



Chapter 14 The Earths Resources

Name: _____

Class: _____

Date: _____

Time: **64 minutes**

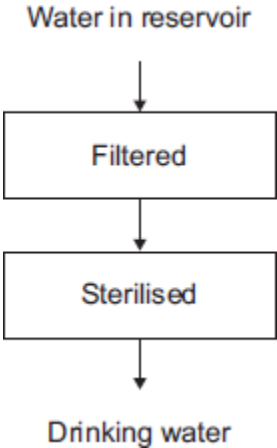
Marks: **64 marks**

Comments:

1

This question is about drinking water.

(a) The flow diagram below shows how water is made suitable for drinking.



(i) What is removed when the water is filtered?

Tick (✓) **one** box.

- Gases
- Liquids
- Solids

(1)

(ii) What is used to sterilise the water?

Tick (✓) **one** box.

- Carbon
- Chlorine
- Sodium chloride

(1)

(iii) Why is the water sterilised?

.....
.....

(1)

(b) Water can be purified by distillation.

Drinking water is **not** usually purified by distillation because distillation is expensive.

Complete the sentence.

Distillation is expensive because it requires a lot of

.....

(1)

(c) Why do some water companies add fluoride to drinking water?

.....
.....

(1)

(Total 5 marks)

2

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

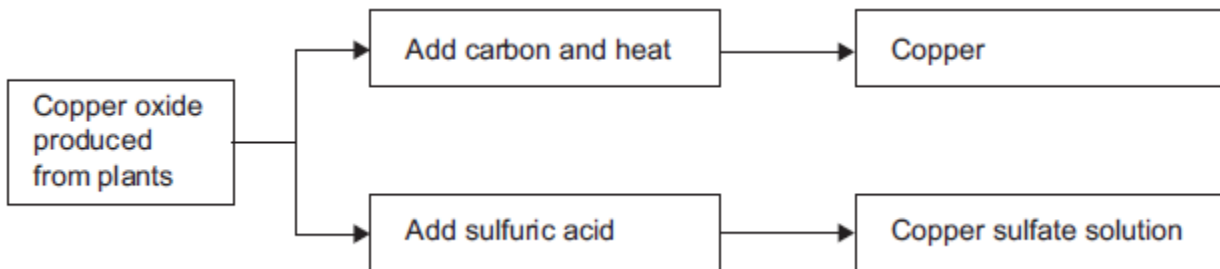
One way to extract the copper is to grow plants on the land.

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

(i) Copper ores contain enough copper to make extraction of the metal

carbon neutral.
economical.
reversible.

(1)

(ii) Using plants to extract metals is called

photosynthesis.
phytomining.
polymerisation.

(1)

(iii) Copper oxide reacts with carbon to produce copper and

carbon dioxide.
oxygen.
sulfur dioxide.

(1)

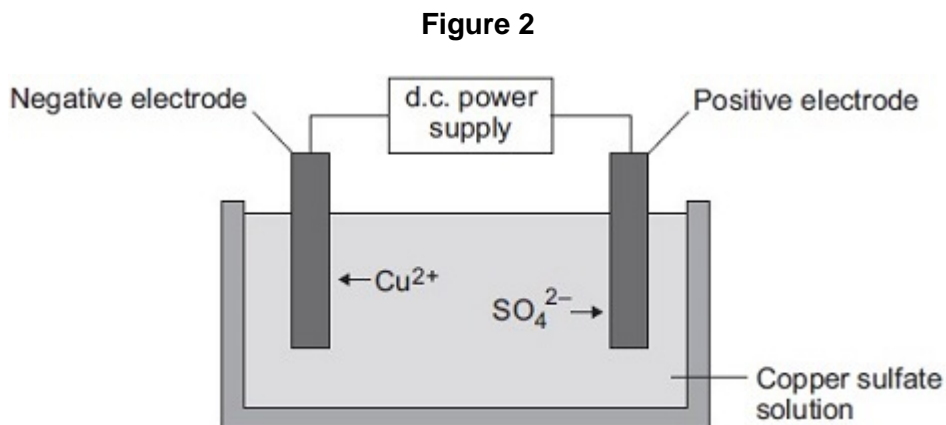
(b) Copper is produced from copper sulfate solution by displacement using iron or by electrolysis.

(i) Complete the word equation.



(2)

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



Why do copper ions go to the negative electrode?

.....
.....

(1)

(c) Suggest **two** reasons why copper should **not** be disposed of in landfill sites.

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

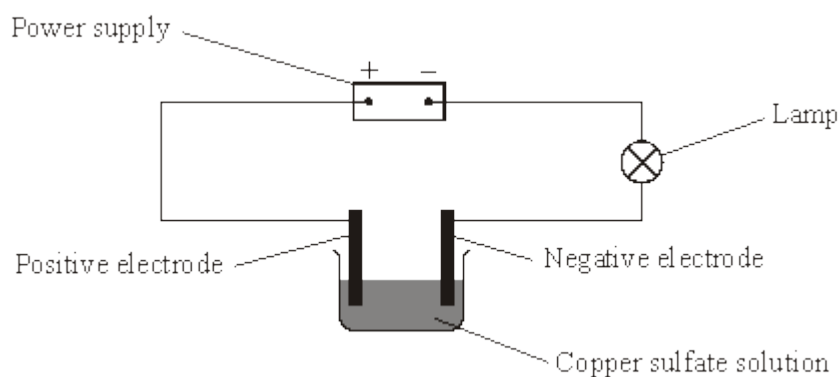
(2)
(Total 8 marks)

3

A student investigated the electrolysis of copper sulfate solution.
The student's method is shown below.

Two clean pieces of copper were weighed. One piece was used as the positive electrode and the other piece was used as the negative electrode.

The circuit was set up as shown in the diagram.



After the electrolysis, the pieces of copper were:

- washed with distilled water
- washed with propanone (a liquid with a lower boiling point than water)
- allowed to dry
- weighed.

(a) Explain why the electrode would dry faster when washed with propanone instead of water.

.....
.....

(1)

(b) The student's results are given in the table.

	Positive electrode	Negative electrode
mass of electrode before electrolysis, in grams	16.41	15.46
mass of electrode after electrolysis, in grams	16.10	15.75

The mass of the positive electrode decreased by 0.31 g.

(i) What is the change in mass of the negative electrode? g

(1)

(ii) The mass lost by the positive electrode should equal the mass gained by the negative electrode.

Suggest **two** reasons why the results were **not** as expected.

1

.....

2

.....

(2)

(c) Describe and explain how electrolysis is used to make pure copper from a lump of impure copper.

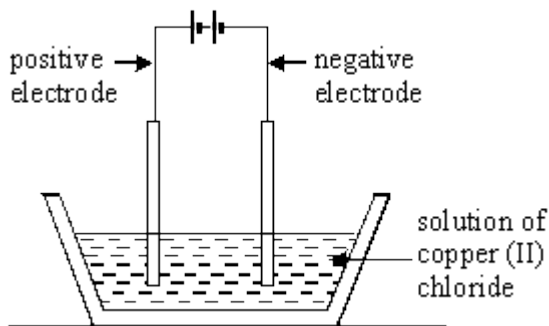
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(4)

(Total 8 marks)

4

Copper metal can be extracted from a solution of copper(II) chloride.



Copper chloride is an ionic compound.

State where the copper would collect and explain your answer fully.

.....

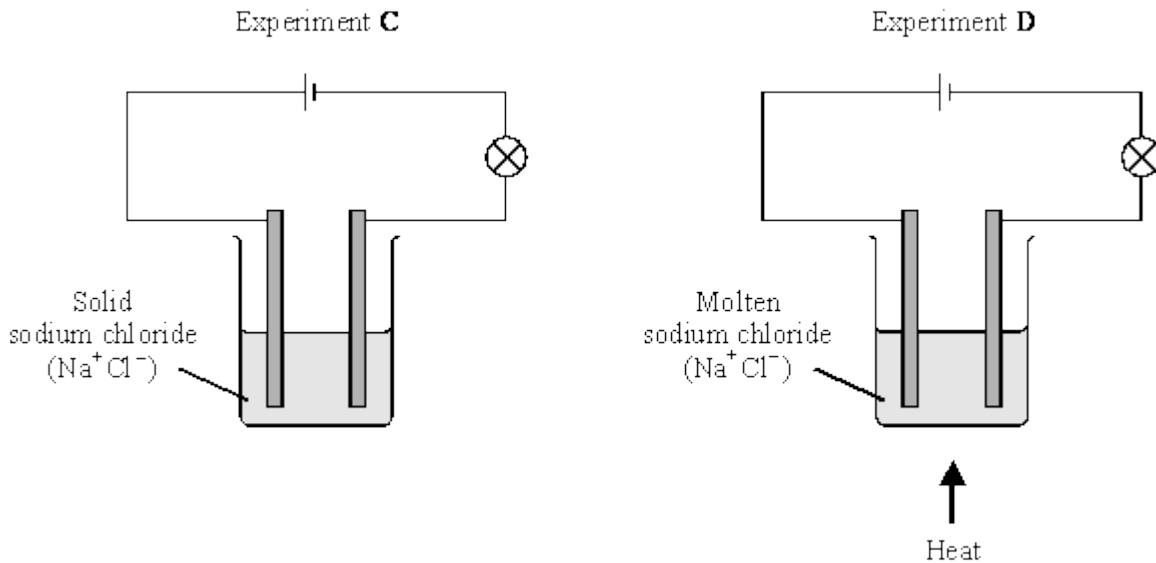
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.....

(Total 2 marks)

5

(a) Two experiments were set up as shown.



(i) Give **two** observations which would be seen only in Experiment D.

1

2

(2)

(ii) Explain why in Experiment C no changes would be seen.

.....

.....

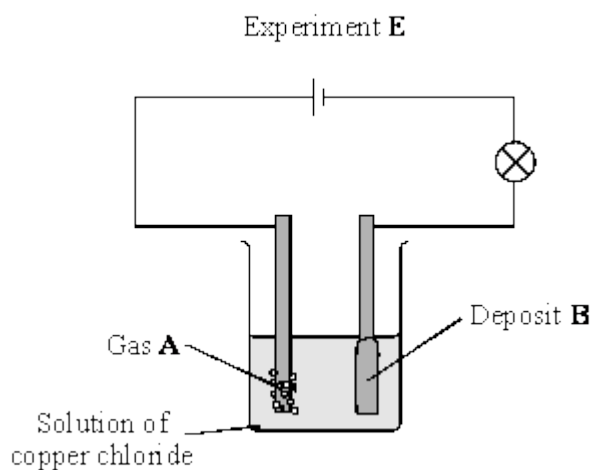
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.....

(2)

(b) Another *electrolysis* experiment used an aqueous solution of copper chloride.



(i) What does *electrolysis* mean?

.....

.....

.....

(2)

(ii) Name the gas **A** and the deposit **B**.

Gas **A**

Deposit **B**

(2)

(c) Give **one** industrial use of electrolysis.

.....

(1)

(Total 9 marks)

6

Metals are extracted from their ores.

Many copper ores contain only 2% of copper compounds.

(a) Copper is now extracted from ores containing a low percentage of copper compounds.

Suggest **two** reasons why.

.....

.....

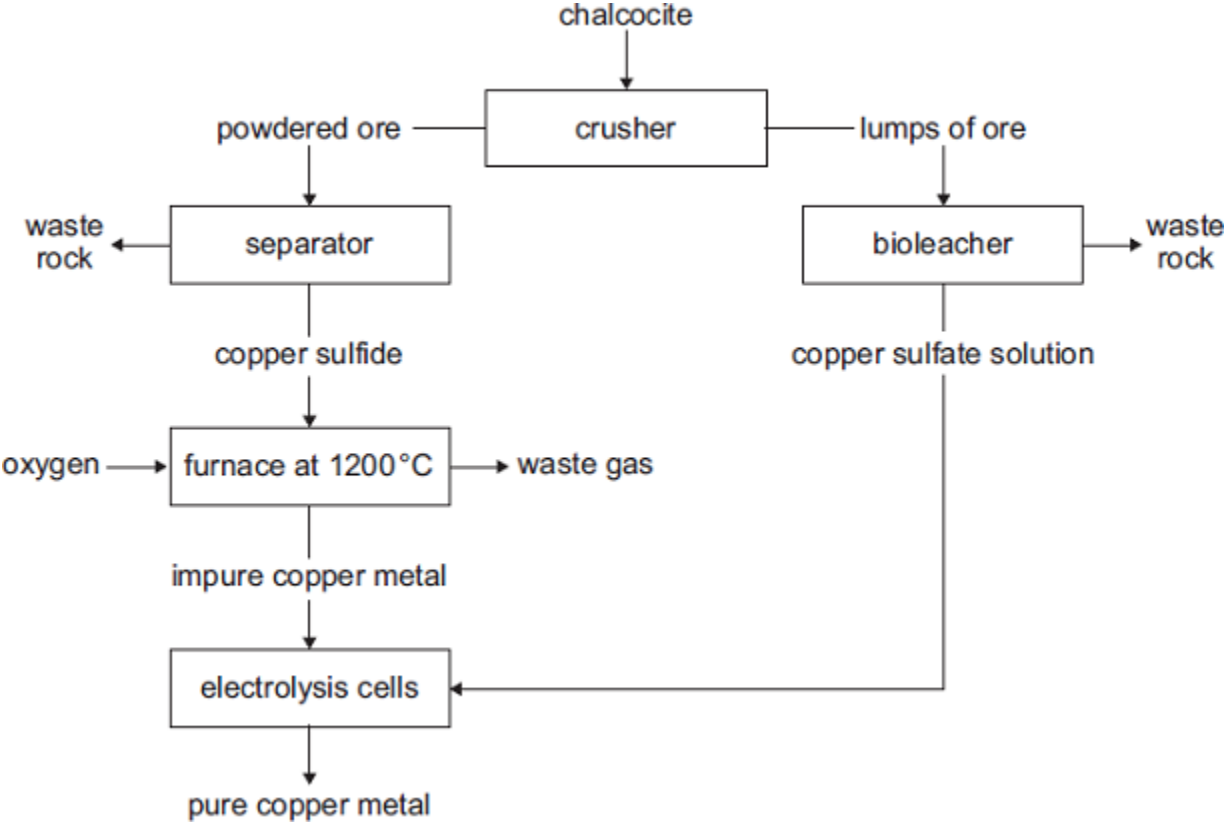
.....

.....

(2)

(b) Chalcocite, an ore of copper, contains copper sulfide.

The flow diagram shows how copper metal is extracted from chalcocite.



(i) Suggest **one** reason why it is difficult to dispose of the waste rock.

.....

.....

(1)

- (ii) The reaction in the furnace could cause environmental pollution.
Explain how.

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

(2)

- (iii) The extraction of pure copper is expensive.
Give **one** reason why.

.....
.....

(1)

- (iv) Pure copper is produced by electrolysis of copper sulfate solution.

Which electrode do the copper ions move towards?
Give a reason for your answer.

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

(2)

- (v) Large areas of land are contaminated with copper compounds.
Phytomining can be used to remove these copper compounds from the land.

What is used in phytomining to remove copper compounds from the land?

.....
.....

(1)

(Total 9 marks)

7

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

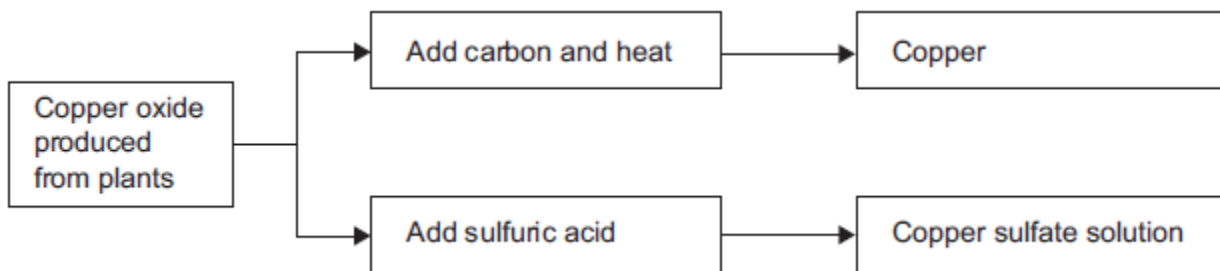
One way to extract the copper is to grow plants on the land.

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.



(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.

.....

.....

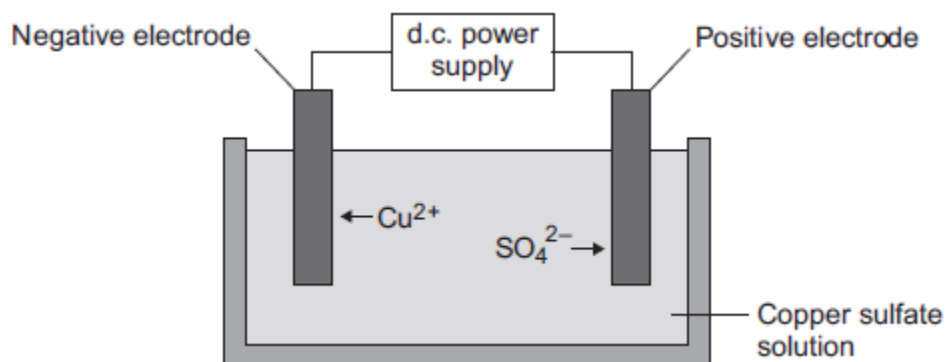
.....

.....

(2)

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

Figure 2



Describe what happens to the copper ions during electrolysis.

.....

.....

.....

.....

(2)

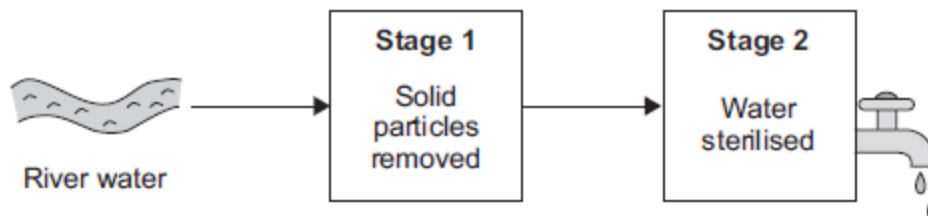
(Total 9 marks)

8

This question is about water.

River water needs to be treated before it is safe to drink.

(a) The diagram shows two stages of the treatment of river water.



(i) What is the name of the process used to remove solid particles in **Stage 1**?

Tick (✓) **one** box.

Crystallisation

Fermentation

Filtration

(1)

(ii) What is added in **Stage 2** to sterilise the water?

Tick (✓) **one** box.

Chlorine

Fluoride

Potassium

(1)

(b) Toxic substances in river water are removed by adding very small amounts of iron oxide nanoparticles.

(i) How is the size of nanoparticles different from normal-sized particles?

.....
.....

(1)

(ii) Nanoparticles are needed in only very small amounts.

Suggest why.

.....
.....

(1)

(c) In certain areas of the UK, tap water contains aluminium ions.

What would you **see** when sodium hydroxide solution is added drop by drop to tap water containing aluminium ions?

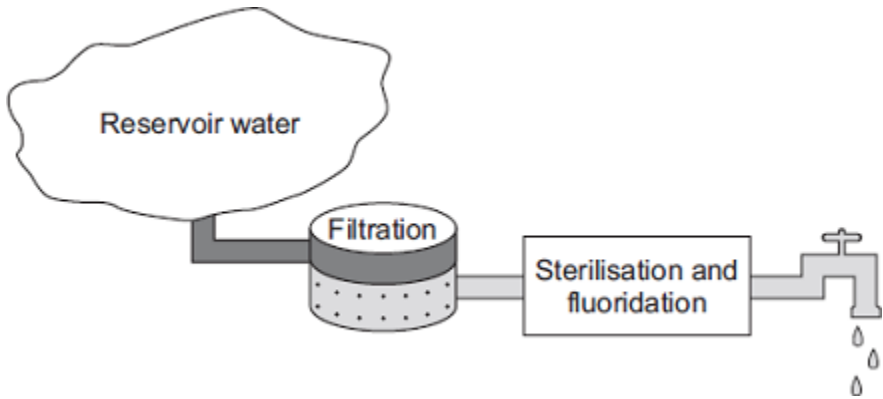
.....
.....
.....
.....

(2)

(Total 6 marks)

9

The diagram shows three stages in the treatment of reservoir water.



(a) (i) What is separated from the reservoir water during filtration?

Tick (✓) **one** box.

- Bacteria
- Dissolved nitrates
- Solids

(1)

(ii) What is added to sterilise the water?

Tick (✓) **one** box.

- Calcium
- Chlorine
- Magnesium

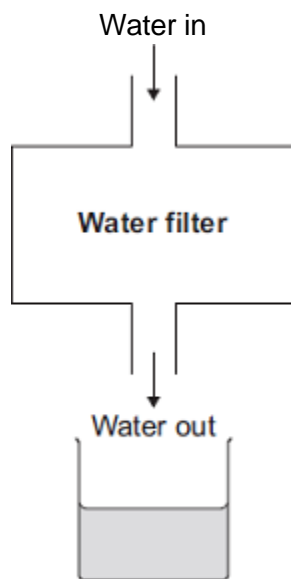
(1)

(iii) State **one** advantage of adding fluoride to drinking water.

.....
.....

(1)

(b) The diagram shows a water filter used in the home.



A student collected a sample of water from the filter.

The student could show that the filtered water contains dissolved salts without using a chemical test.

Describe how.

.....

.....

.....

.....

.....

.....

(2)

(c) Seawater contains dissolved sodium chloride.

(i) Describe a test that could be used to show the presence of sodium ions in seawater.

Test

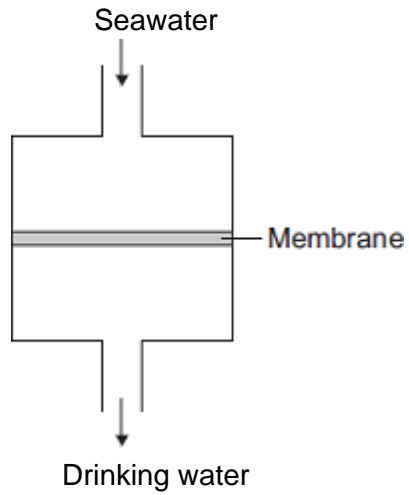
.....

Result with seawater

.....

(2)

- (ii) Seawater is forced through a membrane to make drinking water.



Suggest why water molecules can pass through the membrane, but sodium ions and chloride ions cannot.

.....
.....

(1)
(Total 8 marks)

Mark schemes

1	(a) (i)	Solids	1
	(ii)	Chlorine	1
	(iii)	kill microbes / bacteria	
		<i>allow to make the water safe to drink</i>	
		<i>ignore disinfect</i>	
		<i>ignore remove / get rid of microbes</i>	1
(b)	energy		
	<i>allow heat</i>	1	
(c)	improve dental health		
	<i>allow reduce tooth decay</i>		
	<i>allow (local) government requirement</i>		
	<i>allow help teeth</i>	1	
		[5]	
2	(a) (i)	economical	1
	(ii)	phytomining	1
	(iii)	carbon dioxide	1
	(b) (i)	copper / Cu	1
		iron sulfate / FeSO ₄	1
	(ii)	copper / ions have a positive charge	
	<i>it = copper ions</i>		
	<i>allow copper ions have a different charge</i>		
	<i>accept copper / ions are free to move</i>		
	<i>accept to gain electrons</i>		
	<i>accept copper / ions are attracted to the negative electrode or</i>		
	<i>opposite charges attract</i>	1	

(c) any **two** from:

ignore not biodegradable or does not decay

- copper ores are limited / running out
- copper can be recycled
- copper can be reused
- copper is expensive
- landfill sites are filling up
- copper compounds are toxic

allow copper is running out
allow copper is toxic

2

[8]

3

(a) (propanone) has a low(er) boiling point

or water has a high(er) boiling point or water evaporates slow(er)

or (propanone) evaporates fast(er) owtte

allow propane / solution / it

allow evaporates at lower temperature or boils quicker

ignore density / reactivity / melting point

1

(b) (i) 0.29

ignore + or -

ignore units

1

(ii) any **two** sensible suggestions eg:

- weighing error
accept human error or inaccurate measurements
- (copper) lost during washing owtte
allow different washing of electrodes
- (copper) lost during electrolysis / reaction owtte
- electrodes not completely dry
- impurities in the electrode
- copper falling off when removing electrode / copper from cell
ignore timing errors
ignore 'fair test'
ignore sludge
ignore gases produced

2

(c) any **four** from:

- impure copper is anode / positive (electrode)
- pure copper is cathode / negative (electrode)
- copper sulfate solution **or** any soluble copper salt in solution
- copper loses electrons **or** copper is oxidised(*)
- copper forms positive ions / particles(*)
()as alternative to these two points $Cu \rightarrow Cu^{2+} + 2e^- = 2$ marks*
- copper gains electrons **or** copper reduced at negative electrode
***or** $Cu^{2+} + 2e^- \rightarrow Cu$ at negative electrode*
- copper attracts to / collects at negative electrode
- sludge / impurities collect at the bottom of the tank
*allow sludge left behind **or** sludge left in solution **or** impurities separated from copper*
- impurities not attracted to electrode
ignore get rid of impurities

4

[8]

4

copper collects at the negative electrode
copper positive ions

each for 1 mark

[2]

5

(a) (i) bulb lights up

1

bubbles / fizz / gas or chlorine given off

1

(ii) in solid, ions

1

are not free to move / (charged) particles cannot move or converse
atoms / electrons cannot move worth 0 marks

1

- (b) (i) breakdown / decomposition / splitting up
not separation 1
- by using electricity 1
- (ii) gas **A** = chlorine / oxygen 1
- deposit **B** = copper 1
- (c) any one from:
- manufacturer of chlorine / sodium hydroxide / hydrogen / sodium
 - electroplating of steel / reference to plating
not galvanising
 - extraction of aluminium / metal reactivity series specified
 - purification of copper
not making copper
- 1

[9]

6

- (a) any **two** from:
- copper / ores are running out / harder to find
 - there are no / very small amounts of high-grade copper ores left
 - copper metal is in demand
 - copper is expensive
 - now economical to extract copper from low-grade ores
it = copper
allow new methods of extraction e.g. bioleaching and phytomining
allow high-grade ores are running out for 2 marks
- 2
- (b) (i) large amounts / 98% of rock to dispose of as waste
accept contains toxic (metal) compounds / bioleacher
- or**
- waste rock takes up a lot of space
- 1

- (ii) (copper sulfide reacts with oxygen to) produce sulfur dioxide / SO_2
allow (sulfur reacts with oxygen to) produce sulfur dioxide / SO_2

1

that causes acid rain

*allow description of effects of acid rain **or** sulfur dioxide*

*if no other mark awarded allow CO_2 produced which causes global warming **or** CO_2 produced by burning fuel or heating the furnace for 1 mark*

1

- (iii) any **one** from:

- large amounts of fuels / energy used (for the furnace and electrolysis)
allow large amounts of electricity needed
ignore high temperature / electrolysis unqualified
- (the extraction has) many steps / stages / processes
allow (extraction) is a long process / takes a lot of time
- large amounts of ore / material have to be mined
allow ores contain a low percentage of copper

1

- (iv) (copper ions move towards) the negative electrode / *cathode*

1

because copper ions / Cu^{2+} are positively charged **or** are oppositely charged **or** copper ions need to gain electrons

*allow because metal ions are positive **or** opposites attract*

1

- (v) (growing) plants

1

[9]

7

- (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



allow 2 CuO + C → Cu₂ + CO₂ 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]

8

- (a) (i) Filtration

1

- (ii) Chlorine

1

- (b) (i) nanoparticles are small / smaller / much smaller / tiny

allow any in range 1–100 nm or $1 \times 10^{-9} \text{ m} - 1 \times 10^{-7} \text{ m}$ or a few hundred atoms in size

ignore numbers if stated smaller

1

- (ii) they have a high surface area to volume ratio

reference to surface area without volume ratio is insufficient

allow nanoparticles are very reactive or nanoparticles are more reactive than normal particles.

1

- (c) (sodium hydroxide) produces a white precipitate

accept solid / suspension or ppt or ppte for precipitate.

ignore cloudy / milky

1

which (then) dissolves / disappears (in excess sodium hydroxide)

M2 cannot be awarded unless a solid of some sort has been made

ignore names or formulae of compounds

1

[6]

9

- (a) (i) Solids

1

- (ii) Chlorine

1

- (iii) improves dental health **or** reduces tooth decay 1
- (b) put a sample of the filtered water in an evaporating basin **or** leave to evaporate
accept any description of evaporation (using a Bunsen or leaving on the windowsill) 1
- there will be crystals of salt left 1
- (c) (i) **Test** – flame test 1
- Result** – yellow / orange / persistent orange flame 1
- (ii) sodium and / or chloride ions are bigger than water (molecules) **or** ions are charged **or** molecules are not charged
*do **not** accept sodium chloride molecules as ions is given in the question* 1

[8]