

# MARK SCHEME

# GCSE

## CHEMISTRY

## AQA - TRIPLE SCIENCE

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C5 - TEST 5

ENERGY CHANGES

Advanced

## Mark schemes

1.

(a) any **three** from:

- concentration of (salt) solution
- volume of (salt) solution  
*ignore amount of solution*
- **initial** temperature (of the solution)  
*ignore room temperature*
- surface area / form of metal
- moles of metal  
*allow mass / amount*  
*ignore time*  
*ignore size of tube*

3

(b) 20

1

32

1

12

*allow ecf*

1

(c) (i) four bars of correct height

*tolerance is + / - half square*  
*3 correct for 1 mark*

2

bars labelled

1

(ii) *one variable* is non-continuous / categoric

*accept qualitative or discrete*  
*accept no values between the metals*

1

(iii) magnesium

1

because biggest temperature change

*accept gives out most energy*  
*ignore rate of reaction*  
*dependent on first mark*

1

(iv) does not react / silver cannot displace copper

1

because silver not more reactive (than copper) **or** silver below copper in reactivity series

*do **not** accept silver is less reactive than copper sulfate*

1

(v) replace the copper sulfate

*could be implied*

1

with any compound of a named metal less reactive than copper

*allow students to score even if use an insoluble salt*

1

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2.

(a) gives out

heat

*each for 1 mark*

2

(b) chromium and aluminium oxide

1

(c) (i) chromium oxide

1

(ii) oxygen removed/gains electrons

1

[5]

3.

(a) eg plastic (beaker) / insulation / lid / cover **or** any mention of enclosed

*any sensible modification to reduce heat loss*

*ignore prevent draughts*

*ignore references to gas loss*

1

(b) all the substances react **or** all (the substances) react

fully / completely **or** heat evolved quickly **or**

distribute heat

*accept to mix them*

*'so they react' is insufficient for the mark*

*accept increase chances of (successful) collisions / collision rate*

*increase*

*do **not** accept rate of reaction increase / make reaction faster*

1

(c) experiment 2 **and** different / higher / initial / starting temperature

*accept experiment 2 **and** the room is hotter / at higher temperature*

*do **not** accept temperature change / results higher*

1

- (d) temperature change does not fit pattern  
*accept anomalous / odd or it is the lowest or it is lower than the others or it is different to the others*  
*'results are different' is insufficient* 1
- (e) 7 / 7.0 1
- (f)  $(100 \times 4.2 \times 7) = 2940$   
*ecf from (e)* 1
- (g) diagram A **and** reaction exothermic / heat evolved /  $\Delta H$  is negative / temperature rises  
*accept energy is lost (to the surroundings)* 1

[7]

4.

- (a) A = energy / enthalpy change / difference  
*allow heat change or  $\Delta H$*   
*allow energy released* 1
- B = activation energy / EA  
*allow definition of activation energy* 1
- C = carbon dioxide and water  
*accept products* 1
- (b) exothermic  
*allow combustion / redox / oxidation*  
*ignore reduction / burning* 1

[4]

5.

- (a) any **one** from:
- solution becomes colourless or colour fades
  - zinc becomes bronze / copper coloured  
*allow copper (forms) or a solid (forms)*
  - zinc gets smaller  
*allow zinc dissolves*
  - bubbles or fizzing.  
*ignore precipitate*
- 1

- (b) improvement:  
use a plastic / polystyrene cup or add a lid  
*accept use lagging / insulation*

1

reason - must be linked  
reduce / stop heat loss

**OR**

improvement:  
use a digital thermometer

*allow use a data logger*

reason - must be linked  
more accurate or easy to read or stores data

*allow more precise or more sensitive*

*ignore more reliable*

*ignore improvements to method, eg take more readings*

1

- (c) 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 refer to the information in the Marking Guidance and apply a 'best-fit' approach to the marking.

**0 marks**

No relevant content

**Level 1 (1–2 marks)**

There is a statement about the results.

**Level 2 (3–4 marks)**

There are statements about the results. These statements may be linked or may include data.

**Level 3 (5–6 marks)**

There are statements about the results with at least one link and an attempt at an explanation.

Examples of chemistry points made in the response:

**Description:**

**Statements**

Concentration of copper sulfate increases

Temperature change increases

There is an anomalous result

The temperature change levels off

Reaction is exothermic

**Linked Statements**

Temperature change increases as concentration of copper sulfate increases

The temperature change increases, and then remains constant

After experiment 7 the temperature change remains constant

**Statements including data**

The trend changes at experiment 7

Experiment 3 is anomalous

**Attempted Explanation**

Temperature change increases because rate increases

Temperature change levels off because the reaction is complete

**Explanation**

As more copper sulfate reacts, more heat energy is given off

Once copper sulfate is in excess, no further heat energy produced

6

[9]

6.

- (i) the energy needed by reactants before reaction can occur  
*accept energy required for particles to collide successfully*  
*accept energy required to break bonds*  
*accept energy needed to start reaction*

1

(ii) reference to reactants 'energy' higher than products 'energy'

*accept exothermic reaction*

*accept heat (energy) released*

1

melting point of iron is exceeded

*accept temperature is above melting point of iron*

1

**[3]**

**7.**

(a) either:

calculations: all correct (ethanol = 6, methanol = 3,  
peanut oil = 10, vegetable oil = 15)

*ignore repetition of data from table unqualified*

**or**

implication of correct calculation

(vegetable oil) gives largest temperature / heat increase per gram (owtte)

*allow 'produced most heat in proportion to the fuel used' owtte for 1 mark*

2

(b) any **one** from:

*owtte*

- smoke  
*ignore references to crops/food*
- soot
- carbon
- carbon monoxide
- carbon dioxide
- global warming / climate change / greenhouse gases
- (air) pollution
- harmful/poisonous

1

scrub / wash the gases *owtte*

*filter / remove (gases / fumes / appropriate named substance) owtte*

*(add extra oxygen) can burn more efficiently owtte*

*use a cleaner fuel owtte*

*plant more trees or similar linked to CO<sub>2</sub>*

*any sensible answer*

*'don't burn so much fuel' insufficient alone*

*ignore extractor fans / air conditioning*

1

(c) (i) A

1

(ii) B

1

[6]

8.

(a) eg plastic (beaker) / insulation / lid / cover **or** any mention of enclosed

*any sensible modification to reduce heat loss*

*ignore prevent draughts*

*ignore references to gas loss*

*ignore bomb calorimeter*

1

(b) all the substances react **or** all (the substances) react fully / completely **or** heat evolved quickly **or** distribute heat

*'so they react' is insufficient for the mark*

*accept increase chances of (successful) collisions / collision rate*

*increase*

*do **not** accept rate of reaction increase / make reaction faster*

1



- (c) experiment 2 **and**  
 different / higher / initial / starting temperature  
*accept experiment 2 **and** the room is hotter / at higher temperature*  
*do **not** accept temperature change / results higher* 1
- (d) temperature change does not fit pattern  
*accept anomalous / odd **or** it is the lowest **or** it is lower than the others **or** it is different to the others*  
*'results are different' is insufficient* 1
- (e) 7 / 7.0 1
- (f)  $(100 \times 4.2 \times 7) = 2940$   
*ecf from (e)* 1
- (g) diagram A **and**  
 reaction exothermic / heat evolved /  $\Delta H$  is negative / temperature rises  
*accept energy is lost (to the surroundings)*  
*accept energy of products lower than reactants*  
*allow arrow goes downwards* 1
- 9.** (a) (i) (different) properties  
*allow ideas of different property / behaviour / element* 1
- (ii) any **one** from:  
*they = Crawford + Cruikshank*
- they had high status
- or**
- they were lecturers / doctors / professors / famous scientists
- other scientists repeated experiments  
*allow experiment could be repeated*  
*allow other scientists showed they had different properties*
  - they had proof
- or**
- lots of / strong / conclusive / enough / clear evidence  
*ignore evidence unqualified* 1

(iii) other scientists obtained similar results / proved it

**or**

experiments were repeated

1

(b) (i) any **one** from:

- mass of solid / strontium (chloride) / barium (chloride)  
*allow amount / volume*
- volume of water  
*allow amount / mass*
- type of container  
*allow initial / starting temperature (of water)*  
*ignore room temperature / time / concentration*  
*ignore reference to hydrochloric acid*

1

(ii) **2 and** takes in heat / energy

**or**

**2 and** temperature goes down (owtte)

1

(iii) temperature increased for one experiment and decreased for the other (owtte)

**or**

one was exothermic and one was endothermic (owtte)

*accept experiment 1 was exothermic*

1

(c) any **one** from

- positive / + (charge)  
*do **not** accept incorrect further qualification eg electrons / atoms / electrodes*
- opposite (charges) attract

1

[7]