01. 0620_s12_ms_62 Q: 5

(a) temperature boxes correctly completed (2) 21, 25, 26, 27, 27, 26, 25 [2]

(b) temperature boxes completed correctly (2) 20, 19, 18, 17, 17, 18, 19 [2]

(c) all points correctly plotted (3), –1 for any incorrect
smooth line graphs (2)
labels (1) [6]

(d) **(i)** value from graph (1) allow: ±1/2 small square shown clearly (1) [2]

(ii) value from graph (1) allow: ±1/2 small square shown clearly (1) [2]

(e) endothermic (1) **ignore**: temperature decreases [1]

(f) lower temperature (change)/halved (1) **ignore**: reference to rate/time [1]

(g) room temperature/initial temperature from table/20°C/21°C (1) **ignore**: 25°C
reaction finished/owtte (1) [2]

(h) more readings/more points (1)
more reliable/more accurate (1) ignore: precise
can spot anomalous points or errors (1)
smoother graph/owtte (1) any [2]

[Total: 20]

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02. 0620_s13_ms_61 Q: 5

(a) both lose mass (1) [1]
not: change mass

(b) mass loss increases constantly in graph **A** (1)

becomes constant in graph **B** (after about 7–9 hours) (1)

mass loss or change is greater in acid/less in alkali (1) [3]

(c) goggles / lab coat / tongs / fume cupboard / well ventilated area any two [2]
ignore: reference to hair

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03. 0620_s13_ms_61 Q: 6

weigh mixture (1)

add excess (1) sulfuric acid (1)

heat / stir (1)

filter (1) wash (1) dry (1) the carbon / residue

reweigh(1) calculate percentage (1) max 6 [6]

will not work = 0
ignore: details of evaporation of copper sulfate solution
note: must have at least one weighing for 6 marks

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04. 0620_s13_ms_62 Q: 5

(a) thermometer diagrams completed correctly (3) –1 each incorrect

23, 29, 35, 41, 39, 35, 31 **ignore:** decimal places [3]

(b) points plotted correctly (3), –1 each incorrect

two intersecting straight lines (1) [4]
allow: lines extending beyond intercept but must be just two lines and no curves

(c) 16 (cm^3) ±0.5 (1) any indication (1) [2]

(d) 23 (°C) (1) [1]

(e) good insulator or reference to minimising heat losses (1) [1]

(f) reaction produced heat or energy (1) **accept:** reaction is exothermic

reaction finished / reactant(s) used up / KOH used up / neutralised (1)
not: acid used up/ neutralised [2]

(g) exothermic (1) [1]

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05. 0620_s18_ms_62 Q: 2

(a)	initial temperatures all 21 **AND** final temperatures 18, 17, 15	**1**
	temperature changes –3, –4, –6	**1**
(b)	initial temperatures 22, 22, 21, 22 **AND** final temperatures 26, 27, 29, 33	**1**
	temperature changes +4, +5, +8, +11	**1**
(c)	all points plotted correctly (□ half a small square)	**2**
	best-fit straight-line graphs	**1**
	labels **D** (upper) **and C** (lower) or (expt.) 2 and 1	**1**

(d)	value from graph, –8 °C	**1**
	extrapolation	**1**
(e)	exothermic	**1**
(f)	room temperature / 21 °C / 22 °C	**1**
	heat lost to surroundings	**1**
(g)	half as much	**2**
(h)	change in apparatus or method e.g. use a pipette / burette or use insulation / lid	**1**
	explanation e.g. as more accurate / precise, than a measuring cylinder / reduce heat losses	**1**
(i)	repeat experiments	**1**
	compare / average	**1**

06. 0620_s18_ms_63 Q: 2

(a)	all temperature boxes completed correctly: 21, 23, 25, 27, 29, 31, 30, 29, 28	**2**
(b)	all points plotted correctly (□ half a small square)	**1**
	best-fit intersecting straight-line graphs	**1**
(c)	temperature boxes completed correctly: 21, 26, 31, 32, 31, 30, 29, 28, 27	**2**
(d)	all points plotted correctly	**1**
	best-fit intersecting straight-line graphs	**1**
(e)(i)	value from graph where lines cross: 12 cm^3	**1**
	shown clearly at intersection	**1**

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(e)(ii)	half volume of acid	1
	less / half as many moles of sodium hydroxide present	1
(f)	exothermic / heat given out	1
(g)(i)	to remove traces of acid / clean / remove impurities	1
(g)(ii)	to remove traces of water	1
(h)	sources of error using a measuring cylinder or heat losses	1
	improvement use a pipette / use a burette / lag / insulation / lid	1

07. 0620_w12_ms_62 Q: 4

(a) Table of results for Experiment 1
temperature boxes completed correctly (3), –1 any incorrect

23 27 31 34 36 35 34 33 32 [3]

(b) Table of results for Experiment 2
temperature boxes completed correctly (3), –1 for each incorrect

23 28 32 35 37 38 39 38 36 [3]

(c) all points correctly plotted ±1/2 small space(3) –1 for any incorrect
best fit smooth line graphs (2)
labels (1) [6]

(d) value from graph ,29–30 °C (1)
shown clearly (1) [2]

(e) exothermic (1) [1]

(f) **(i)** experiment 2/acid H (1) [1]

(ii) acid (H) is more concentrated/stronger (1) [1]

(g) room/initial temperature from table/23 °C (1)
reaction finished/owtte (1) [2]

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(a) Table of results
temperature boxes completed correctly (3)
all 7 correct (3)
6 correct (2)
5 correct (1)
4 or fewer correct (0)

26 35 45 54 56 52 48 [3]

(b) all points correctly plotted (3)
all 7 correct (3)
6 correct (2)
5 correct (1)
4 or fewer correct (0)
two intersecting straight line graphs drawn with a ruler (1) [4]

(c) (i) value from graph, 50 (°C) (1) ± 1
shown clearly (1) [2]

(ii) value from graph, 34 ± 1 (1)
unit cm^3 (1)
shown clearly (1) [3]
note: if tie-line not to peak of graph, max 1, for unit.

(d) sodium hydroxide (1)
less volume used than acid / volume of acid used was greater (1) [2]

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(e) exothermic (1) [1]

(f) room / initial temperature / 26 °C (1)
ignore: 20 °C
reaction finished owtte (1) [2]

(g) repeat (1)
compare results (1) [2]
allow: take mean / average (1)
ignore: references to insulation

---

09. 0620_w15_ms_63 Q: 3

(a)	all temperatures correctly recorded: 30, 35, 33, 29 4 correct = 2 3 correct = 1 2 or fewer correct = 0 temperature rises: 5, 10, 8, 4;	**2** **1**	**I:** trailing zeros **I:** trailing zeros
(b)	idea of fair test / comparability of results / only one variable / control (variable);	**1**	
(c)	4 points plotted correctly, ± half a small square; **two** intersecting straight lines drawn with a ruler; through points 1 and 2 **and** 3 and 4, extrapolated to intersect;	**1** **1** **1**	**I:** origins
(d)(i)	11 °C;	**1**	ecf from the graph, ± 0.1 °C **I:** absence of arrow
(d)(ii)	C = 28 **and** D = 22; cm^3;	**1** **1**	ecf from the graph, C + D = 50
(e)	22 (°C) / 2 × value from **(d)(i)**;	**1**	answer must be a number **I:** units / lack of units

10. 0620_w16_ms_63 Q: 2

(a)	table of results for Experiment 1 temperature boxes completed correctly 20, 20, 20, 25, 28, 31, 33, 34, 35, 36, 36	**2**
(b)	table of results for Experiment 2 temperature boxes completed correctly 22, 22, 22, 71, 76, 75, 72, 70, 67, 65, 64	**2**
(c)	all points correctly plotted ± half a small square smooth line graphs labelled	**2** **1** **1**
(d)(i)	working shown clearly as construction lines or cross value from graph (29–30 °C ± 0.5 °C)	**1** **1**
(d)(ii)	value from graph (72 s) –60 s	**1** **1**
(e)	room temperature or initial temperature from table (20–22 °C) reaction has finished / stopped	**1** **1**
(f)	more readings / points / data smoother curve / better or more accurate graph	**1** **1**
(g)	polystyrene is an insulator / copper is a (good) conductor reduced heat losses	**1** **1**

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11. 0620_w17_ms_62 Q: 2

(a)	initial and final temperature boxes completed: 21, 21, 21, 32, 37, 48 all readings correct = [2] 4 or 5 readings correct = [1]	**2**
(b)	initial and final temperature boxes completed: 23, 23, 23, 23, 20, 18, 16, 12 all readings correct = [2] 6 or 7 readings correct = [1]	**2**
(c)	all points plotted	**2**
	two straight lines of best fit drawn with a ruler	**1**
	both graphs appropriately labelled	**1**
(d)(i)	value from graph	**1**
	shown clearly	**1**
(d)(ii)	value from graph	**1**
	shown clearly	**1**
(e)	exothermic	**1**
(f)	*change to the experiments* use burette / pipette use insulation / lid use a new cup / dry the cup	**1**
	explanation (to match change) more accurate (than measuring cylinder) reduce heat losses remove water left from the previous experiment	**1**
(g)	repeat experiments	**1**
(h)	lower temperatures measured / smaller temperature changes	**1**
	changed is halved / more water (to heat)	**1**

12. 0620_w17_ms_63 Q: 2

(a)	temperature boxes completed: 23, 16, 14, 13, 12, 11, 11, 11, 11, 11 all readings correct = [2] 8 or 9 readings correct = [1]	**2**
(b)	temperature boxes completed correctly: 22, 26, 29, 31, 32, 33, 34, 35, 35, 35 all readings correct = [2] 8 or 9 readings correct = [1]	**2**
(c)	all points plotted	**1**
	two smooth line graphs (one line graph correct = [1])	**2**
	both graphs appropriately labelled	**1**
(d)(i)	value from graph	**1**
	shown clearly	**1**

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<table>
<tr><td>(d)(ii)</td><td>value from graph</td><td>1</td></tr>
<tr><td></td><td>shown clearly</td><td>1</td></tr>
<tr><td>(e)</td><td>exothermic</td><td>1</td></tr>
<tr><td>(f)</td><td>room temperature / 22 °C
AND
reaction has finished / all the solid has dissolved</td><td>1</td></tr>
<tr><td>(g)</td><td><table><tr><th>source of error</th><th>improvement</th></tr><tr><td>heat losses</td><td>use a lid / lag the apparatus</td></tr><tr><td>use of a measuring cylinder</td><td>use a pipette/burette</td></tr><tr><td>wet cup in the second experiment</td><td>use new/another cup OR dry the cup</td></tr><tr><td>the solid absorbs water from the air</td><td>store in a sealed container / airtight container / desiccator</td></tr><tr><td>only done once</td><td>repeat and average</td></tr><tr><td>different masses of solids used / masses of solids not measured</td><td>use same mass of solid / weigh the solids</td></tr></table></td><td>4</td></tr>
<tr><td>(h)</td><td>fewer data / less detail / fewer readings / graph not as good / not enough readings whilst the solid is reacting</td><td>1</td></tr>
</table>

13. 0620_w18_ms_62 Q: 4

<table>
<tr><td></td><td>Any 4 from

□ Measured volume of dilute hydrochloric acid
□ Use of suitable container (e.g. test tube / beaker / flask / plastic cup)
□ Initial temperature of acid
□ Add known mass of solid C
□ Final temperature of mixture / Calculate temperature change
□ Repeat with (same mass / moles of) solid D

And

□ Bigger temperature change is bigger energy change
□ Temperature increase is exothermic / temperature decrease is endothermic process</td><td>Max 6</td></tr>
</table>

14. 0620_w19_ms_62 Q: 2

<table>
<tr><td>(a)</td><td>table of results for Experiment 1
temperature boxes completed correctly

22, 24, 25, 26, 27, 27, 26</td><td>2</td></tr>
<tr><td>(b)</td><td>table of results for Experiment 2
temperature boxes completed correctly

21, 15, 12, 11, 10, 10, 11</td><td>2</td></tr>
</table>

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(c)	all points plotted correctly	1
	two smooth line graphs	1
	both labelled	1
(d)(i)	initial temperature minus 3 °C, 18 °C	1
	value from graph	1
	with clear indication	1
(d)(ii)	graph for Experiment 1 extended downwards	1
	correct temperature value	1
(e)	endothermic, temperature decreases	1
(f)	two sources of error: e.g. heat losses / use of a measuring cylinder / imprecise thermometer / temperature not accurate / experiment only done once / readings taken every 30 s	2
	two improvements: e.g. use a lid / lag the apparatus / use a pipette / burette / use more accurate / precise thermometer / repeat and average / compare / take readings at shorter intervals to get smoother graph	2

15. 0620_w19_ms_63 Q: 4

	any **six** from: □ known volume / amount of (distilled) water □ initial temperature (of water before solid is added) □ add measured mass / stated mass of potassium nitrate or ammonium chloride □ stir / mix / dissolve / swirl / shake □ final temperature of solution / temperature every 30 s □ repeat with (same mass of) other solid (and volume / amount of water) OR measured mass of other solid □ greater temperature change / decrease OR lowest final temperature is larger energy change / calculate energy change per gram	**Max 6**

16. 0620_w21_ms_63 Q: 2

Question	Answer	Marks
(a)	**M1 and M2** all temperature recorded correctly (43.0, 49.0, 51.0, 52.0, 51.0, 49.5, 48.0, 46.5). If seven correct score 1 mark	2
	M3 all temperature changes calculated correctly (20.0, 26.0, 28.0, 29.0, 28.0, 26.5, 25.0, 23.5)	1
(b)	**M1** all temperature recorded correctly (33.0, 38.0, 41.5, 42.0, 41.0, 40.0, 39.0, 38.0)	1
	M2 all temperature changes calculated correctly (9.0, 14.0, 17.5, 18.0, 17.0, 16.0, 15.0,14.0)	1
	M3 all temperatures and changes in experiment 2 recorded to 1 dp	1
(c)	**M1** suitable scale for y-axis	1
	M2 M3 plotting – all 16 correct scores 2, 14 or 15 correct scores 1	2
	M4 best fit curves for both experiments	1
	M5 correct labels	1
(d)	**M1** correct working shown	1
	M2 Value read correctly from graph (correct line gives 28.5-29.0)	1
(e)	**M1** room temperature / 24	1
	M2 reaction over	1
(f)(i)	insulator	1
(f)(ii)	temperature changes lower / temperatures lower	1
(g)	change: use a pipette / burette	1
	explanation: more accurate than a measuring cylinder **OR** change: use a lid explanation: reduces heat loss	1

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