MARK SCHEME

GCSE

CHEMISTRY

AQA - TRIPLE SCIENCE

C4 - TEST 4

CHEMICAL CHANGES

Intermediate

1.

(a) (i) contains enough metal to <u>make it economical</u> to extract

1

(ii) Fe (+) CO_2

formula of both products must be correct

1

(Fe_2O_3) (+) ....3....(CO)

→

.....2.....(Fe) (+) .....3...(CO_2)

balancing correct

allow correct balancing using Fe_2

1

(iii) reduction

accept redox

1

(b) (i) oxygen <u>reacts</u> with the carbon to produce carbon dioxide

allow carbon monoxide for carbon dioxide

1

OR

carbon dioxide is produced (1)

which escapes as a gas (1)

1

(ii) to give steels with <u>different</u> / particular properties or for <u>different</u> / <u>particular</u> uses

ignore to make different alloys

1

(c) copper is very expensive

accept the metal (iron / steel) costs less than copper

ignore energy

1

because copper ores are 'low grade' / running out

allow copper is rare

ignore nickel

1

[9]

2.

Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also apply a 'best-fit' approach to the marking.

Level 3 (5 – 6 marks)
There is a description of titrations that would allow a comparison to be made between the two solutions of hydrochloric acid.

Level 2 (3 – 4 marks)
There is a description of an experimental method including addition of acid to alkali which may include an indicator or colour change and may include a measurement of volume.

Level 1 (1 – 2 marks)
There is a simple description of using some of the apparatus.

0 marks
No relevant content.

examples of chemistry points made in the response could include:

- acid in burette **or** flask
- alkali/sodium hydroxide **or** acid in burette **or** flask
- volume of acid **or** alkali measured using the pipette
- indicator in flask
- white tile under the flask
- slow addition
- swirling/mixing
- colour change of indicator
- burette volume measured

[6]

3. (a) (i) aluminium oxide

ignore (III) after aluminium

1

(ii) (because it provides) heat / energy (to overcome activation energy)

1

(b) (i) contains only one sort of atom

1

(ii) the atoms (in cast iron) are different sizes

*any mention of molecules, maximum **1** mark*

*accept layers are distorted **or** structure is disrupted*

1

which prevents the layers / rows sliding

accept an answer in terms of pure iron being softer than cast iron for both marks

1

(c) (i) because aluminium is more reactive than carbon

'it' = aluminium must be a comparison between the elements

or

because aluminium is above carbon in the reactivity series

*do **not** accept any comparison of the reactivity of aluminium and iron*

1

(ii) reduces / lowers the temperature for the process **or** lowers the operating temperature **or** allows ions to move

ignore any temperature values

allow reduces the (effective) melting point (of Al_2O_3)

1

(iii) 3

accept multiples

1

(iv) electrons are gained (by Al^{3+})

ignore any numbers

ignore any reference to oxygen

1

(v) electrodes are made of carbon

allow graphite / coke

1

oxygen is produced (at the positive electrode / anode)

accept $2O^{2-} \rightarrow O_2 + 4e^-$

1

so the electrodes react with the oxygen / are oxidised

1

producing carbon dioxide (gas)

accept $C + O_2 \rightarrow CO_2$ for marking points 3 and 4.

1

[13]

4. (a) (i) 2.8.3

any sensible symbol can be used to represent an electron

1

(ii) proton(s) **and** neutron(s)

both needed for the mark

1

(iii) number of protons is equal to number of electrons

allow positive and negative charges cancel out

allow same amount of protons and electrons

1

(b) (i) **2** Al + Fe_2O_3 → **2** Fe + Al_2O_3

equation must be balanced

1

(ii) aluminium is more reactive (than iron)

it = aluminium

accept converse

accept aluminium displaces iron

accept aluminium is higher in the reactivity series (than iron)

1

[5]

5. (a) hydroxide (ion) / OH^- / OH^-(aq)

ignore OH

1

(b) fully / all / completely ionised / dissociated

*ignore strongly ionised **or** more ions **or** concentration*

ignore all 'noise'

*do **not** accept <u>ions</u> are fully ionised / dissociated*

1

(c) *assume it = sodium hydroxide*

any valid test

*incorrect test / titration = **0** marks for question*

1

linked comparison

*correct result / reference to pH with no test = **1** mark*

eg UI **or** full range indicator **or** pH

paper / solution / (pH) meter (1)

NaOH has higher pH **or**

allow converse for weak(er)

pH values must be above 7

correct comparison of colours (1)

NaOH – purple, Ammonia – blue

allow correct comparison of blue or purple

or

conductivity test (1)

NaOH conducts better / more **or** bulb brighter (1)

1

[4]

6. (a) (i) C

must be correct symbol

*do **not** accept carbon*

any balancing must be correct

1

(ii) $Fe + CO_2$

correct formulae

1

2... . + 3... .

correct balancing

allow $Fe_2 + 3CO_2$ for this mark

1

(iii) layers / atoms in pure iron are able to slide over each other

it = pure iron

accept ions for atoms

ignore molecules / particles

or

layers / atoms in cast iron are unable to slide over each other (easily)

1

(b) any **three** from:

*mention of ozone = max **2***

- less iron ore used

  accept the idea that ores would be conserved but not unspecified conservation

- less other metals extracted / used to make different steels

  accept the idea that ores would be conserved but not unspecified conservation

- less fuel used

  accept the idea that fuels would be conserved

  ignore reduces energy requirements

- less specified pollution

  accept global warming / greenhouse effect / CO_2 / CO / carbon emissions / acid rain / SO_2 / global dimming /

  *do **not** accept ozone layer*

- less / no landfill space needed

  ignore reduces waste

- less / no mining needed **or** fewer specified effects of mining

  accept effect such as eyesore / loss of habitat

  *eg 'less mining iron ore' = **2** marks*

3

[7]

7. (a) positive

*accept + **or** +ve **or** plus*

1

(b) chlorine

1

(c) (i) hydroxide

Any indication of hydro…

1

(ii) destroys / damages / dissolves (owtte) the hair / follicle / root

allow burns / reacts with the hair

ignore incorrect name of compound

1

[4]

8. (a) (i) sulfuric

accept H_2SO_4

accept sulphuric

allow phonetic spellings

1

(ii) $CuO + H_2SO_4 \rightarrow CuSO_4 + H_2O$

***1** mark for reactants*

***1** mark for products*

ignore state symbols

*max **1** mark for incorrect balancing*

2

(b) any **two** from:

- particles gain energy **or** particles have more energy

  allow have more activation energy

- particles move faster

  allow they collide faster / quicker

  ignore move / vibrate more

- collide more often

  allow more collisions

- collide more energetically

- more of the collisions are successful
  or more particles have the activation energy

  ***NB** more successful collisions alone = **1** mark*

  *if particles are identified as electrons = max **1** mark*

2

[5]

9. (a) (i) $Cu_2S + 2O_2$ ® $2CuO + SO_2$

accept fractions and multiple

1

(ii) any **two** from:

- sulfur dioxide

  accept sulphur dioxide / sulphur oxide / SO_2

- causes acid rain

  ignore other comments eg global warming / ozone / global dimming / greenhouse effect

- consequence of acid rain eg kills fish / plants

2

(b) any **two** from:

- heat (copper oxide with carbon)
- oxygen is removed by carbon

  accept copper (oxide) loses oxygen

  or

  carbon gains oxygen

  accept carbon oxide

  or

  carbon monoxide / carbon dioxide is produced

  or

  carbon displaces copper

  accept a correct word or balanced symbol equation
- because carbon is more reactive than copper

  allow a correct comparison of reactivity

2

(c) (i) electrolysis

accept electroplating

1

(ii) (electrical) wiring / appliances / coins / pipes / cladding for buildings / jewellery / making alloys

1

or

named alloys

(d) any **three** explanations from:

<u>for recycling</u>

- less acid rain (pollution)
- copper reserves last longer / conserved

  or

  do not run out
- energy for extraction (saved)

  or

  less energy required
- less mining / quarrying
- less waste (copper) / electrical appliances dumped

  or

  less landfill

<u>against recycling</u>

- collection problems
- transport problems
- difficult to separate copper from appliances
- energy used to melt the collected copper

  ignore electrolysis / pollution
  ignore ideas about less machinery / plant
  ignore idea of cost

3

[10]

10. (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]

11. (i) electrolysis

1

(ii) oxidation

1

(iii) hydroxide ions **or** OH^-

accept sodium hydroxide ***or*** *hydroxide* ***or*** *OH for one mark only*

2

(iv) $H^+ + e^-$

1

H_2

ignore any state symbols

1

$2H^+ + 2e^- \rightarrow H_2$

accept $H^+ + e^- \rightarrow H$ *for* ***one*** *mark only*

1

[7]