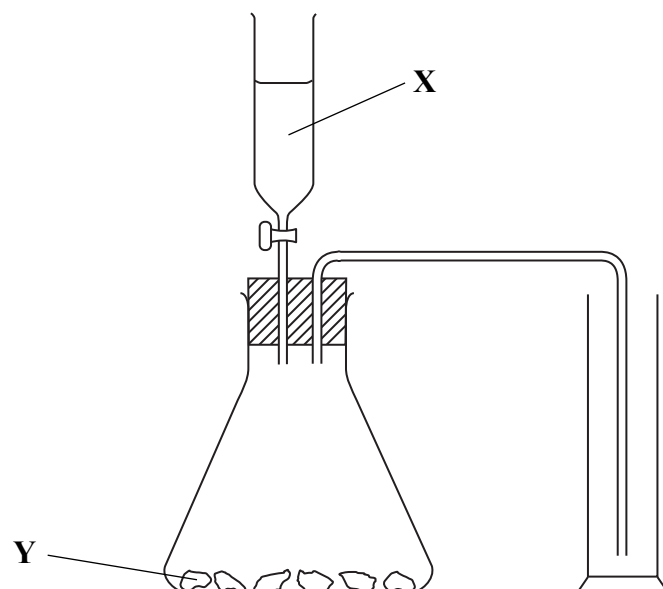
- (ii) Which gas is represented by C?

.....

(1)



(b) Carbon dioxide can be prepared in the laboratory using the apparatus shown.



(i) Place crosses (☒) in **two** boxes to show the identity of **X** and of **Y**.

- | X is | | Y is | |
|-------------------|-------------------------------------|-------------------|--------------------------|
| calcium carbonate | <input checked="" type="checkbox"/> | calcium carbonate | <input type="checkbox"/> |
| calcium oxide | <input type="checkbox"/> | calcium oxide | <input type="checkbox"/> |
| hydrochloric acid | <input type="checkbox"/> | hydrochloric acid | <input type="checkbox"/> |
| sulphuric acid | <input type="checkbox"/> | sulphuric acid | <input type="checkbox"/> |

(2)

(ii) The diagram shows carbon dioxide gas being collected by downward delivery.

Place a cross (☒) in **one** box to show the property of carbon dioxide on which this method of collection depends.

- carbon dioxide is less dense than air
- carbon dioxide is more dense than air
- carbon dioxide is colourless

(1)



(iii) Carbon dioxide reacts with water to form a weak acid.

What colour change is observed when carbon dioxide is bubbled into a beaker containing water and universal indicator?

Start colour

Finish colour

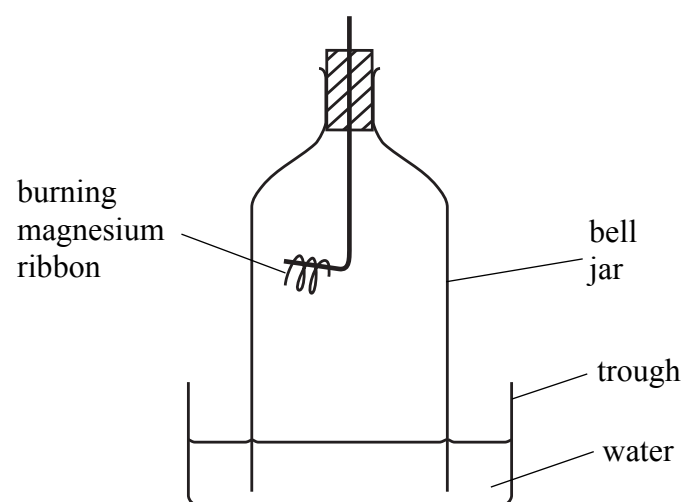
(2)

(iv) State **one** industrial use of carbon dioxide.

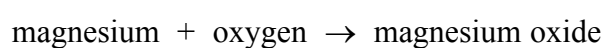
.....

(1)

(c) The following apparatus can be used to determine the percentage by volume of oxygen in the air.



The word equation for the reaction is



Has the magnesium been oxidised or reduced in this reaction?
Explain your answer.

.....

.....

(1)



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blank

(d) At the start of the experiment the volume of air in the bell jar was 5.0 dm^3 .
At the end of the experiment the water had risen up inside the bell jar.
The volume of gas inside the bell jar was now 4.0 dm^3 .

(i) Why did the water rise up inside the bell jar?

.....

.....

(1)

(ii) Use the results of the experiment to calculate the percentage by volume of oxygen
in the air. Show your working.

(2)

Q6

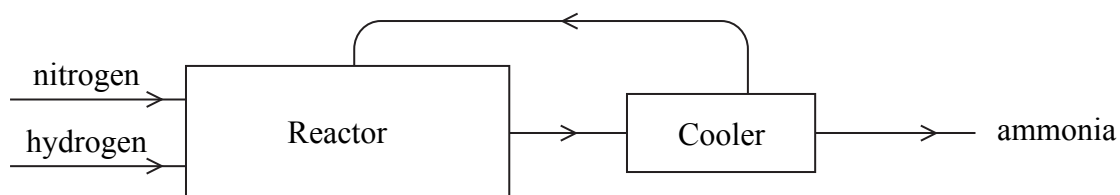
(Total 12 marks)

TOTAL FOR SECTION A: 55 MARKS



SECTION B

7. The flow diagram represents the manufacture of ammonia by the Haber process.



(a) State **three** conditions used in the reactor.

1

2

3

(3)

(b) What change of state does the ammonia undergo in the cooler?

.....

(1)

(c) Some of the ammonia formed in the Haber process is reacted with nitric acid to form ammonium nitrate.

(i) Write a chemical equation for this reaction.

.....

(2)

(ii) Give **one** major use of ammonium nitrate.

.....

(1)

(Total 7 marks)

Q7



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Turn over for Question 8



8. Copper, iron and zinc can be reactants or products in displacement reactions. These metals have different reactivities.

The table shows the observations made when a student added a small amount of each metal to a solution of the sulphate of one of the other metals.

Experiment	Reagents	Observations
1	copper + iron(II) sulphate	no change
2	copper + zinc sulphate	no change
3	iron + copper(II) sulphate	solution turns from blue to pale green solid turns from dark grey to pink-brown
4	iron + zinc sulphate	no change
5	zinc + copper(II) sulphate	solution turns from blue to colourless solid turns from light grey to pink-brown
6	zinc + iron(II) sulphate	solution turns from pale green to colourless solid turns from light grey to dark grey

(a) In Experiment 1, why was there no reaction?

.....

 (1)

(b) In Experiment 3, which ion is responsible for the blue colour?

.....
 (1)

(c) In Experiment 5, what is the pink-brown solid?

.....
 (1)

(d) In Experiment 6, why does the solid turn from light grey to dark grey?

.....

 (1)



<p>(e) Which of the three metals is the most reactive?</p> <p>.....</p> <p style="text-align: right;">(1)</p> <p>(f) When preparing for these experiments, the student found a bottle labelled “iron sulphate solution”. To find out whether the solution contained iron(II) sulphate or iron(III) sulphate he tested it by adding sodium hydroxide solution.</p> <p>State the observation made, and identify the substance responsible for the observation, if the bottle contained iron(II) sulphate solution.</p> <p>Observation</p> <p>Substance responsible</p> <p style="text-align: right;">(2)</p> <p style="text-align: right;">(Total 7 marks)</p>	<p>Leave blank</p> <p>Q8</p> <div style="border: 1px solid black; width: 20px; height: 20px; margin: 0 auto;"></div>



9. The formulae C_2H_6 and C_3H_8 represent two organic compounds.

(a) State why these compounds are described as

(i) hydrocarbons
.....
(1)

(ii) saturated
.....
(1)

(b) The compounds C_2H_6 and C_3H_8 are members of the same homologous series.

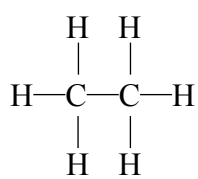
(i) What is the name of this homologous series?
.....
(1)

(ii) What is the general formula of this homologous series?
.....
(1)

(iii) Other than having the same general formula, state **two** other characteristics of members of the same homologous series.

1
2
(2)

(c) The displayed formula of C_2H_6 is



Draw the displayed formula of C_3H_8 .

(1)



Leave
blank

(d) Compounds with the molecular formula C_4H_{10} are also members of this homologous series.

There are two isomers with this molecular formula.

(i) What is meant by the term **isomers**?

.....

.....

(2)

(ii) Name **one** of these isomers and draw its displayed formula.

Name

Displayed formula

(2)

(e) Methane is another member of this homologous series.

Write a word equation for the complete combustion of methane.

.....

.....

(2)

Q9

(Total 13 marks)



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10. Salts can be made by neutralising acids.

For example, the salt magnesium sulphate is formed when magnesium, magnesium oxide, or magnesium carbonate is added to dilute sulphuric acid.

(a) Complete the table to show the equations and products for these methods of making magnesium sulphate.

Method	Equation	Names of products
1	$\text{Mg} + \text{H}_2\text{SO}_4 \rightarrow \text{MgSO}_4 + \dots\dots\dots$	magnesium sulphate and
2	$\text{MgO} + \text{H}_2\text{SO}_4 \rightarrow \text{MgSO}_4 + \text{H}_2\text{O}$	magnesium sulphate and water
3	$\text{MgCO}_3 + \text{H}_2\text{SO}_4 \rightarrow \text{MgSO}_4 + \dots\dots\dots + \dots\dots\dots$	magnesium sulphate and and

(5)

(b) State **one** observation that would be made when using methods 1 and 3, but not when using method 2.

.....
(1)

(c) A student showed the presence of sulphate ions in magnesium sulphate solution by adding dilute hydrochloric acid and barium chloride solution.

State the observation made and name the product responsible for the observation.

Observation

Name of product

(2)

Q10

(Total 8 marks)



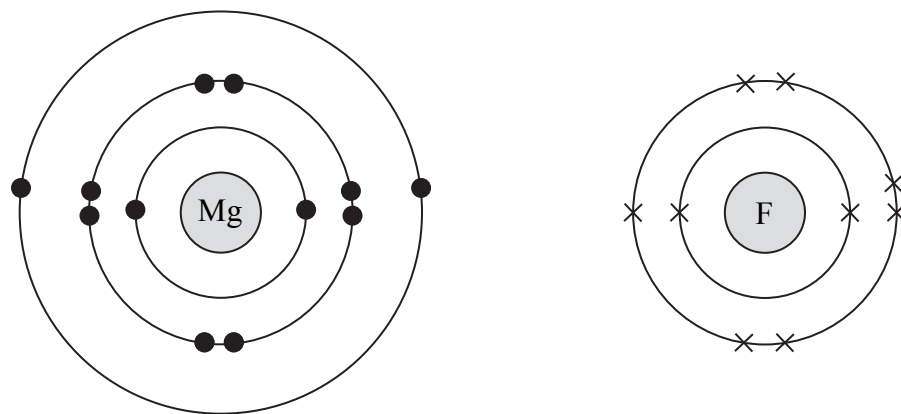
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Turn over for Question 11



11. (a) Magnesium and fluorine react to form the ionic compound magnesium fluoride.

(i) The diagrams show the electron arrangement in an atom of magnesium and in an atom of fluorine.



Describe what happens, in terms of electrons, when magnesium reacts with fluorine.

.....
.....
.....
.....
.....
.....

(3)

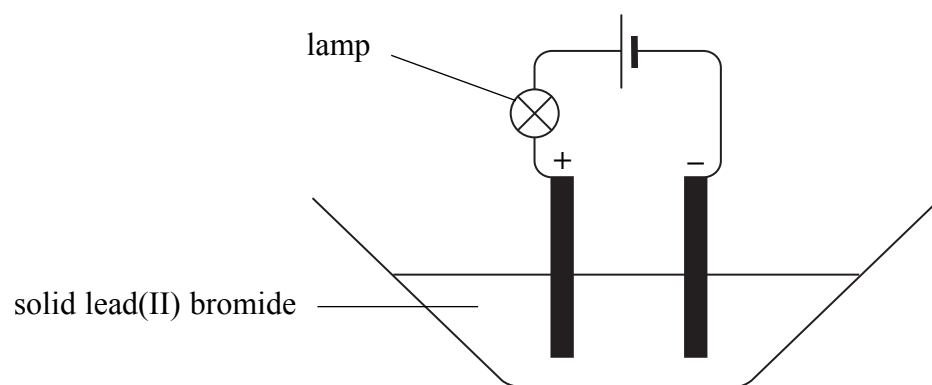
(ii) Give the formula of each of the ions in magnesium fluoride.

.....
.....

(2)



(b) The diagram shows apparatus for the electrolysis of lead(II) bromide.



(i) Identify the non-metallic element used for both electrodes.

.....
(1)

(ii) When the apparatus is set up as shown, the lamp does not light.

State what must happen to the lead(II) bromide before the lamp will light.

.....

(1)

(iii) When the lamp lights, electrolysis occurs and changes can be seen in the electrolyte.

Complete the table to show the substance responsible for the change and the electrode (+ or -) at which the substance is formed.

Observation	Substance	Electrode
Silvery liquid		
Brown gas		

(3)

Q11

(Total 10 marks)

TOTAL FOR SECTION B: 45 MARKS

TOTAL FOR PAPER: 100 MARKS

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