

Exothermic and Endothermic Reactions

Mark Scheme 1

Level	GCSE (9-1)
Subject	Combined Science: Trilogy - Chemistry
Exam Board	AQA
Topic	5.5 Energy Changes
Sub-Topic	Exothermic and Endothermic Reactions
Difficulty Level	Silver Level
Booklet	Mark Scheme 1

Time Allowed: 60 minutes

Score: /58

Percentage: /100

Grade Boundaries:

M1.(a)	products below reactants	1
	correct energy profile	1
	activation energy correctly labelled	1
	energy given out correctly labelled	1
(b)	31 (%)	1
(c)	the products would be above the reactants	1
(d)	catalysts increase rate of reaction <i>1 mark for each property</i> <i>1 mark for each explanation</i> so products formed in less time or catalysts lower activation energy <i>explanation must be linked correctly to the property to gain the mark</i> so lowers energy requirements or catalysts not used up in the reaction	

so only an initial outlay needed

or

only a small amount of catalyst needed

so small initial cost

max. 4

(e) Protein

1

(f) high temperatures

1

extremes of pH

1

(g) lactase acts as the lock, lactose is the key (substrate)

1

lactase has an active site which will only fit lactose molecules

1

so lactase will not work with other molecules

1

[16]

M2.(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]

M3.(a) (i) covalent

1

(ii) increases the rate of reaction

1

(b) (i) the reaction is reversible

1

(ii) at lower pressure the molecules will be further apart

1

so there will be fewer collisions per unit time

accept frequency of collisions lower

1

(iii) as the temperature increases, the yield of the reaction increases

1

- (iv) 2 molecules / volumes become 4 **or** more molecules / volumes **of** product than reactant

1

- (c) Marks awarded for this answer will be determined by the Quality of Communication (QoC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5, and apply a 'best-fit' approach to the marking.

0 marks

No relevant content

Level 1 (1 – 2 marks)

Candidate has written about some basic points from the table but has not added any extra knowledge. Candidate may have included advantages **or** disadvantages.

Level 2 (3 – 4 marks)

Candidate has attempted an evaluation using points from the table and their own knowledge. Candidate has included advantages **and** disadvantages.

Level 3 (5 – 6 marks)

Candidate has given an evaluation that includes both advantages and disadvantages. Candidate has clearly linked points from the table with their own knowledge and uses appropriate scientific terminology.

examples of the points made in the response

Advantages of using hydrogen:

- its combustion only produces water
- combustion of hydrogen does not produce carbon dioxide **or** does not contribute to climate change
- petrol requires much more oxygen to burn so partial combustion is possible producing carbon monoxide
- combustion of hydrogen does not produce any particulates **or** does not contribute to global dimming
- petrol comes from a non-renewable source **or** there are renewable ways of producing hydrogen, eg electrolysis of water.

Disadvantages of using hydrogen:

- hydrogen has to be stored at high pressure **or** risk of explosion or larger volume needed for storage.
- much less energy produced from the combustion of hydrogen **or** need to refuel more often
- most methods of producing hydrogen need fossil fuels.

6

[13]

M4.(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

[16]

- M5. (a) heat
light
an exothermic

in any order for 1 mark each

3

(b) oxygen / O₂

for 1 mark

1

[4]