

# MARK SCHEME

# GCSE

## CHEMISTRY

## AQA - TRIPLE SCIENCE

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C5 - TEST 3

ENERGY CHANGES

Intermediate

## Mark schemes

- 1.** (a) copper, zinc, sodium chloride solution 1
- (b) a reactant is used up  
*allow the reaction stops*  
*allow electrolyte / electrode / ions / metal / metal*  
*hydroxide / alkali for reactant* 1
- (c) the reaction is not reversible 1
- (d)  $2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$   
*allow fractions / multiples*  
*allow 1 mark for O<sub>2</sub>* 2
- (e) **Level 3:** A judgement, strongly linked and logically supported by a sufficient range of correct reasons, is given. 5–6
- Level 2:** Some logically linked reasons are given. There may also be a simple judgement. 3–4
- Level 1:** Relevant points are made. This is not logically linked. 1–2
- No relevant content** 0

## Indicative content

### reasons why fuel cells could be judged as better

from the table	from other knowledge
<ul style="list-style-type: none"><li>time for refuelling a fuel cell is faster than recharging</li></ul> <p><b>or</b></p> <ul style="list-style-type: none"><li>a fuel cell does not need to be recharged</li><li>a fuel cell has a greater range</li></ul>	<ul style="list-style-type: none"><li>hydrogen can be renewable if made by electrolysis using renewable energy</li><li>lithium-ion batteries can catch fire</li><li>produces only water</li></ul> <p><b>or</b></p> <ul style="list-style-type: none"><li>no pollutants produced</li><li>lithium-ion batteries may release toxic chemicals on disposal</li><li>lithium-ion batteries (eventually cannot be recharged so) have a finite life</li></ul>

### reasons why the lithium-ion battery could be judged as better

from the table	from other knowledge
<ul style="list-style-type: none"><li>lithium-ion uses energy more efficiently</li><li>cost of lithium-ion car much less</li><li>cost of recharging much less than refuelling with hydrogen</li></ul>	<ul style="list-style-type: none"><li>hydrogen is often made from fossil fuels so is not renewable</li><li>charging points are more widely available than hydrogen filling stations</li><li>hydrogen takes up a lot of space</li></ul> <p><b>or</b></p> <ul style="list-style-type: none"><li>is difficult to store</li><li>hydrogen can be highly flammable / explosive</li><li>no emissions produced</li><li>(catalyst in the hydrogen fuel-cell eventually becomes poisoned so) have a finite life</li></ul>

[11]

2.

(a) (i) 5.75 **or** 5.8

*correct answer with or without working gains 2 marks*

*correct working showing addition of any four results and division by 4 gains 1 mark*

**OR**

*6(.04) for 1 mark*

2

- (ii) use a polystyrene cup **or** lid  
*accept insulate the beaker*

1

to prevent energy/heat gain  
*accept to prevent energy/heat transfer*  
*do **not** accept energy/heat loss*

**OR**

use a digital thermometer  
*allow use a data logger*

easier to read (to 0.1°C)

1

- (b) (as mass increases) the final temperature increases

1

then stays constant

1

correct reference to a value above 8 g up to and including 10 g as mass when the trend changes

1

[7]

3.

- (a) exothermic (reaction)

1

- (b) smaller lumps react faster  
**or** larger lumps react slower

*accept smaller lumps cause a more rapid rise in temperature **or***  
*vice versa*

*do **not** accept higher temperature*  
***or** more heat unless linked to time*

1

smaller lumps have a larger surface (area) or larger lumps have a smaller surface (area)

*more water can react at the same time*  
***or** so less water can react at the same time*

1

(c) heats up (too) rapidly  
*accept temperature (too) high* 1

burning the food **or** the hands  
*accept danger of container exploding **or** splitting **or** food overheating*  
*do not accept reference to handling of powder*  
*do **not** accept a lot of powder needed **or** powder getting into food **or** too hot to eat **or** food would not cook properly **or** heat through properly* 1

[5]

4.

(a) (i) sulphuric acid /  $H_2SO_4$  (accept sulfuric)  
*for one mark* 1

(ii)  $Na_2SO_4$  /  $(Na)_2SO_4$  /  $Na_2(SO_4)$  /  $(Na_+)_2SO_4^{2-}$   
*for one mark*  
*lower case O ( $Na_2So_4$ ) not accepted/tops of subscripted numbers should be in line with or lower than lower case letters of symbols / upper case 'a' not accepted* 1

(b) (i) exothermic  
*for one mark* 1

(ii) 60 KJ  
*for one mark* 1

(iii) energy given out when bonds form  
energy taken in when bonds break  
energy given out is greater than energy taken in (owtte)  
*for 1 mark each* 3

(iv) activation energy is low / many molecules have enough energy to react  
*for one mark* 1

[8]

- 5.** (a) fuels  
heat – allow light  
*for 1 mark each* 2
- (b) gases  
*for 1 mark* 1
- [3]**
- 6.** (a) heat  
light  
an exothermic  
*in any order for 1 mark each* 3
- (b) oxygen / O<sub>2</sub>  
*for 1 mark* 1
- [4]**

**7. NOTE**

In this question and throughout the Paper, if the name of a chemical is asked for, then the formula is acceptable only if it is correct in every detail. If the name is correct and the candidate has tried to be 'helpful' by giving, in addition, an incorrect version of the formula, then this is acceptable provided it does not lead to ambiguity.

- (i) nitric (acid)  
*accept HNO<sub>3</sub>* 1
- (ii) sulphuric (acid)  
*accept H<sub>2</sub>SO<sub>4</sub>* 1
- (iii) heat given out  
*or temperature rise*  
*or energy given out*  
*or steam*  
*do not credit just 'use a thermometer'*  
*do not credit just 'change in temperature'* 1

(iv) neutralisation

*accept neutralise*

*accept neutral*

*accept formation of salt **or** water*

*do not credit exothermic*

1

[4]

8.

(i) sulphuric acid /  $\text{H}_2\text{SO}_4$

*accept sulfuric*

*1 for one mark*

1

(ii) exothermic

*for one mark*

1

(iii)  $\text{Na}_2\text{SO}_4$  /  $(\text{Na})_2\text{SO}_4$  /  $\text{Na}_2(\text{SO}_4)$  /  $(\text{Na}^+)_2\text{SO}_4^{2-}$

*for one mark*

*lower case O( $\text{Na}_2\text{SO}_4$ ) not accepted / tops of subscripted letters*

*should be in line or lower than lower case letters of symbols*

1

[3]