

## Mark schemes

1.

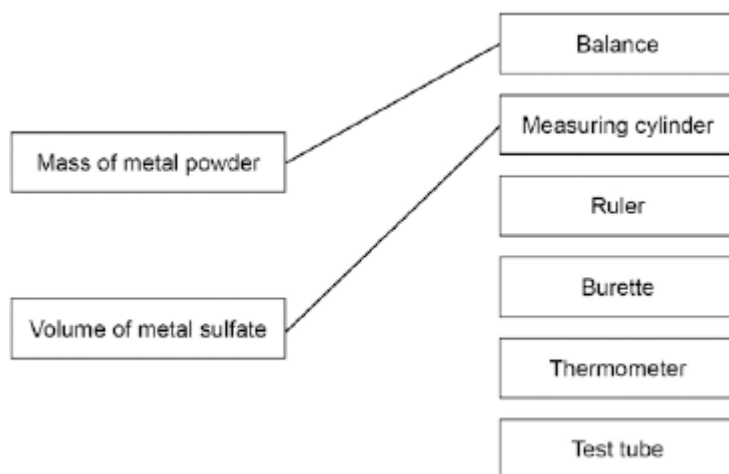
(a) Whether there was a reaction or not

1

(b) brown / orange / dark deposit on zinc  
or  
blue solution turns colourless / paler

1

(c) **Variable** **Measuring instrument**



more than one line drawn from a variable negates the mark

2

(d) (Most reactive) **Magnesium**  
**Zinc**  
(Least reactive) **Copper**  
*must all be correct*

1

(e) would not be safe or  
too reactive

*allow too dangerous*

1

(f) Gold

1

(g)  $2\text{Fe}_2\text{O}_3 + 3\text{C} \rightarrow 4\text{Fe} + 3\text{CO}_2$   
*allow multiples*

1

(h) carbon

1

(i) Loss of oxygen

1

[10]

2.

(a) any **two** from:

- concentration / volume of dilute hydrochloric acid
- mass of metal powder
- surface area of metal powder
- stirring (of any) / rate of stirring

*allow reacted for the same length of time*

2

(b) 4.2 °C

*allow Magnesium Test 2*

1

and any **one** from:

- lower mass of magnesium added
- surface area of magnesium too low
- magnesium coated in magnesium oxide (so took a while to start reacting)
- not stirred
- not stirred as quickly as the other metals
- not reacted for as long a time as the other metals

*allow reason for break in circuit*

1

(c) 17.4(°C)

1

(d) bubbles of gas

1

more (bubbles) seen with calcium than other metals

*allow any correct comparison between two metals*

1

(e) any value between 7.9 °C and 12.3 °C

1

**[8]**

3.

- (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 /  $Al^{3+} + 3e^{-} \rightarrow Al$   
*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  $C + O_2 \rightarrow CO_2$  gains 1 mark (M3)* 1

[13]

**4.** (a) gold 1

(b) atom (s) 1

(c) (i) protons  
*any order*  
*allow proton* 1

neutrons  
*allow neutron* 1

(ii) 3 / three 1

(d) (i) Al  
*ignore any numbers / charges* 1

- (ii) any **two** from:
- limited resource
  - expensive in terms of energy / mining
  - effects on the environment, such as, landfill, atmospheric pollution, quarrying
- allow uses a lot of energy to extract.*

2

- (e) resistant to corrosion

1

does not react (with water or food)

*allow **one** mark for low density with a suitable reason given*

1

[10]

5.

- (a) The ore is not pure or contains impurities or the ore does not contain 100% of the metal compound

*allow to concentrate the metal or metal compound*

1

rock / other compounds need to be removed / separated

1

- (b) (i) (cast iron is) brittle

*allow not strong*

*ignore weak*

1

- (ii) the oxygen reacts with carbon

*allow carbon burns in oxygen or is oxidised*

1

reducing the percentage of carbon in the mixture  
**or** producing carbon dioxide

1

- (c) (i) aluminium has a low density

1

- (ii) (because copper) is in the central / middle (block of the periodic table)

1

whereas aluminium is in Group 3 (of the periodic table)

1

- (iii) iron is more reactive (than copper)

*ignore cost*

1

so copper is displaced / reduced

1

[10]