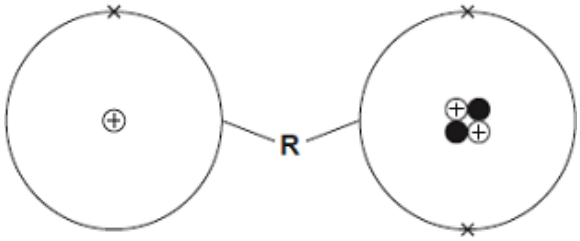
Q1. The Sun is mainly hydrogen and helium.
The diagrams show an atom of hydrogen and an atom of helium.

Hydrogen **Helium**



(a) Draw a ring around the correct answer to complete each sentence.

(i) The centre of each atom is called the

molecule.

nucleus.

shell.

(1)

(ii) The circle (labelled **R**) around the centre of each atom is called

a bond.

an electrical charge.

an energy level (shell).

(1)

(b) Use the diagrams in part (a) to help you to answer these questions.

Draw **one** line from each question to its correct answer.

Question	Answer
How many protons are there in the hydrogen atom?	1
How many electrons are there in the helium atom?	2
What is the mass number of the helium atom?	3
	4

(3)

(c) The Sun is 73% hydrogen and 25% helium. The rest is other elements.

What is the percentage of other elements in the Sun?

..... %

(1)

(d) One of the other elements in the Sun is neon.
Neon is in the same group of the periodic table as helium.

Use the Chemistry Data Sheet to help you to answer these questions.

(i) How many protons are there in a neon atom?

.....

(1)

(ii) Which group of the periodic table are helium and neon in?

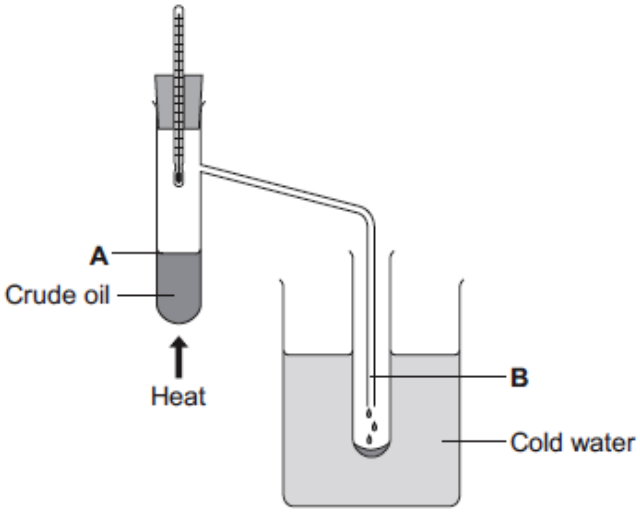
.....

(1)
(Total 8 marks)

Q2. Crude oil is a mixture of a very large number of compounds.

Figure 1 shows a laboratory experiment to separate crude oil.

Figure 1



(a) Complete the sentence.

The name for compounds that contain only hydrogen and

carbon is ..... .

(1)

(b) Use the correct word from the box to complete each sentence.

condensation	decomposition	distillation
evaporation	reduction	

(i) The process of separating crude oil is fractional ..... .

(1)

(ii) The process taking place at **A** is ..... .

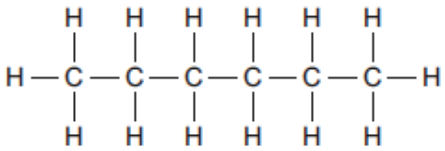
(1)

(iii) The process taking place at **B** is ..... .

(1)

(c) One of the compounds in crude oil is hexane. The displayed structure of hexane is shown in **Figure 2**.

Figure 2



Complete the sentences.

(i) Each line between the atoms in hexane represents a covalent ..... .

(1)

(ii) Complete the chemical formula for hexane.

C_6H.....

(1)

(iii) Hexane can be broken down into smaller molecules by a process called

..... .

(1)

(d) Small molecules, called alkenes, are used to make polymers.

(i) Name the polymer made from butene.

..... .

(1)

(ii) Incinerators are used to burn waste polymers, such as plastic bags.

Tick (✓) **one** advantage and tick (✓) **one** disadvantage of burning plastic bags.

	Advantage Tick (✓)	**Disadvantage Tick (✓)**
Energy is released.		
More recycling is needed.		
Carbon dioxide is produced.		

(2)

(Total 10 marks)

Q3. Iron is extracted from iron oxide in the blast furnace.

(a) The equation for one of the reactions in the blast furnace is:

$$Fe_2O_3 + 3CO \longrightarrow 2Fe + 3CO_2$$

(i) Complete the word equation for this reaction.

iron oxide + carbon monoxide ⟶ ..... + ...

(2)

(ii) Oxygen is removed from iron oxide in the blast furnace.

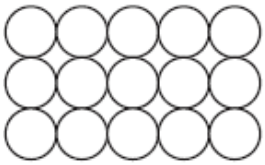
Draw a ring around the correct answer to complete the sentence.

The iron oxide is

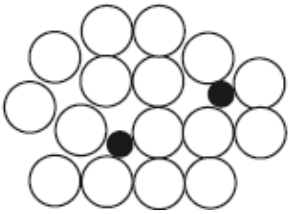
neutralised.
oxidised.
reduced.

(1)

(b) The diagrams represent pure iron and iron from the blast furnace.



Pure iron



Iron from the blast furnace

(i) Draw **one** line from each statement to the correct explanation.

Statement	**Explanation**
Pure iron is an element because	it is made of one sort of atom only.
	it contains two elements not chemically combined.
Iron from the blast furnace is a mixture because	every atom has the same number of neutrons.
	it contains two elements chemically combined.

(2)

(ii) Explain why iron from the blast furnace is harder than pure iron.

Use the diagrams on page 4 to help you.

.....

.....

.....

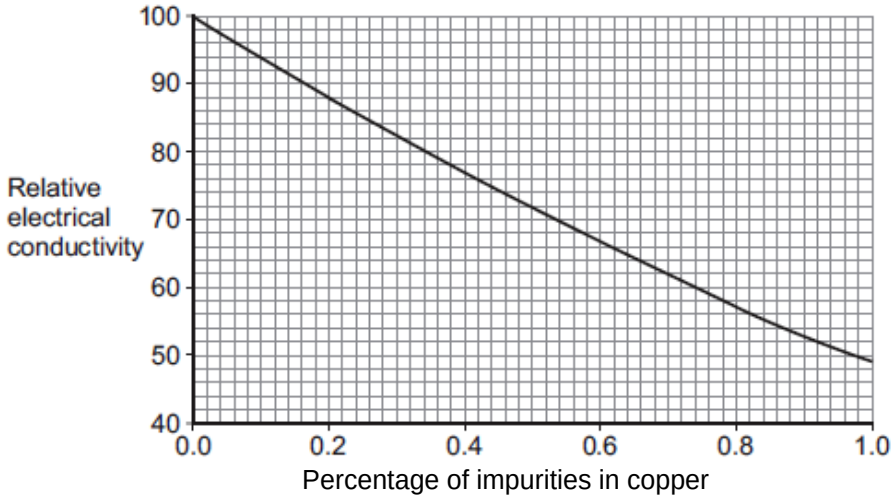
.....

(2)
(Total 7 marks)

Q4. This question is about copper.

(a) Most of the copper extracted is used in electric circuits.

The figure below shows how impurities change the electrical conductivity of copper.



Copper extracted by smelting is about 99% pure.

The 99% pure copper produced by smelting is purified to 99.9999% pure copper by electrolysis.

Use values from the graph to explain why copper is purified to 99.9999%.

.....

.....

.....

.....

(2)

(b) **In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.**

Read the information in the box.

Copper extraction

World demand for copper for the year 2011 was about 20 million tonnes.

World reserves of copper are estimated to be 700 million tonnes.

Most of the copper used is obtained from copper ores, which are mined.

The copper ore chalcopyrite is heated in a furnace to produce copper sulfide, CuS

The furnace is heated by burning fossil fuels.

Air is then blown through the hot copper sulfide, to produce copper and sulfur dioxide.

$$CuS + O_2 \rightarrow Cu + SO_2$$

A scientist made the statement: 'Copper should be recycled'.

Use the information in the box and your own knowledge and understanding to justify the scientist's statement.

.....

.....

.....

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.....

.....

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.....

.....

Extra space .....

.....

.....

.....

.....

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.....

.....

.....

(6)

(c) Phytomining is used to obtain copper from land that contains very low percentages of copper compounds.

Describe how copper compounds are obtained by phytomining.

.....

.....

.....

.....

.....

.....

.....

.....

(3)
(Total 11 marks)

Q5. Where copper ore has been mined there are areas of land that contain very low percentages of copper compounds.

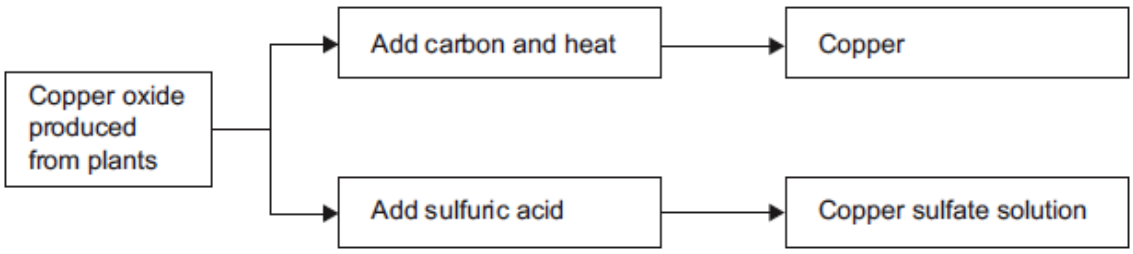
One way to extract the copper is to grow plants on the land.

The plants absorb copper compounds through their roots.

The plants are burned to produce copper oxide.

The copper oxide produced from plants can be reacted to produce copper or copper sulfate solution, as shown in **Figure 1**.

Figure 1



(a) (i) Complete the sentence.

Using plants to extract metals is called ..... .

(1)

(ii) Suggest **two** reasons why copper from these areas of land is **not** extracted by smelting.

.....

.....

.....

.....

.....

(2)

(iii) Complete and balance the chemical equation for the reaction of copper oxide with carbon.

.....CuO + C ⟶ ..... + CO_2

(2)

(b) Copper is produced from copper sulfate solution by displacement using scrap iron or by electrolysis.

(i) Use the Chemistry Data Sheet to help you to answer this question.

Give **two** reasons why scrap iron is used to displace copper.

.....

.....

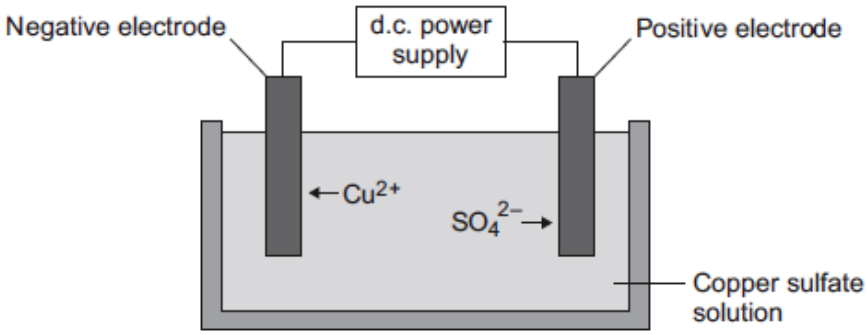
.....

.....

(2)

(ii) **Figure 2** shows the electrolysis of copper sulfate solution.

Figure 2



Describe what happens to the copper ions during electrolysis.

.....

.....

.....

.....

(2)
(Total 9 marks)

Q6. (a) Some metal carbonates break down when heated to produce carbon dioxide gas.

The word equation for this reaction is:

metal carbonate ⟶ metal oxide + carbon dioxide

(i) What name is given to a chemical reaction in which a compound breaks down when heated?

Tick (✓) **one** box.

Exothermic ☐

Neutralisation ☐

Thermal decomposition ☐

(1)

(ii) What is the name of the metal oxide produced when calcium carbonate is heated?

.....

(1)

(iii) Limestone contains calcium carbonate.

Draw a ring around the correct answer to complete the sentence.

Limestone is obtained by

distillation **electrolysis** **quarrying**

(1)

(iv) Limestone is used in the extraction of iron.

State **one** other use of limestone.

.....

(1)

(b) A student investigated the change in mass when metal carbonates are heated.

(i) The equation for the reaction that takes place when copper carbonate is heated is:

$$CuCO_3(s) \longrightarrow CuO(s) + CO_2(g)$$

Why is there a decrease in mass of the solid when copper carbonate is heated?

Tick (✓) **one** box.

Carbon dioxide gas is given off. ☐

The copper carbonate expands when heated. ☐

There are two products. ☐

(1)

(ii) When potassium carbonate is heated there is no change in the mass of the solid.

Suggest why.

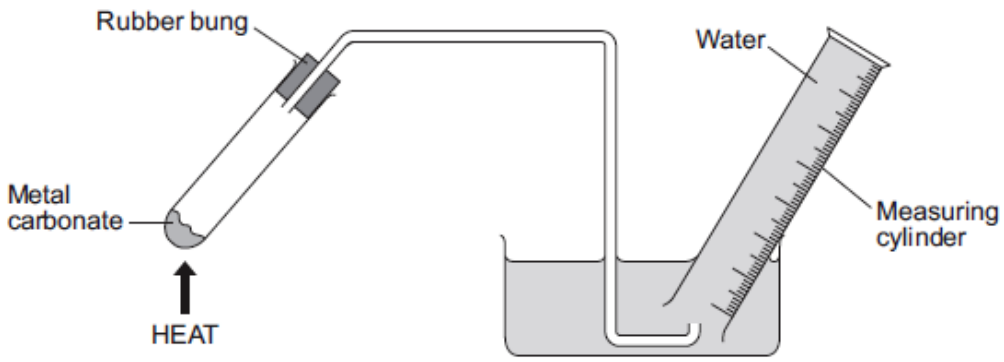
.....

.....

.....

(1)

(c) The student investigated the decomposition of metal carbonates using the apparatus shown in the figure below.



The student measured the volume of gas collected after heating the metal carbonate for 5 minutes.

(i) The student made a mistake in setting up the apparatus.

The mistake would cause a systematic error.

What mistake did the student make?

.....

.....

(1)

(ii) The student corrected the mistake he had made.

The table below shows the student's results.

Metal carbonate	Volume of gas collected in cm^3		
	Experiment 1	**Experiment 2**	**Experiment 3**
Magnesium carbonate	22	21	20
Iron carbonate	29	28	27
Rubidium carbonate	4	4	4
Zinc carbonate	24	22	0

One of the results in the table is anomalous.

Draw a ring around the anomalous result.

Suggest what may have caused the anomalous result.

.....

.....

.....

(2)

(iii) The student tested the gases collected with limewater.

The gas collected when rubidium carbonate was heated strongly did **not** turn limewater cloudy.

Explain why.

.....

.....

.....

.....

(2)
(Total 11 marks)

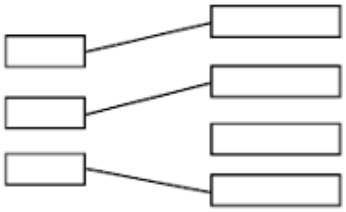
M1. (a) (i) nucleus

1

(ii) an energy level (shell)

1

(b)



3

(c) 2 / two(%)

1

(d) (i) 10 / ten

1

(ii) (group) 0

accept noble gases
ignore (group) 8

1

[8]

M2. (a) hydrocarbons **or** hydrocarbon

1

(b) (i) distillation

1

(ii) evaporation

1

(iii) condensation

1

(c) (i) bond

1

(ii) $(C_6H)_{14}$

1

(iii) cracking

1

(d) (i) poly(butene)

allow with or without brackets

1

(ii) Advantage = energy is released

*do **not** accept more than one tick in the advantage column*

1

Disadvantage = carbon dioxide is produced

*do **not** accept more than one tick in the disadvantage column*

1

[10]

M3. (a) (i) iron

either order

1

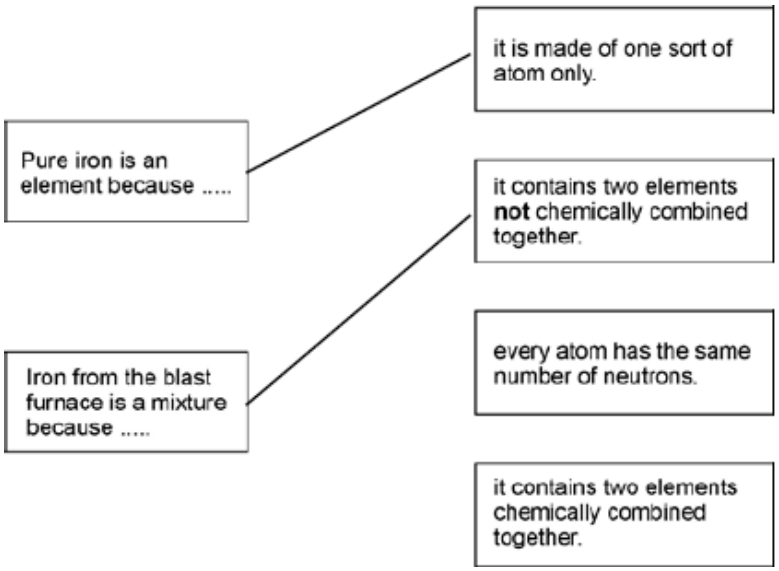
carbon dioxide

1

(ii) reduced

1

(b) (i) **Statemant** **Explanation**



*each correct line gains **1** mark*

extra lines from statement negate the mark

max. 2

(ii) the layers / rows are distorted / disrupted **or** it doesn't occur in layers **or** the atoms are different

1

so cannot **slide** over one another **or slide** less easily

1

[7]

M4. (a) pure copper is twice as good a conductor as 99% pure copper

accept reverse argument

*accept answers quoting 2 correct values from the graph scores **2***

*qualitative answer (e.g. pure copper is a better conductor than impure copper) scores **1***

or

*answers quoting a conductivity value from the graph scores **1***

2

(b) Marks awarded for this answer will be determined by the Quality of Communication (QC) as well as the standard of the scientific response.

0 marks
No relevant content

Level 1 (1–2 marks)
Simple list of a limited number of points given, with no linking between ideas

Level 2 (3–4 marks)
A broader set of points made. There will probably not be links between ideas

Level 3 (5–6 marks)
Answer includes linking between ideas, showing the consequence of either not recycling or the advantage of recycling. Answers such as less fossil fuel needed so less carbon dioxide produced **or** less carbon dioxide produced so less global warming

examples of the points made in the response

resources
(recycling) conserves supplies of ores
copper available for longer
as (at present rate of use) copper ores will run out in about 35 years
(recycling) conserves supplies of fossil fuels **or** energy
less fuel used at a lower cost

land pollution
mining scars landscape **or** produces noise pollution
mining destroys wildlife habitats
(recycling) less need to mine ores / fossil fuels
so less habitat destroyed or less scarring of landscape
(recycling) less need to use landfill for waste

atmospheric pollution
burning fossil fuels produces carbon dioxide / greenhouse gas
which (may) cause global warming **or** climate change
extraction produces sulfur dioxide
which causes acid rain
which can kill trees / fish

6

(c) grow plants

accept plants absorb copper (through roots)

1

then plants are burned

1

ash (from burning) contains copper compounds

1

[11]

M5. (a) (i) phytomining

1

(ii) *(the land contains)* very little copper

*allow low grade ore **or** large amounts of waste*

ignore quarrying / benefits of using plants

1

uneconomical

accept (smelting) uses a lot of energy / fossil fuels

allow expensive

1

(iii) Cu

1

2 CuO + C ➔ **2** Cu + CO_2

*allow 2 CuO + C ➔ Cu_2 + CO_2 for **1** mark*

1

(b) (i) iron is more reactive (than copper)

1

iron is cheap(er than copper)

*allow cheaper **or** uses less energy than electrolysis*

1

(ii) any **two** from:

- copper / ions move **or** are attracted to the negative electrode / *cathode*
- where they are reduced **or** gain (two) electrons
- *where they form copper (metal / atoms)*

2

[9]

M6. (a) (i) thermal decomposition

1

(ii) calcium oxide

accept quicklime

1

(iii) quarrying

1

(iv) any **one** from:

- building (material)
- controlling soil acidity

  accept to neutralise acid soil
- making cement
- making glass
- produce CaO (lime)
- produce $Ca(OH)_2$ (calcium hydroxide)

  accept to produce limewater

  ignore to test for CO_2

  ignore use in iron extraction

1

(b) (i) carbon dioxide gas is given off

1

(ii) does not break down / decompose

*accept is stable to heat **or** has not reacted **or** not hot enough to break down*

do not accept incorrect references to reactivity

accept no gas is given off

1

(c) (i) measuring cylinder not vertical / straight / level

ignore gas escaping

1

(ii) third result for zinc carbonate indicated

1

did not put bung in firmly **or** gas leaked

accept any answer which would cause no gas to be collected

accept did not heat it

*do **not** accept did not heat strongly enough – as any heating would produce a gas due to expansion*

dependent on first mark

1

(iii) no carbon dioxide **or** gas not carbon dioxide

*do **not** accept insufficient carbon dioxide*

because rubidium carbonate does not break down

accept not hot enough to break down

*if no other mark gained, allow air in the tube expands when heated **or** feasible alternative gas for **1** mark*

1

[11]