

M1.(a) The forces between iodine molecules are stronger 1

(b) anything in range +30 to +120 1

(c) Brown 1

(d) $2 \text{I}^- + \text{Cl}_2 \rightarrow \text{I}_2 + 2 \text{Cl}^-$ 1

(e) It contains ions which can move 1

(f) hydrogen iodine 1

[6]

- M2.(a)** giant structure / lattice / layers / close packed
first 3 marks can be obtained from a suitably labelled diagram
incorrect structure or bonding or particle = max 3 1
- made up of atoms / positive ions 1
- with delocalized / free electrons 1
- so electrons can move / flow through the metal
accept so electrons can carry charge through the metal
accept so electrons can form a current 1
- (b) an alloy (is a metal which) has different types / sizes of atoms
accept converse for pure metal throughout
both marks can be obtained from suitable diagrams
allow made of different metals
allow mixture of metals / atoms / elements
ignore particles
ignore properties
*do **not** accept compound* 1
- alloy has distorted layers
allow layers are unable to slide 1
- (c) (i) can return to its original shape
accept shape memory alloy
accept smart alloy
ignore other properties 1
- (ii) (pure copper is too) soft
accept converse
accept malleable or bends
accept copper is running out
ignore references to strength and weakness 1

(iii) aluminium oxide

accept alumina

accept Al_2O_3

ignore bauxite / aluminium ore

1

(iv) any **one** from:

- different conditions

- different catalyst

- different pressure

allow different concentration

- different temperature.

*do **not** accept different monomers*

1

(d) any **two** from:

- accurate

- sensitive

- rapid

- small sample.

both needed for 1 mark

1

[11]

- M3.(a) (i) points correctly plotted ($\pm \frac{1}{2}$ small square)
four points = 2 marks
three points = 1 mark

Max 2

straight line of best fit using full range of points from 0,0

1

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

must explain why the point is below the line

- the solution may not have been properly stirred
- the electrodes may have been a larger distance apart
- the drop of sodium chloride may have been a smaller volume / smaller

allow not enough sodium chloride added

allow smaller amount of sodium chloride

*do **not** allow too few drops added*

ignore the student may have misread the conductivity meter

1

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

- the volume of pure water
allow amount
- the concentration (of the solutions added)
- the volume (of the drops) of solution added
ignore number of drops
- the distance between the electrodes
- the same electrodes **or** electrodes made of the same material
- same depth **or** surface area of electrodes in the water
- constant power supply
ignore current
- stirred

1

- (b) (i) because (pure) water is covalent / molecular (simple) **or** contains molecules

1

therefore (pure) water has no free / mobile electrons **or** ions
molecules do not have a charge or molecules do not contain ions
gains 2 marks

1

(ii) because there are ions in sodium chloride
allow Na⁺ and / or Cl⁻(ions) or ionic bonding.
Ignore particles other than ions for MP1.

1

which can move **or** carry the current / charge
MP2 must be linked to ions only.

1

(iii) Hydrogen
allow H₂ / H

1

[10]

M4.(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

orwaste 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]

M5. (a) any **one** from:

- they are negative / anions
allow Cl⁻
ignore atoms / chlorine
*do **not** accept chloride ions are negative electrodes*
- they are attracted
- they are oppositely charged

1

(b) hydrogen is less reactive than sodium

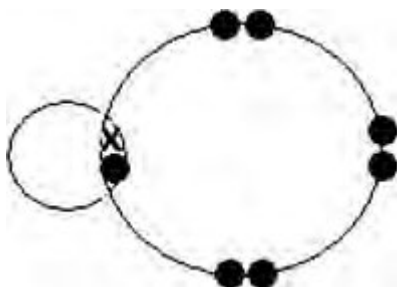
1

(c) hydroxide (ions) / OH⁻

ignore OH

*do **not** accept NaOH / sodium hydroxide*

1



(d) (i)

allow any combination of dots or crosses
ignore chemical symbols

1

(ii) covalent

allow close spelling errors
apply list principle

1

(iii) hydrogen (ion) / H⁺

ignore (aq) / H

do not accept hydrochloric acid / HCl

apply list principle

1

[6]

- M6.** (a) (i) low percentage / very little of metal (in the ore)
*accept only 0.5% metal in the ore **or** over 99% waste in the ore **or** nearly 100% waste in the ore*
*ignore reference to percentage of metal in the Earth's crust **or** energy used or pollution*

1

- (ii) any **one** from

(it = iron)

- iron uses less energy / fuel for extraction
ignore electrolysis / uses electricity / reactivity
- iron has more uses
- more demand for iron
ignore high abundance in the Earth's crust / high percentage of metal in ore
- iron is stronger
ignore harder
- cheaper / costs less
- easier to extract

1

- (b) (i) has melting point lower than 950°C
(it = aluminium)
allow has a low melting point
ignore boiling point

1

- (ii) electrode(s) made of carbon

1

oxygen reacts with electrode(s) / carbon
accept $C + O_2 \rightarrow CO_2$

NB oxygen reacts with the carbon electrode(s) = 2 marks

1

*(iii) any **two** from:*

- saves resources / non-renewable
accept aluminium / ore will run out **or** conserves aluminium*
- landfill problem
accept aluminium does not corrode*
- saves energy / fuel / electricity
ignore global warming*
- less carbon dioxide / carbon emissions **or** reduces carbon footprint
ignore consequences of quarrying / mining*
- less quarrying / mining
ignore pollution / harms environment / costs / easy to recycle*

2

[7]

M7. (a) the ions can move / travel / flow / are free
accept particles / they for ions
allow delocalised ions

or

ignore delocalised / free electrons
ignore references to collisions
accept converse with reference to solid

the ions carry the charge / current
ignore ions carry electricity

1

(b) any **one** from:

- because they are negative / anion
allow Cl^-
ignore chlorine
- opposite charges / attract

1

(c) 13

1

(d) (i) reasonable attempt at straight line which misses the anomalous point
must touch all five crosses
do **not** allow multiple lines

1

(ii) 40

ignore 2.2

1

(iii) any **two** sensible errors from:

ignore systematic / human / apparatus / zero / experimental /

random / measurement / reading errors unless qualified

- *gas escapes*
- *weighing error*
allow NaCl not measured correctly
- *error in measuring (volume / amount) of hydrogen*
- *error in measuring (volume / amount) of water*
allow error in measuring volume / scale for 1 mark if neither hydrogen or water mentioned
- *incorrect concentration*
allow NaCl not fully dissolved or spilled or impure
- *timing error*
- *change in voltage / current*
allow faulty power supply
- *change in temperature*
- *recording / plotting error*

2

(iv) any **one** from:

ignore 'do more tests'

- *repeat the experiment*
- *results compared with results from /other students / other groups / other laboratories / internet / literature.*
- *results compared with another method*

1

(v) *increases owtte*

allow directly proportional or positive correlation

allow rate / it is faster / quicker

1

[9]