AQA GCSE Chemistry

Energy changes mark scheme · goes with “Energy changes · Higher tier” · whiteboardchemistry.com/revision/gcse-chemistry/exam-questions

Mark schemes

Energy changes · Higher tier · 5 questions

Q1 · June 2023 · Paper 1 Foundation · Q10 · Paper 1 Higher · Q2 · [11 marks]

10.1

(independent variable)

mass (of ammonium nitrate)

(dependent variable)

(lowest) temperature (reached by solution)

allow change in temperature (of solution)

[2 marks]

10.2

all 6 points plotted correctly

allow a tolerance of ± ½ a small square

*allow **1** mark for 4 or 5 points plotted correctly*

line of best fit

[3 marks]

10.3

line extrapolated to y-axis

(initial temperature)

value for temperature where extrapolated line meets y-axis

allow a tolerance of ± ½ a small square

[2 marks]

10.4

temperature decreased

ignore correct references to energy transfer

[1 mark]

10.5

(0.3 °C) is the uncertainty

(because 0.3 °C) is the range about the mean value

allow values are (a maximum of)

0.3 (°C) either side of the mean

allow (because)

16.8 = 16.5 + 0.3

and

16.2 = 16.5 – 0.3

[2 marks]

10.6

random error

[1 mark]

Q2 · June 2024 · Paper 1 Higher · Q4 · [14 marks]

04.1

*max **1** mark if the lines do not intersect*

line of best fit using the first five points

line of best fit using the last four points

[2 marks]

04.2

the temperature rises because the reaction is exothermic

or

the temperature rises because energy is transferred to the surroundings

allow heat for energy

until 0.8 g (zinc) is added

allow a tolerance of ± ½ a small square

allow until the temperature reaches 47 °C

allow a correctly determined value for mass of zinc or temperature from the intersection of drawn lines of best fit

(so) there is no additional reaction

allow (when) the reaction has finished

(because) zinc is in excess

or

(because) copper sulfate is used up

[4 marks]

04.3

allow converse statements for glass

polystyrene is a better (thermal) insulator

(so) there is less energy transfer to the surroundings

allow (so) less energy is lost (to the surroundings)

allow heat for energy

[2 marks]

04.4

$Zn(s) + Cu^{2+}(aq) \rightarrow Zn^{2+}(aq) + Cu(s)$

*allow **1** mark for $Zn^{2+} + Cu$*

[2 marks]

04.5

(mean highest temperature =)

$$\frac{37.6 + 37.2 + 37.8 + 37.4}{4}$$

allow

(mean highest temperature =)

$$\frac{150}{4}$$

= 37.5 (°C)

37.5 (°C) ± 0.3 (°C)

[3 marks]

04.6

any **one** from:

- starting temperature may be different
- inconsistent stirring

ignore room temperature

allow inconsistent use of a lid

[1 mark]

Q3 · June 2024 · Paper 1 Higher · Q6 · [11 marks]

06.1

(most reactive)

Mg Zn Ni Cu Ag

(least reactive)

allow name of metal for symbol

*allow **1** mark for*

(most reactive)

Mg Zn Ni

or

Ni Cu Ag

(least reactive)

(justification)

the higher the (positive) voltage the more reactive the metal

allow the most reactive (metal) has the highest (positive) voltage

allow the least reactive (metal) has the most negative voltage

allow the greater the difference in reactivity the greater the (magnitude of the) voltage

[3 marks]

06.2

Level 3 (5–6 marks): The method would lead to the production of a valid outcome. The key steps are identified and logically sequenced.

Level 2 (3–4 marks): The method would not necessarily lead to a valid outcome. Most steps are identified, but the method is not fully logically sequenced.

Level 1 (1–2 marks): The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.

No relevant content (0 marks)

Indicative content

- **set up cell with sodium chloride solution as the electrolyte**
- **use two different metals as electrodes**
- **measure voltage**
- **repeat at different concentrations of electrolyte solution**
- **by diluting the sodium chloride solution with water**
- using measured volumes of sodium chloride solution and water
- measure volumes with a measuring cylinder (allow pipette / burette)
- use the same two metals each time
- use the same volume of electrolyte solution

[6 marks]

06.3

ignore references to electrodes

hydrogen is oxidised (electrochemically)

allow hydrogen loses electrons

to produce water

[2 marks]

Q4 · June 2024 · Paper 1 Higher · Q8 · [9 marks]

08.1

propane is a small molecule

allow propane is a simple molecule

(so) the forces between molecules are weak

or

(so) the intermolecular forces are weak

do not accept covalent bonds are weak

(which) require little energy to overcome

do not accept answers in terms of breaking covalent bonds

[3 marks]

08.2

B

[1 mark]

08.3

(bonds broken = 2(347) + 8X + 5(498) =)

3184 + 8X

(bonds made = 6(805) + 8(464) =)

8542

(energy released = bonds made

– bonds broken =)

2219 = 8542 – (3184 + 8X)

allow correct use of incorrectly determined values of bonds broken and/or bonds made

(8X =) 3139 (kJ/mol)

allow correct evaluation of the expression energy released =

bonds broken – bonds made

(X =) 392 (kJ/mol)

allow 392.375 correctly rounded to at least 3 significant figures

allow correct use of an incorrectly determined value for 8X

[5 marks]

Q5 · June 2025 · Paper 1 Higher · Q7 · [11 marks]

07.1

Level 2 (3–4 marks): A judgement, strongly linked and logically supported by a sufficient range of correct reasons, is given.

Level 1 (1–2 marks): Some logically linked reasons are given. There may also be a simple judgement.

No relevant content (0 marks)

Indicative content

- hydrazine is liquid so easier to store / transport

o because takes up less space

- both have significant dangers
- both produce harmless products
- hydrazine produces a higher voltage so fewer cells will be needed (to produce the same voltage)

o so the battery would be lighter

- hydrazine needs no catalyst so costs may be less
- hydrogen uses platinum as a catalyst which is a rare metal
- judgement

[4 marks]

07.2

allow any combination of x, o, $e^{(-)}$, • for electrons

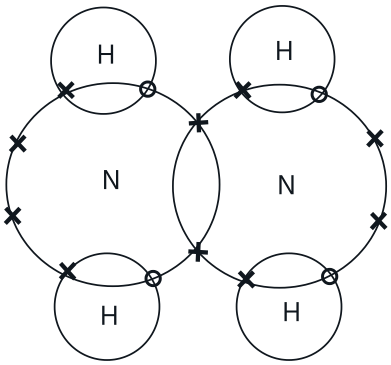
bonded pair of electrons in each overlap

each nitrogen atom with 2 non-bonded electrons

do not accept if extra electrons on hydrogen atom(s)

MP2 is dependent upon the award of MP1

an answer of



scores 2 marks

[2 marks]

07.3

(the ball and stick model)

shows the shape (of the molecule)

or

(the ball and stick model) is 3-D

[1 mark]

07.4

(bonds broken =

(4 × 391) + 498 + X =)

2062 + X

(bonds formed = 945 + (4 × 464) =)

2801

581 = 2801 - (2062 + X)

allow correct use of incorrectly determined values of bonds broken and / or bonds made

(X =) 158 (kJ/mol)

[4 marks]

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