Mark schemes

(a) (i) reduction

*accept redox / smelting*

1

(ii) 3 4 3

1

(b) (i) 55

*ignore other units*

(ii) Water

*accept sodium hydroxide*

*accept correct formulae H₂O or NaOH*

1

(iii) any one from:

• save energy / fuel for transporting the ore

*accept less (cost of) transport allow transported quickly*

• (old) quarries nearby for waste/red mud

1

(c) Environmental

any one from:

• less mining / quarrying (of bauxite)

*allow loss of habitat / less qualified noise pollution*

• less landfill space needed / used

*allow less red mud / waste*

• less use of fossil fuels / energy

• less carbon dioxide produced

1
Ethical or social

any one from:

- saves resources
  
  *allow using resources more than once*

- creates (local) employment
  
  *if answers reversed and both correct award 1 mark*

- more people aware of the need for recycling
  
  *allow less qualified noise pollution if not given in environmental*

2

(a) Desalination

Sterilising

(b) Chloride ion

(c) correct bar for NO₃⁻

(d) D

(e) any two from:

- people have the right to choose (opinion)
- ethical / moral question
- cannot be tested by experiment

(f) \( \frac{1.5}{4.0} \times 100 \)

(g) the percentage tooth decay increases with age

  by 4 % for each increasing age group

(h) reduces tooth decay (for all age groups)

  greater reduction in older people

[12]
(a) (i) Solids

(ii) Chlorine

(iii) kill microbes / bacteria

*allow to make the water safe to drink*

*ignore disinfect*

*ignore remove / get rid of microbes*

(b) energy

*allow heat*

(c) improve dental health

*allow reduce tooth decay*

*allow (local) government requirement*

*allow help teeth*

(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*

(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
(ii) (copper sulfide reacts with oxygen to) produce sulfur dioxide / SO₂

... that causes acid rain

allow description of effects of acid rain or sulfur dioxide

if no other mark awarded allow CO₂ produced which causes global warming or CO₂ produced by burning fuel or heating the furnace for 1 mark 

(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

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

because copper ions / Cu²⁺ are positively charged or are oppositely charged or copper ions need to gain electrons

allow because metal ions are positive or opposites attract

(v) (growing) plants

[9]
(a) filter
to remove solids or insoluble particles

**OR**

*add coagulant (1)*

flocculation / settling / remove solids (1)

(add) chlorine

  *accept ozone / UV*

(to reduce the number of microbes

  *accept to kill microbes / bacteria / germs*

  *accept sterilise*

  *allow disinfect*

  ignore remove microbes

(b) (i) ion exchange resin

  *allow ion exchange column*

  *allow sodium ions / Na\(^+\)*

  *allow hydrogen ions / H\(^+\)*

(ii) prevent growth of microbes

  *accept sterilise*

  *accept to kill microbes / bacteria / germs*

  *accept to reduce the number of microbes*

  ignore remove microbes

(c) high cost of energy / heating

  *allow uses a lot of energy*

(d) any one from:

  - helps to develop / maintain bones
    *allow any suitable positive effect on bones*
  - helps to develop / maintain teeth
    *allow any suitable positive effect on teeth*
  - reduces heart disease
(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
(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

(c) grow plants
   accept plants absorb copper (through roots)

then plants are burned

ash (from burning) contains copper compounds
(a) because it is a good conductor of electricity.

(b) (i) 2.1 (%) 

(ii) correct bar for calcium at 3.6 %

  *allow error of +/- 0.05%

correct bar for iron at 5.0 %

  *allow error of +/- 0.05%

(c) (i) decomposition

(ii) carbon dioxide

(iii) carbon = 1

  *allow one

oxygen = 3

  *allow three

(iv) 44 (g)

  *allow forty four

(d) (i) to make alloys for specific uses.

(ii) any three from:

* to conserve resources of iron or iron ore
  *allow steel instead of iron or iron ore
  *allow limited resource or non-renewable

* to avoid the need for quarrying/mining

* to conserve energy resources or fossil fuels

* to limit the amount of carbon dioxide produced or to reduce global warming

* to reduce the amount of landfill

  *“it” = steel

  *ignore cost and reuse and time and waste