PEARSON EDEXCEL GCSE COMBINED SCIENCE (HIGHER) · 1SC0

# CHEMISTRY



## MARK SCHEME

TOPIC 7: RATES OF REACTION AND ENERGY CHANGES: HEAT ENERGY CHANGES IN CHEMICAL REACTIONS (PAPER 2)

| SCORE | PERCENTAGE |
| --- | --- |
| /145 | % |

STEMUP

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## Mark Scheme

Q1.

| Question Number | Answer | Mark |
|---|---|---|
| | R P S Q T<br><br>R P S as first 3 (1)<br>Q T as last 2 (1) | **(2)**<br><br>AO 3 2a<br>AO 3 2b |

(**Q01 1SC0/2CF, June 2018**)

Q2.

| Question number | Answer | Mark |
|---|---|---|
| **(i)** | **C** arrow R is the only correct answer<br><br>**A, B** and **D** are incorrect because they do not show the activation energy | **(1)**<br>**AO2-1** |

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| (ii) | A description to include:<br>any two for 1 mark<br>all three for 2 marks<br><br>• energy is taken in breaking bonds (in the reactants)<br><br>• energy is given out making bonds (in the products)<br><br>• more energy is given out than taken in | <br><br>allow breaking bonds is endothermic<br><br>allow forming bonds is exothermic<br><br>allow less energy taken in than given out<br><br>ignore products have less energy than reactants ignore reaction is exothermic / gives out energy alone<br><br>for energy taken in allow : absorbed / needed / used /required for energy given out allow: released | **(2) AO1-1** |

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| (iii) | -76 with or without working scores 4<br><br>BROKEN<br>944 + (3 x 436) = 2252 (1)<br><br>MADE<br>2 x (3x388) = 2328 (1)<br><br>DIFFERENCE<br>(broken) 2252 – (made) 2328 (1)<br><br>ANSWER<br>= - 76 (1) | allow ecf<br><br>ignore sign<br><br>ignore sign<br><br>MP3 for difference between their 2 values<br><br>MP4 for correct evaluation, including correct sign, of <u>bonds broken – bonds made</u> using their values<br><br>(+)76 scores 3<br>(+)1088 scores 3<br>(+)604 scores 3<br>(+)1476 scores 3<br>-1088 scores 2<br>-604 scores 2 | **(4) AO2-1** |

(**QU05b 1SC0/2CH, June 2023**)

Q3.

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| (i) | thermometer | ignore temperature probe | (1) AO2 2 |

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| (ii) | stops polystyrene cup from falling over | allow keeps {heat / thermal energy} {in / out} allow provides insulation<br><br>ignore references to keeping temperature in ignore prevents<br><br>burns / too hot to pick up | (1) AO3 1 |

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| (iii) | reduces {heat/thermal energy} loss / traps heat | allow maintains the temperature allow reduces {heat / thermal energy} gain allow insulation<br><br>ignore references to keeping temperature in ignore references to cold {entering/leaving} polystyrene cup | (1) AO3 1 |

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| (iv) | salt R: (+) 3(.0) (1)<br><br>salt S: -1.5 (2)<br><br>salt with most negative value **only** ticked (1) | reject -<br><br>3(.0)<br><br>for MP1<br><br>(+)1.5<br><br>scores<br><br>1 | (4) AO2 2 |

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| (v) | Ba2+ | allow $Ba^{+2}$ / Ba2+ ignore any other ions<br>reject subscript reject incorrect cases | (1) AO2 1 |

(**QU02b 1SC0/2CF, June 2024**)

Q4.

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **(i)** | hydrogen + brom**ine** →<br><br>hydrogen brom**ide** (2)<br><br>hydrogen + brom**ine** → (1)<br><br>→ hydrogen brom**ide** (only) (1) | if balanced equation attempted, must have correct formulae and correct balancing: $H_2 + Br_2 \rightarrow 2\ HBr$ (2) | **(2) AO2 1** |

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **(ii)** | neutralisation | allow exothermic / acid-base | **(1) AO1 1** |

(**QU04b 1SC0/2CF, June 2024**)

Q5.

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **(i)** | to make the {magnesium chloride / solid} dissolve | allow 'so it dissolves'<br>allow to increase the rate of the reaction<br>allow to {mix / spread / distribute} the reactants<br>allow so it reacts<br>allow to help 'break up' the {magnesium chloride / solid}<br><br>allow to get an even temperature<br><br>ignore to make it more accurate / more reliable | **AO2 2 (1)** |

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **(ii)** | • use a polystyrene cup / insulate the beaker (1)<br><br>• add a lid to the beaker (1) | allow any relevant wrapping e.g. foil, cotton wool<br><br>ignore draught shield<br>ignore 'trap heat'<br><br>ignore close the beaker / use a bung / cover (the beaker) / seal the beaker<br><br>max 1 mark if methods of keeping a constant temperature e.g. water bath are given | **AO3 3b (2)** |

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **(iii)** | 13.4 with or without working scores 2<br><br>13.5 + 12.8 + 13.9 = 40.2 (1)<br><br>$\frac{40.2}{3}$ = 13.4 (1) | -13.4 scores 1<br>40.2 with or without working scores 1<br>33.4 with or without working scores 1<br><br>allow ecf<br><br>MP2 for correctly dividing by 3 a value derived from an attempt at adding the three temperature changes<br><br>$\frac{13.5 + 13.9}{2}$ = 13.7 scores 2<br>**only** with working | **AO1 2 (2)** |

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **(iv)** | an explanation linking:<br><br>• exothermic (1)<br><br>• (because) temperature increases (1) | mark independently<br><br>allow heat is {given out / released / lost} / gets {hotter / warmer}<br><br>allow energy is released | **AO3 2 (2)** |

(**QU02b 1SC0/2CF, June 2025**)

Q6.

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| | • calculates energy needed to break bonds (1)<br>• calculates energy released in forming bonds (1)<br>• calculates energy change (1)<br>• evaluation of final answer with negative sign (1) | <u>Example of calculation</u><br><br>Bonds broken = 436 + 243 = 679 (kJ $mol^{-1}$)<br><br>Bonds formed = 2 × 432 = 864 (kJ $mol^{-1}$)<br><br>Energy change = 679 − 864 = −185 (kJ $mol^{-1}$)<br><br>Award full marks for correct numerical answer without working | **(4)** |

(**Q06d 1SC0/2CH, SAM 2016**)

Q7.

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| | heat energy change when bonds broken = 413 + 243 (1)<br><br>heat energy change when bonds formed = 346 + 432 (1)<br><br>overall heat energy change = (346 + 432) − (413 + 243) or vice versa (1)<br>= 122 (or -122) (kJ $mol^{-1}$)<br><br>more heat released than required therefore reaction exothermic (1)<br><br>**OR**<br>heat energy change when bonds broken = (4 x 413) + 243 (1)<br><br>heat energy change when bonds formed = (3 x 413) + 346 + 432 (1)<br><br>overall heat energy change = ((3 x 413) + 346 + 432) − ((4 x 413) + 243) (1)<br>= 122 (or -122) (kJ $mol^{-1}$)<br><br>more heat released than required therefore reaction exothermic (1) | allow full marks for correct numerical answer without working | **(4)** |

(**Q06b 1SC0/2CH/S2, SAM**)

Q8.

| Question number | Answer | | Mark |
|---|---|---|---|
| | -55 with or without working scores 4<br><br>BROKEN: 612 + 4(412) + 431 = 2691 (1)<br><br>MADE: 412 + 348 + 338 + 4(412) = 2746 (1)<br><br>DIFFERENCE: 2691 – 2746 (1)<br><br>ANSWER: = - 55 (1) | <br><br>allow positive or negative<br><br>allow positive or negative<br><br>allow ecf for +broken -made<br><br>allow ecf for addition or subtraction of 2 calculated values (working required) using bond energies | (4)<br>AO2<br>1 |

| | | | |
|---|---|---|---|
| | **OR**<br><br>BROKEN: 612 + 431 = 1043 (1)<br><br>MADE: 412 + 348 + 338 = 1098 (1)<br><br>DIFFERENCE:1043 – 1098 (1)<br><br>ANSWER: = - 55 (1) | allow positive or negative<br>allow positive or negative<br>allow ecf for +broken -made<br>allow ecf for addition or subtraction of 2 calculated values (working must be seen) using bond energies<br>with or without working, final answers of:<br>-55 scores 4<br>(+) 55 scores 3<br>(+)293 scores 3<br>(+)705 scores 3<br>-486 scores 3<br>(+)486 scores 2 | |

(**QU05d 1SC0/2CH, June 2024**)

Q9.

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| | -467 kJ $mol^{-1}$ with or without working scores 4<br><br>• bonds broken = (4 x 299) + 495 = 1691 (1)<br><br>• bonds made = (4 x 464) + (2 x 151) = 2158 (1)<br><br>• energy change = 1691 – 2158 (1)<br><br>• = -467 kJ $mol^{-1}$ (1) | -467 without correct unit scores 3,<br><br>+467 without correct unit scores 2<br><br>allow ecf throughout<br><br>ignore sign / unit<br><br>ignore sign / unit<br><br>allow answers without positive sign where appropriate<br><br>ecf, answer including sign and unit needed<br><br>if no sign, assume it is positive | **(4)**<br>**AO2-1** |

(**QU06e 1SC0/2CH, June 2025**)

Q10.

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| | -730 as final answer with or without working scores 4<br>+730 as final answer with or without working scores 3<br><br>bonds broken = (4 x 435) + (2 x 496) = 2732 **(1)**<br>bonds made = (2 x 805) + (4 x 463) = 3462 **(1)**<br>energy change = broken - made **(1)** [2732 - 3462]<br>= **-**730 (kJ $mol^{-1}$) **(1)** | allow ECF | **(4)** |

(**Q06b 1SC0/2CH, Nov 2020**)

Q11.

| Question number | Answer | Mark |
|---|---|---|
| | 24.16 – 22.52 = 1.64 (g) | **(1)**<br>**AO2-2** |

(**QU02a 1SC0/2CF, June 2023**)

Q12.

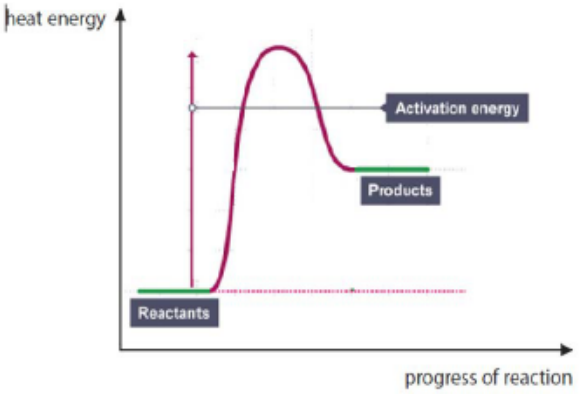
| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **(i)** | **+** (1) 8.7 (1) (°C)<br>sign (1)<br>value (1) | Allow answer to be shown on the table<br><br>mark independently | **(2)**<br>**AO2-2** |

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **(ii)** | An explanation linking<br><br>• salt with larger positive temperature rise in part (i) (1)<br><br>• shows the {largest/highest} temperature rise (1) | allow ecf from part(i)<br>+8.7 °C in part(i) gives salt C in Q (ii)<br><br>MP2 depends on MP1<br>allow gives out most heat / loses most energy /heats up the most / biggest temperature change<br><br>ignore just quoting numbers<br>ignore biggest exothermic change / because it's getting hotter<br><br>reject B for both marking points | **(2)**<br>**AO2-1** |

(**QU02b 1SC0/2CF, June 2023**)

Q13.

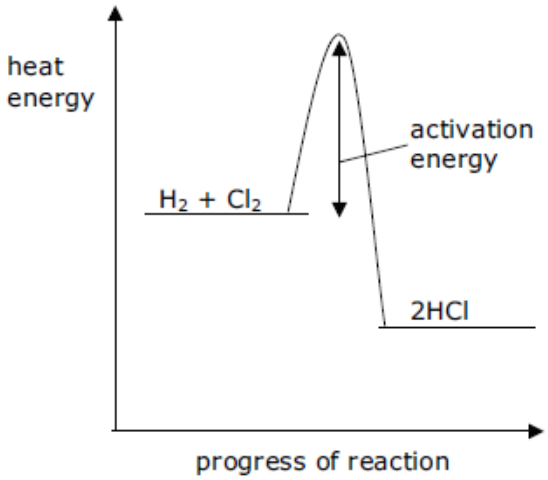
| Question Number | Answer | Mark |
|---|---|---|
| **(i)** | fuel oil | **(1)**<br>AO 3 2a |

| Question Number | Answer | Additional guidance | Mark |
|---|---|---|---|
| (ii) | • reactant(s) and product(s) labelled in their correct positions (1) | example of diagram   | (3) AO 1 1 |
| | • activation energy labelled (1) | ignore arrow heads | |
| | • energy of reactants lower than energy of products (1) | allow unlabelled diagram of an endothermic reaction showing the basic outline shape<br>if exothermic reaction profile shown, allow (1) for reactants and products in correct position and (1) for correct labelling of activation energy | |

| Question Number | Answer | Additional guidance | Mark |
|---|---|---|---|
| (iii) | $C_6H_{14}$ | | (1) AO 2 1 |

(**Q15 1SC0/2CH, June 2018**)

Q14.

| Question number | Answer | Mark |
|---|---|---|
| | <br>• product line, labelled (2)HCl/product(s), to right of and lower than reactant line, labelled $H^2 + Cl^2$/reactants (1)<br>• curve drawn on diagram (1)<br>• activation energy labelled (1) | **(3)** |

(**Q06c 1SC0/2CH, SAM 2016**)

Q15.

| Question Number | Answer | Acceptable answers | Mark |
|---|---|---|---|
| **(a)(i)** | An explanation linking<br><br>{the temperature/it} {increased / went up (by 26°C)} (1)<br><br>(so the reaction is) exothermic (1) | <br><br>it got hotter/it gets hot<br>heat (energy){released /given out}<br>ignore incorrect temperature rise<br>do not allow just 'heat increases' | <br><br>**(2)** |

| Question Number | Answer | Acceptable answers | Mark |
|---|---|---|---|
| **(a)(ii)** | $ZnSO_4$ (1)<br><br>Cu (1) | allow formulae in either order<br><br>maximum if additional formulae are included<br><br>maximum if balancing numbers added<br><br>do not allow upper case N /superscript 4 | <br><br><br><br>**(2)** |

| Question Number | Answer | Acceptable answers | Mark |
|---|---|---|---|
| **(b)** | An explanation linking<br><br>**First mark – relating concentration to time**<br>(as the concentration/amount of acid increases) the time (taken for the magnesium to react) decreases (1)<br><br>Ignore any reference to negative correlation<br>Ignore time gets faster/quicker<br><br>**Second mark – effect on rate**<br>(so){ the rate/it} increases/reaction becomes {faster/quicker} (1)<br><br>Ignore any reference to positive correlation | Reverse arguments if candidate has related time and rate to decreasing concentration of acid<br><br>{less/shorter} time | **(2)** |

| Question Number | | Indicative Content | Mark |
|---|---|---|---|
| **QWC** | ***(c)** | A description including some of the following points<br><br>**Experiment 1**<br>• measure volume of acid/stated volume<br>• measure mass of marble chips/stated mass<br>• add acid to marble or marble to acid in a suitable container eg flask, beaker, boiling tube, test tube<br>• collect the gas in a {gas syringe/measuring cylinder over water/ tube over water}/bubble gas through limewater/bubble gas through water<br>• measure {amount/volume} of carbon dioxide/count the bubbles/fixed volume of carbon dioxide<br>• measure mass/mass loss (on a balance)<br>• time/measure how long the reaction takes<br><br>**Experiment 2**<br>• do another experiment with different size marble chips<br>• use the same mass of marble chips<br>• use the same {volume/concentration/mass} of acid/same acid<br>• crush the marble/use powdered marble<br><br>**Results**<br>• smaller chips (of marble) have a more vigorous reaction/produce more {fizzing/bubbles} ORA<br>• smaller chips take less time to {react/produce a certain volume of gas /have a certain mass loss} ORA<br>• smaller chips have a larger surface area ORA<br>• smaller chips react faster ORA<br>• larger surface gives a faster reaction | **(6)** |

| Level | 0 | No rewardable content |
|---|---|---|
| 1 | 1 - 2 | • a limited description e.g. crush the marble chips/smaller marble chips give more fizzing<br>• the answer communicates ideas using simple language and uses limited scientific terminology<br>• spelling, punctuation and grammar are used with limited accuracy |
| 2 | 3 - 4 | • a simple description e.g. put marble chips and acid in a flask and repeat with the same mass of small marble chips / collect the gas in a syringe, smaller pieces of marble react faster<br>• the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately<br>• spelling, punctuation and grammar are used with some accuracy |
| 3 | 5 - 6 | • a detailed description e.g. put marble chips and acid in a flask, repeat the experiment with the same mass of crushed marble, crushed marble takes less time to react<br>• the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately<br>• spelling, punctuation and grammar are used with few errors |

**(Total for Question = 12 marks)**

(**Q06 1SC0/2CF, June 2014**)

Q16.

| Question Number | Answer | Mark |
|---|---|---|
| | **A** always higher<br><br>**The only correct answer is A**<br><br>***B*** *is not correct because temperature rise*<br><br>***C*** *is not correct because temperature always rises*<br><br>***D*** *is not correct because temperature rises* | **(1)**<br><br>AO 2 2 |

(**Q02 1SC0/2CF, June 2018**)

Q17.

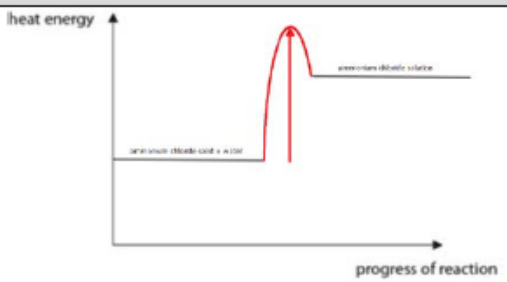
| | Answer | Acceptable answers | Mark |
|---|---|---|---|
| **(i)** | B displacement | | **(1)** |
| **(ii)** | Shown on diagram<br><br>• horizontal reactant line above product line (1)<br>• horizontal product line to right of reactant line (1) | lines must be correctly labelled eg reactants/Zn + $CuSO_4$ and products/ $CuSO_4$ and Cu | **(2)** |

| | | | |
|---|---|---|---|
| | | ignore any extra lines/curves/labels<br><br>if not drawn lines but just labels in correct relative positions max 1<br><br>If two lines drawn in correct positions but no labels max 1 | |

(**Q20 1SC0/2CH, June 2013**)

Q18.

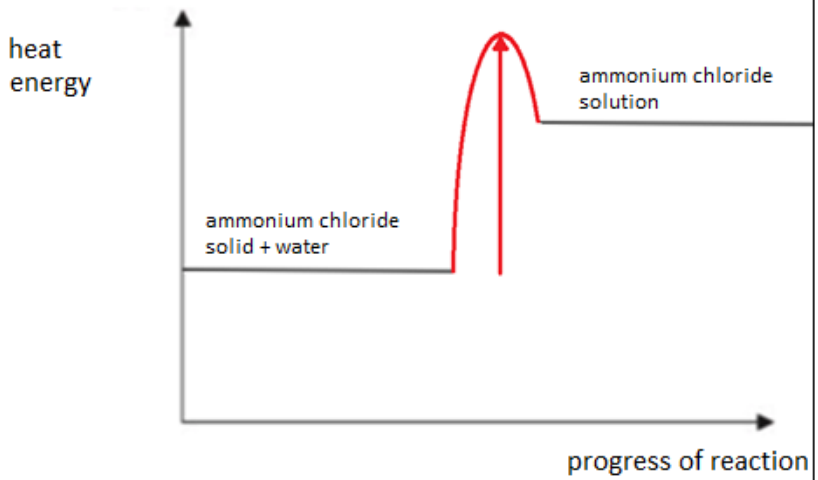
| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **(i)** | an explanation linking two of:<br><br>• {ammonium chloride solution/product} has more energy than {ammonium chloride solid and water/reactant} / ORA (1)<br><br>• heat (energy) has increased / energy change is positive (1)<br><br>• (therefore) heat energy has been {absorbed/taken in} (1) | ignore arguments about bond making / bond breaking | **(2)**<br><br>**AO3** |

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **(ii)** | <br>(2) | curve from reactants to products with peak higher than product energy (1)<br><br>arrow labelled activation energy on correct curve (1) | **(2)**<br><br>**AO2** |

(**Q05b 1SC0/2CF, Nov 2021**)

Q19.

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| (i) | an explanation linking two of:<br><br>• {ammonium chloride solution/product} has more energy than {ammonium chloride solid and water/reactant} / ora (1)<br><br>• heat (energy) has increased / energy change is positive (1)<br><br>• (therefore) heat energy has been {absorbed/taken in} (1) | ignore arguments about bond making / bond breaking | (2) AO3 |

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| (ii) | <br>(2) | curve from reactants to products with peak higher than product energy (1)<br><br>arrow labelled activation energy on correct curve (1) | (2) AO2 |

(**Q01b 1SC0/2CH, Nov 2021**)

Q20.

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| | an explanation linking<br><br>• bond breaking {endothermic/ requires energy} (1)<br><br>• bond forming {exothermic/ releases energy} (1)<br><br>• less energy is released (forming bonds) than is required (to break bonds) (1) | allow heat for energy<br>ignore number of bonds/ more bond breaking etc.<br><br>MP3 dependant on scoring **MP1 AND MP2**<br><br>energy needed to break bonds is more than energy released forming bonds (3) | (3)<br>AO1 1 |

(**QU05c 1SC0/2CH, June 2024**)

Q21.

| Question Number | Answer | Additional guidance | Mark |
|---|---|---|---|
| | An explanation linking<br><br>• temperature rises / increases (by 11 °C) (1)<br><br>• exothermic process (1) | <br><br>allow gets hotter / water heats up {temperature / it} goes up<br><br>Ignore heat increasing for MP1<br><br>allow heat / energy {given out / released to surroundings}<br><br>reject endothermic for MP2 | **(2)** |

(**Q03b 1SC0/2CF, June 2019**)

Q22.

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| | An explanation linking<br><br>• polystyrene is an insulator / poor conductor (of heat) (1)<br><br>• reduces {heat/energy} {loss/transfer} (1) | allow RA for glass<br>allow polystyrene has a higher specific heat capacity than glass<br><br>allow (polystyrene) {keeps heat in / doesn't absorb heat}<br>allow holds {warmth/heat} better (than glass)<br><br>ignore temperature stays in the cup ignore loss of heat through the top | **(2)**<br>**AO3-3** |

(**QU02c 1SC0/2CF, June 2023**)

Q23.

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| | an explanation linking<br><br>breaking bonds {needs energy/ endothermic} (1)<br><br>making bonds {releases energy/ exothermic} (1)<br><br>more energy is **given out** than is **taken in** (1) | allow heat for energy<br><br>ignore refs to energy level diagrams<br><br>ignore refs to number of bonds made/broken | **(3)** |

(**Q05b 1SC0/2CH, June 2019**)

Q24.

| Question Number | Answer | Additional guidance | Mark |
|---|---|---|---|
| | (top pan) balance (1) | allow (weighing) scale(s) | **(1)** |

Q25.

| Question number | Answer | Mark |
|---|---|---|
| **(i)** | A / thermometer | **(1) AO2 2** |

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **(ii)** | **beaker** | allow measuring beaker/ plastic beaker reject measuring cup/ jug | **(1) AO2 2** |

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **(iii)** | it is a (good heat) insulator | allow would hold / trap heat / keeps heat in / doesn't absorb heat / reduces heat loss / poor conductor<br><br>allow correct comparison of heat conductivity with glass e.g polystyrene is a better insulator than glass<br><br>ignore keeps temperature in / heat resistant ignore not breakable / glass is breakable<br>ignore 'traps energy' alone | **(1) AO2 2** |

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **(iv)** | -2.5℃ scores 3 with or without working<br><br>16.1 – 18.6 (1)<br><br>= -2.5 (1)<br><br>℃ (1) | 2.5℃ scores 2 with or without working<br>2.5 scores 1 with or without working<br><br>MP3 standalone mark<br><br>ignore 'C' / 'o' alone<br><br>ignore 'deg C' | **(3) AO2 1** |

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **(v)** | formula: $NH_4NO_3$ (1)<br><br>name: ammonium nitrate (1) | letters must be capitals and 4, 3 must be subscripts allow $NH_4^+NO_3^-$ allow $N_2H_4O_3$ ignore state symbols ignore $NH_4^+ + NO_3^-$<br><br>reject ammonia nitrate | **(2)**<br>**AO2 1** |

(**QU02b 1SC0/2CF, June 2019**)

Q26.

| Question number | Answer | Mark |
|---|---|---|
| **(i)** | A / thermometer | **(1)**<br>**AO2 2** |

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **(ii)** | **beaker** | allow measuring beaker/ plastic beaker reject measuring cup/ jug | **(1)**<br>**AO2 2** |

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **(iii)** | it is a (good heat) insulator | allow would hold / trap heat / keeps heat in / doesn't absorb heat / reduces heat loss / poor conductor<br><br>allow correct comparison of heat conductivity with glass e.g polystyrene is a better insulator than glass<br><br>ignore keeps temperature in / heat resistant ignore not breakable / glass is breakable ignore 'traps energy' alone | **(1)**<br>**AO2 2** |

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **(iv)** | -2.5℃ scores 3 with or without working<br><br>16.1 – 18.6 (1)<br><br>= -2.5 (1)<br><br>℃ (1) | 2.5℃ scores 2 with or without working<br>2.5 scores 1 with or without working<br><br>MP3 standalone mark<br><br>ignore 'C' / 'º' alone<br><br>ignore 'deg C' | **(3)**<br>**AO2 1** |

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **(v)** | formula: $NH_4NO_3$ (1)<br><br>name: ammonium nitrate (1) | letters must be capitals and 4, 3 must be subscripts allow $NH_4^+NO_3^-$ allow $N_2H_4O_3$ ignore state symbols ignore $NH_4^+ + NO_3^-$<br><br>reject ammonia nitrate | **(2)**<br>**AO2 1** |

(**QU02b 1SC0/2CF, June 2022**)

Q27.

| Question number | Answer | Mark |
|---|---|---|
| | An answer that combines the following points of application of knowledge and understanding to provide a logical description:<br><br>• use a thermometer (1)<br>• to measure initial and final temperature (1) | **(2)** |

(**Q02b 1SC0/2CF/S2, SAM**)

Q28.

| Question number | Answer | Mark |
|---|---|---|
| | endothermic | (1) |

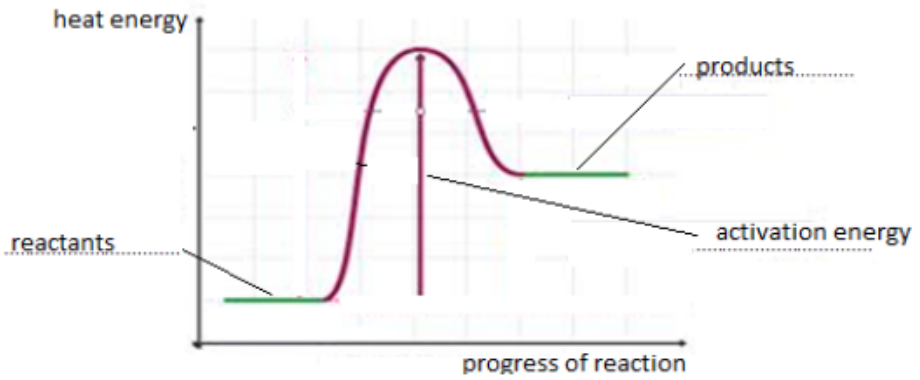
(**Q03a 1SC0/2CF, SAM 2016**)

Q29.

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| (i) | measuring cylinder / (volumetric) pipette / burette | ignore dropping pipette / beaker | (1) |

| Question number | Answer | Additional Guidance | Mark |
|---|---|---|---|
| (ii) | measure the initial temperature (of the water) | allow subtract initial temperature from final temperature<br>OR vice versa<br>allow temperature before mixing | (1) |

| Question number | Answer | Additional Guidance | Mark |
|---|---|---|---|
| (iii) | insulator / reduces heat transfer / poor conductor of heat | ignore references to heat loss | (1) |

| Question number | Answer | Mark |
|---|---|---|
| (iv) | • any one label correct (1)<br>• all three labels correct (1)<br> | (2) |

(**Q02b 1SC0/2CF, Nov 2020**)

Q30.

| Question number | Answer | Mark |
|---|---|---|
| | **B** endothermic | **(1)** |

(**Q02c 1SC0/2CF/S2, SAM**)

Q31.

| Question number | Answer | Mark |
|---|---|---|
| **(i)** | **C** energy is absorbed energy is released is the only correct answer.<br><br>**B, C** and **D** are incorrect because at least one energy change is reversed. | **(1)**<br>**AO1 1** |

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **(ii)** | • energy change in reactants = 436 + 158 (= 594) (1)<br>• energy change in products = 2 x 562 (= 1124) (1)<br>• overall energy change = 594 – 1124 (1)<br>• = -530 (1) (kJ $mol^{-1}$) | allow ECF throughout<br>ignore sign/unit in MP1<br>ignore sign/unit in MP2<br>MP3 for the difference between MP1 and MP2<br>ignore sign / unit in MP3<br>MP4 for correct sign or stating exothermic / endothermic based on MP3<br><br>(+)530 scores 3 marks (loses MP4)<br>(+)64 scores 3 marks (MP1 doubled)<br>-64 scores 2 marks (MP1 doubled and loses MP4)<br>(+)32 scores 3 marks (MP2 not doubled)<br>-32 scores 2 marks (MP2 not doubled and loses MP4) | **(4)**<br>**AO2 1** |

(**QU06a 1SC0/2CH, June 2022**)

Q32.

| Question Number | Answer | Mark |
|---|---|---|
| (i) | C  is the only correct answer<br><br>**A** is the hazard symbol for corrosive substances<br>**B** is the hazard symbol for substances that are harmful to the environment<br>**D** is the hazard symbol for flammable substances | (1) |

| Question Number | Answer | Additional guidance | Mark |
|---|---|---|---|
| (ii) | wear {goggles / **safety** glasses} / wear gloves | allow eye protection<br>ignore tie long hair back<br>ignore safety clothing / ppe | (1) |

(**Q03c 1SC0/2CF, June 2019**)

Q33.

| Question number | Answer | Mark |
|---|---|---|
| | **B** dissolving | (1) |

(**Q02a 1SC0/2CF/S2, SAM**)

Q34.

| Question number | Answer | Mark |
|---|---|---|
| | **B** endothermic is the only correct answer.<br><br>**A**, **C** and **D** are incorrect as all endothermic reactions absorb heat. | (1)<br>AO1<br>1 |

(**QU02a 1SC0/2CF, June 2024**)

Q35.

| Question number | Answer | Mark |
|---|---|---|
| (i) | Any one from:<br>• beaker (1)<br>• polystyrene cup (1)<br>• conical flask (1) | (1) |

| Question number | Answer | Mark |
|---|---|---|
| (ii) | Stir the mixtures with the thermometer | (1) |

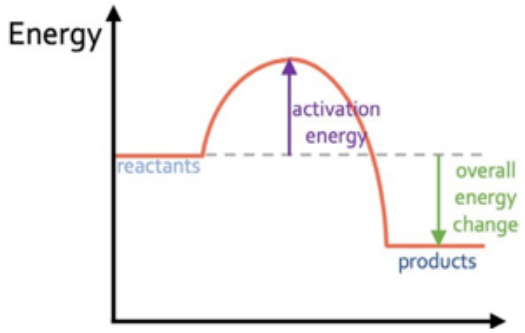
| Question number | Answer | Mark |
|---|---|---|
| (iii) | An explanation that combines identification via a judgement (1 mark) to reach a conclusion via justification/reasoning (1 mark):<br>• order of reactivity from most reactive to least reactive magnesium, zinc, (iron), copper (1)<br>• because the most reactive shows biggest temperature rise/least reactive shows lowest temperature rise (1) | (2) |

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| (iv) | An explanation that combines identification – improvement of the experimental procedure (1 mark) and justification/reasoning which must be linked to the improvement (1 mark):<br>• use magnesium, zinc and copper as powders (1)<br>• so they have the same/similar size particles/surface area/shape (1) | allow other acceptable answers, e.g. use same mass / no moles of each | (2) |

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| (v) | 1000 $cm^3$ contain $\frac{6.2 \times 1000}{50}$ (1)<br>1 $dm^3$ contains 124 ($g\,dm^{-3}$) (1) | Award full marks for correct numerical answer without working. | (2) |

(**Q03b 1SC0/2CF, SAM 2016**)

Q36.

| Question number | Answer | Additional Guidance | Mark |
|---|---|---|---|
| | <br>(3)<br>y axis: 'energy' (1)<br><br>shape: products line below reactants line with activation energy peak (1)<br><br>labels: {energy change / ΔH / -400} **and** activation energy labelled with arrows (1) | axis:<br>allow heat energy / energy level.<br>Ignore any units.<br>reject 'energy change'<br><br>shape:<br>can consist of straight lines<br>energy levels do not need labelling but penalise if reactants & products are the wrong way round<br><br>labels:<br>allow any unambiguous labelling of activation energy and energy change.<br>ignore direction of arrows.<br><br>endothermic graph can score MP1 and MP3 | **(3)**<br>**AO1-1** |

(**QU04c 1SC0/2CH, June 2025**)

Q37.

| Question Number | Answer | Additional guidance | Mark |
|---|---|---|---|
| | use a **measuring cylinder** | allow pipette/ burette<br><br>ignore syringe , measuring jug/tube etc. | **(1)**<br>AO 3 3a |

(**Q03 1SC0/2CF, June 2018**)

Q38.

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| | thermometer | | **AO2 2 (1)** |

(**QU02a 1SC0/2CF, June 2025**)

Q39.

| Question number | Answer | Marks |
|---|---|---|
| | An answer that combines the following points to provide a plan:<br>• measure known volume of sodium hydroxide solution (1)<br>• add same volume of each of the acids (1)<br>• stir the mixture (1)<br>• record the initial and final temperatures/temperature change (1) | **(4)** |

(**Q06b 1SC0/2CH, SAM 2016**)

Q40.

| Question number | Answer | Mark |
|---|---|---|
| | Any two suggestions from the following:<br>• (same) volume of water (1)<br>• (same) mass of solid (1)<br>• (same rate of) stirring (1) | **(2)** |

(**Q02d 1SC0/2CF/S2, SAM**)