

# MARK SCHEME

# GCSE

## CHEMISTRY

## AQA - TRIPLE SCIENCE

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C4 - TEST 5

CHEMICAL CHANGES

Advanced

## Mark schemes

- 1.** (a) (2) : (6) : (2)  
*All 3 correct gains 2 marks*  
*2 correct gains 1 mark* 2
- (b) no water present/moist air cannot enter/do not thoroughly mix/  
must be in solution etc.  
*for 1 mark* 1
- (c) (i) hydroxide (ion) / OH<sup>-</sup>  
*for 1 mark* 1
- (ii) hydrogen (ion) / H<sup>+</sup>  
*for 1 mark* 1
- (iii) water/H<sub>2</sub>O/hydrogen oxide  
*for 1 mark* 1
- [6]**
- 2.** (a) (i) hydrogen/H<sub>2</sub>  
*for 1 mark* 1
- (ii) i.e.  $2\text{Cl}^- - 2\text{e}^- \rightarrow \text{Cl}_2$   
*for 1 mark* 1
- (iii) hydroxide or OH<sup>-</sup>  
*for 1 mark* 1
- (iv) sodium hydroxide/caustic soda/NaOH/bleach/  
chemical name of bleach  
*for 1 mark* 1
- (b) (i) Na<sub>2</sub>CO<sub>3</sub> or (Na<sup>+</sup>)<sub>2</sub> CO<sub>3</sub><sup>2-</sup>  
*for 1 mark* 1
- (ii) coal  
water/H<sub>2</sub>O  
limestone/CaCO<sub>3</sub>/calcium carbonate  
*any one for 1 mark* 1

(iii) calcium chloride/ $\text{CaCl}_2$ /sodium hydrogen carbonate/ $\text{NaHCO}_3$

*for 1 mark*

1

(iv) decomposition/heating of limestone  
decomposition/heating of coal  
decomposition/heating of sodium hydrogen carbonate

*any 1 for 1 mark*

1

described change e.g.  $\text{NaHCO}_3 \rightarrow \text{Na}_2\text{CO}_3$

(Use judgement)

breakdown (owtte.)

by heat

*for 1 mark each*

2

(v) carbon dioxide/ $\text{CO}_2$  or ammonia/ $\text{NH}_3$

*for 1 mark*

1

(c) (i) zinc carbonate/ $\text{ZnCO}_3$ /zinc hydroxide/ $\text{Zn(OH)}_2$

*for 1 mark*

1

(ii) It is insoluble  
zinc carbonate is insoluble in water

*for 1 mark*

1

**[13]**

**3.**

(a) (zinc has) lost electron(s)

*accept loss of electrons*

1

(b) copper is the least reactive

1

because it gave the most negative voltage when it was metal 2

**or**

it gave the biggest voltage with chromium

**or**

it gave the most positive voltage when it was metal 1

1

(c)  $-0.7\text{ V}$

1

The voltage with chromium and copper is 1.2

*accept use of other cell pairings such as tin with copper and tin with iron*

1

The voltage with chromium and iron is 0.5 and copper is less reactive (than iron)

1

(d) hydrogen + oxygen = water

1

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

1

$O_2 + 4H^+ + 4e^- \rightarrow 2H_2O$

1

[9]

4.

(a) (sulfuric acid is) completely / fully ionised

1

In aqueous solution **or** when dissolved in water

1

(b)  $H^+(aq) + OH^-(aq) \rightarrow H_2O(l)$

*allow multiples*

*1 mark for equation*

*1 mark for state symbols*

2

(c) adds indicator, eg phenolphthalein / methyl orange / litmus added to the sodium hydroxide (in the conical flask)

*do not accept universal indicator*

1

(adds the acid from a) burette

1

with swirling **or** dropwise towards the end point **or** until the indicator just changes colour

1

until the indicator changes from pink to colourless (for phenolphthalein) or yellow to red (for methyl orange) or blue to red (for litmus)

1

(d) titrations 3, 4 and 5

**or**

$$\frac{27.05 + 27.15 + 27.15}{3}$$

1

27.12 cm<sup>3</sup>

*accept 27.12 with no working shown for 2 marks*

1

allow 27.1166 with no working shown for 2 marks

(e) Moles  $\text{H}_2\text{SO}_4$  = conc  $\times$  vol = 0.00271

allow ecf from 8.4

1

Ratio  $\text{H}_2\text{SO}_4$ :NaOH is 1:2

or

Moles NaOH = Moles  $\text{H}_2\text{SO}_4 \times 2 = 0.00542$

1

Concentration NaOH = mol / vol =  $0.00542 / 0.025 = 0.2168$

1

0.217 (mol /  $\text{dm}^3$ )

accept 0.217 with no working for 4 marks

1

accept 0.2168 with no working for 3 marks

(f)  $\frac{20}{1000} \times 0.18 =$  no of moles

or

$0.15 \times 40$  g

1

0.144 (g)

1

accept 0.144g with no working for 2 marks

[16]

5.

(a) potassium / K

for 1 mark

1

(b) carbon dioxide /  $\text{CO}_2$

for 1 mark

1

(c) losing  
electrons  
gaining  
electrons

for 1 mark each

4

(d) (i) power supply, (not mains)  
beaker containing solution,  
(inert) electrodes and circuit  
ammeter or bulb/  
(or see bubbling etc. at electrodes written by drawing)

for 1 mark each

4

- (ii) reading on ammeter/bulb lights / (solution) conducts (electricity)  
 bubbling / gas produced  
 hydrogen produced  
 chlorine / oxygen produced  
 ions move  
 to electrodes (must be linked to ions move)  
 negative ions move to the positive electrode  
and/or positive ions move to the negative electrode  
 negative ions lose electrons  
and/or positive ions gain electrons  
*any 3 for 1 mark each*

3

[13]

6.

- (a) (i) calcium oxide  
*in either order*

1

carbon dioxide  
*accept correct formulae*

1

- (ii)  $C(s) + CO_2(g) \rightarrow 2CO(g)$   
*allow multiples*

1

- (iii) 210 (tonnes)  
*award 3 marks for the correct answer with or without working*  
*allow ecf for arithmetical errors*  
*if answer incorrect allow up to 2 marks for any of the steps below:*  
 $160 \rightarrow 112$   
 $300 \rightarrow 112 / 160 \times 300$   
**or**  
*moles  $Fe_2O_3 = 1.875 (\times 10^6)$  or  $300 / 160$*   
*moles of Fe =  $3.75 (\times 10^6)$  or  $2 \times$  moles  $Fe_2O_3$*   
*mass Fe = moles Fe  $\times$  56*  
*105 (tonnes) scores 2 (missing 1:2 ratio)*  
*420 (tonnes) scores 2 – taken  $M_r$  of iron as 112*

3

- (b) (i) aluminium is more reactive than carbon **or** carbon is less reactive than aluminium  
*must have a comparison of reactivity of carbon and aluminium*  
*accept comparison of position in reactivity series.* 1
- (ii) (because) aluminium ions are positive  
*ignore aluminium is positive* 1
- and are attracted / move / go to the negative electrode / cathode 1
- where they gain electrons / are reduced /  $\text{Al}^{3+} + 3\text{e}^- \rightarrow \text{Al}$   
*accept equation or statements involving the wrong number of electrons.* 1
- (iii) (because) the anodes **or** (positive) electrodes are made of carbon / graphite 1
- oxygen is produced (at anode) 1
- which reacts with the electrodes / anodes  
*do **not** accept any reference to the anodes reacting with oxygen from the air*  
*equation  $\text{C} + \text{O}_2 \rightarrow \text{CO}_2$  gains 1 mark (M3)* 1

[13]

7.

- (a) (i) silver nitrate  
*allow  $\text{AgNO}_3$*  1
- (ii) potassium carbonate **or**  
*allow  $\text{K}_2\text{CO}_3$*
- sodium carbonate  
*allow  $\text{Na}_2\text{CO}_3$*  1
- (b) base  
*allow ionic*  
*ignore insoluble or soluble*  
*ignore alkali* 1

- (c) (i) evaporate  
or  
crystallise  
*allow heat or boil or leave (to evaporate)*  
*allow cool*  
*ignore filtration unless given as an alternative*  
*do **not** accept freeze or solidify* 1
- (ii) 2 (HNO<sub>3</sub>)  
*accept multiples* 1
- (iii) 9  
*accept nine* 1
- (d) 6.21 / 207      0.72 / 16  
*1 mark for dividing mass by A<sub>r</sub>* 1
- = 0.03      = 0.045  
*1 mark for correct proportions (allow multiples)* 1
- 2      3  
*1 mark for correct whole number ratio (allow multiples). Can be awarded from formula.* 1
- Pb<sub>2</sub>O<sub>3</sub>  
*allow O<sub>3</sub>Pb<sub>2</sub>*  
*ecf allowed throughout if sensible attempt at step 1*  
*correct formula with no working gains 1 mark* 1

[10]

8.

- (a) electrolytes 1
- (b) oxidation 1
- electrons lost 1
- (c)  $2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2$   
*minus sign on e<sup>-</sup> not needed* 2



(d) concentration increases

1

$\text{OH}^-$  discharged from water / water decomposes

1

$\text{H}^+$  concentration increases /  $\text{H}_2$  and  $\text{O}_2$  evolved

1

**[8]**