

MARK SCHEME

GCSE

CHEMISTRY

AQA - TRIPLE SCIENCE

C4 - TEST 3

CHEMICAL CHANGES

Intermediate

Mark schemes

1.

(a) (i) copper is less reactive than hydrogen **or** copper is unreactive

1

(ii) Zinc and dilute hydrochloric acid

1

(b) (gas) syringe

1

(c) (i) 35

allow 3

1

because not close to others

accept it is much lower than the others

ignore references to trends or patterns

dependent on the first mark

1

(ii) $(49 + 50 + 48) / 3$

= 49

correct answer with or without working gains 2 marks

1

allow ecf from anomaly identified in (i) for 2 marks:

- *Exp 1 anomalous gives 43.3*
- *Exp. 2 anomalous gives 44*
- *Exp. 4 anomalous gives 44.7*

answer of 45.5 or 46 (anomaly not excluded) gains 1 mark

*correct working **excluding anomaly** but with wrong answer gains 1 mark*

1

(iii) so that a mean can be calculated

*accept improves accuracy of the mean **or** so anomalies can be identified / discarded **or** to reduce effect of random errors*

ignore makes it a fair test

ignore reliability, validity, repeatability, reproducibility

1

(d) (i) idea of mixing with oxygen / air, letting air / oxygen in

accept converse

1

(ii) H₂O

do not accept incorrect additional products

1

balancing 2 ... (1) ... 4
allow fractions or multiples
dependent on first mark

1

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2.

- (a) (i) electron(s)
allow free / delocalised / negative electrons
do not accept additional particles 1
- (ii) ion(s)
allow named ions from table
ignore positive or negative
do not accept additional particles 1
- (b) (i) copper
accept Cu
do not accept Cu²⁺ 1
- (ii) it is / they are positive (ions)
accept formula of positive ion 1
- and it is the least reactive 1
- (c) (i) loss of electron(s)
ignore numbers 1
- (ii) $2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2$
accept correct multiples / fractions
accept e / e⁻
allow $2\text{H}^+ \rightarrow \text{H}_2 - 2\text{e}^-$ 1

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3.

- (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

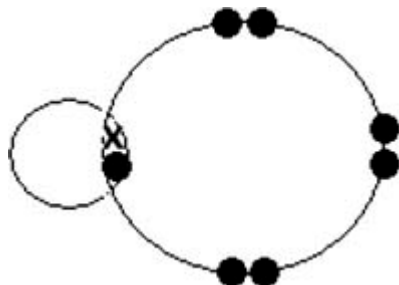
(c) hydroxide (ions) / OH^-

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]

4.

(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 / SO₂
allow (sulfur reacts with oxygen to) produce sulfur dioxide / SO₂ 1
- 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 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 / Cu²⁺ 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

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5.

- (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

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6.	<p>(a) fill burette with sodium hydroxide</p> <p>add sodium hydroxide from the burette to the hydrochloric acid and indicator</p> <p>stop when colour changes</p> <p>measure volume used from burette</p> <p>plus any two from:</p> <ul style="list-style-type: none"> • stand flask on white tile • swirl • add dropwise near the endpoint • repeat <p>(b) filtration</p> <p>(c) evaporate some of the solution and leave to cool</p> <p style="padding-left: 40px;">or</p> <p style="padding-left: 40px;"><i>heat with an electric heater</i></p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>2</p> <p>1</p> <p>1</p> <p>[8]</p>
7.	<p>(a) (i) low percentage / very little of metal (in the ore)</p> <p style="padding-left: 40px;"><i>accept <u>only</u> 0.5% metal in the ore or over 99% waste in the ore or nearly 100% waste in the ore</i></p> <p style="padding-left: 40px;"><i>ignore reference to percentage of metal in the Earth's crust or energy used or pollution</i></p> <p>(ii) any one from</p> <p style="padding-left: 40px;"><i>(it = iron)</i></p> <ul style="list-style-type: none"> • iron uses less energy / fuel for extraction <li style="padding-left: 40px;"><i>ignore electrolysis / uses electricity / reactivity</i> • iron has more uses • more demand for iron <li style="padding-left: 40px;"><i>ignore high abundance in the Earth's crust / high percentage of metal in ore</i> • iron is stronger <li style="padding-left: 40px;"><i>ignore harder</i> • cheaper / costs less • easier to extract 	<p>1</p> <p>1</p>

(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

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8.

(a) any **one** from:

- no method / electrolysis / equipment / technology
allow 'didn't know how to' **or** 'no knowledge'
- aluminium is a very reactive metal
- high melting point
allow 'couldn't heat it enough'
- potassium had not been discovered

1

(b) because others / scientists / they could not repeat the experiment
ignore he could not repeat the experiment

or

others / they could not obtain the same results

1

- (c) reaction is endothermic **or**
 reaction takes in heat / energy
accept activation energy
ignore rate / high temperature
ignore bonds broken 1
- (d) (aluminium chloride + potassium) → aluminium + potassium chloride
in either order
accept correct formulae
ignore metal
ignore balancing 1
- (e) when tested it had the properties of a metal
accept a test for a metal property eg conductivity / reaction with acid 1
- properties were different (from other known metals)
accept properties compared with other metals 1

[6]

9.

- (a) *ignore any attempts to change the charge on chloride ion*
- 2.8.2 (drawn as dots or crosses on the circles)
accept e instead of dots or crosses 1
- 2.8.8 (drawn as dots or crosses on the circles) 1
- (b) (i) filtration
accept decanting or centrifugation
*do **not** accept evaporation* 1
- (ii) hydrochloric
accept HCl 1
- (c) (i) so that ions / particles can move (in electrolyte)
allow so it can conduct electricity / carry charge / carry current
ignore reference to electrons moving in the external circuit
any unqualified reference to electrons moving / carrying charge / carrying current = 0 marks 1
- (ii) electrons are lost
ignore numbers 1

- (iii) + 2e⁻ on left hand side of equation
must be correct with no other additions
accept correct multiples

1

[7]

10.

- (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

1

[7]