AQA GCSE Physics | 8463

SPECIFICATION POINT 4.3.2.3

Changes of state and specific latent heat

Mark schemes and examiner comments

Tier	**Higher**
Question groups	**9**
Available paper years	**2007–2025**

Using this booklet

1. Booklet answer numbers match the question booklet.
2. Use the original question number within marking tables.
3. Examiner comments are included where available.

Name: _____ **Date:** _____

Where a precise marking extract is unavailable, the full source document is included in an appendix. Any missing mark scheme is explicitly identified.

4.3.2.3 Changes of state and specific latent heat

Answer 01 · Mark scheme

January 2007 | PHY1H | Original Q1 | Legacy

No matching mark scheme was available in the supplied archive for this question.

Answer 02 · Mark scheme

November 2009 | PHY1AP | Original Q3 | Legacy

Three	**4**	**2**	**3**	**4**

4.3.2.3 Changes of state and specific latent heat

Answer 03 · Mark scheme

January 2011 | PHY1H | Original Q5 | Legacy

Question 5

question	answers	extra information	mark
5(a)(i)	conduction		1
5(a)(ii)	free / mobile electrons gain (kinetic) energy free electrons collide with other (free) electrons / ions / atoms / particles	accept free / mobile electrons move faster an answer in terms of atoms / particles gaining (kinetic) energy (and) colliding with / vibrating and passing energy to other atoms / particles gains **1** mark only answers in terms of heat particles negate	1 1
5(a)(iii)	convection		1
5(b)(i)	**A** and **C** **or** **B** and **D** only one (independent) variable **or** different shapes but the same colour	this mark only scores if a correct pair is chosen **and** a correct reason given both required and none other both required and none other accept only the shape changes	1

Question 5 continues on the next page . . .

PHY1H

Question 5 continued . . .

question	answers	extra information	mark
5(b)(ii)	**B** radiates heat faster **or** **B** is a better emitter (of heat) but **B** has a smaller (surface) area **or** **B** has a smaller (surface) area: volume ratio	converse answer in terms of **A** gains full marks allow **2** marks for both lose the same quantity / amount of heat in the same time **or** both have same rate of heat loss allow **1** mark for both lose the same quantity / amount of heat	1 1
5(b)(iii)	any **one** from: • transfer a lot of heat (too rapidly) • water temperature drops too rapidly • water too cold for the next radiator	 accept (significantly) more heat will be lost from the first radiator mention of absorption of heat negates mark	1
Total			**8**

4.3.2.3 Changes of state and specific latent heat

Answer 03 · Mark scheme January 2011 | PHY1H | Original Q5 | Legacy

PHY1H

4.3.2.3 Changes of state and specific latent heat

Answer 04 · Mark scheme

June 2019 | 8463/1H | Original Q8

Question 8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
8.1	Initial temperature was a control variable		1	WS3.7 4.3.2.2 AO3
8.2	copper greater change in mass (than the other metals)	 this mark is dependent on scoring the first mark allow more ice melted (than the other metals) allow the ice melted faster (than the other metals)	1 1	4.1.2.1 AO3
8.3	variation in initial mass of ice cube **or** surface area of the ice cube touching the metal	allow variation in initial volume of ice cube allow melting of ice while handling allow variation in room temperature allow initial temperature of metal block	1	WS3.7 4.1.2.1 AO3

4.3.2.3 Changes of state and specific latent heat

Answer 04 · Mark scheme

June 2019 | 8463/1H | Original Q8

8.4	$E = m \times 2100 \times 15$ $E = m \times 334\ 000$ $5848 = 31\ 500\ m + 334\ 000\ m$ **or** $5848 = 365\ 500\ m$ $m = \frac{5848}{(31\ 500 + 334\ 000)}$ **or** $m = \frac{5848}{(365\ 500)}$ $m = 0.016$ (kg)	an answer of 0.016 (kg) scores **5** marks allow **2** marks for an answer that rounds to 0.186 or 0.0175 if no other mark scored allow **1** mark for either $5848 = m \times 2100 \times 15$ **or** $5848 = m \times 334\ 000$	1 1 1 1 1	4.3.2.2 4.3.2.3 AO2
Total			**9**	

4.3.2.3 Changes of state and specific latent heat

Answer 05 · Mark scheme

November 2021 | 8463/1H | Original Q11

Question 11

Question	Answers	Extra information	Mark	AO / Spec. Ref.
11.1	the gradient for ice is steeper than the gradient for water (liquid) which means that less energy is needed to increase the temperature by a fixed amount	allow the temperature of the ice increased faster than the temperature of the water	1 1	AO3 4.3.2.2
11.2	water took more time to vaporise than the ice took to melt which means that less energy is needed to change the state from solid to liquid (than from liquid to vapour)		1 1	AO3 4.3.2.3
11.3	any **two** from: • ice/water would take more time to increase in temperature • ice/water would take more time to change state • the change in temperature with time would not be linear	allow gradients would be less steep allow horizontal lines would be longer	2	AO3 4.3.2.2 4.3.2.3 RPA1

4.3.2.3 Changes of state and specific latent heat

Answer 05 · Mark scheme

11.4	E = 69 000 (J)		1	AO2 4.3.2.3
	69 000 = 0.030 × L	allow a correct substitution of an incorrectly/not converted value of E	1	
	$L = \frac{69\,000}{0.030}$	allow a correct rearrangement using an incorrectly/not converted value of E	1	
	L = 2 300 000 **or** $L = 2.3 \times 10^6$	allow a correct calculation using an incorrectly/not converted value of E	1	
	J/kg	allow a unit consistent with their numerical answer eg 2300 kJ/kg	1	

Total			**11**

4.3.2.3 Changes of state and specific latent heat

Answer 06 · Mark scheme

June 2022 | 8463/1H | Original Q8

Question 8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.1	measuring cylinder	allow burette allow beaker with scale / graduations	1	AO3 4.3.2.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.2	boiling water		1	AO3 4.3.2.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.3	change in mass = 0.009 (kg)		1	AO2
	25 200 = 0.009 L	allow a correct substitution using an incorrectly calculated value of m	1	AO2
	$L = \frac{25\,200}{0.009}$	allow a correct rearrangement using an incorrectly calculated value of m	1	AO2 AO2
	$L = 2.8 \times 10^6$ or $L = 2\,800\,000$	allow a correctly calculated answer using an incorrectly calculated value of m	1	AO1 4.3.2.3
	J/kg	if a unit other than J/kg is given it must match the numerical answer	1	

4.3.2.3 Changes of state and specific latent heat

Answer 06 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.4	less energy (than 25 200 J) was transferred to the water (so) student's value of *L* was too high	 2nd mark conditional on scoring 1st mark	1 1	AO3 4.3.2.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.5	the measured change in mass is too high (for the energy supplied) (so) student's value of L is too low	allow a smaller mass of water actually changed state at boiling point 2nd mark conditional on scoring 1st mark	1 1	AO3 4.3.2.3

Total Question 8		**11**

4.3.2.3 Changes of state and specific latent heat

Answer 07 · Mark scheme

June 2023 | 8463/1H | Original Q3

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	polarity of the potential difference doesn't change	allow direction of the potential difference doesn't change	1	AO1 4.2.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	$E = QV$		1	AO1 4.2.4.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.3	$5010 = Q \times 12$ $Q = \frac{5010}{12}$ $Q = 417.5$ (C)	 allow 418 (C)	1 1 1	AO2 4.2.4.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.4	$5010 = 0.015 \times L$ $L = \frac{5010}{0.015}$ $L = 334\,000$ (J/kg)		1 1 1	AO2 4.3.2.3

4.3.2.3 Changes of state and specific latent heat

Answer 07 · Mark scheme

June 2023 | 8463/1H | Original Q3

Question	Answers	Mark	AO / Spec. Ref.
03.5	**Level 3:** Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.	5–6	AO1 4.3.1.1 4.3.2.1
	Level 2: Relevant points (reasons / causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear.	3–4	
	Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.	1–2	
	No relevant content	0	
	Indicative content • particles in a solid are in a regular pattern • particles in a liquid are in a random arrangement • particles in a solid are vibrating about fixed positions • particles in a liquid are moving freely • as the ice changes to water the temperature remains constant • because as the ice changes to water the potential energy of the particles increases • as the water warms the particles move faster • so the kinetic energy of the particles increases • internal energy is the total kinetic and potential energy of all the particles ignore any references to density of ice vs liquid water ignore any references to spacing of particles		

Total Question 3	14

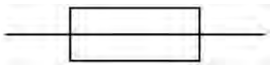
4.3.2.3 Changes of state and specific latent heat

Answer 08 · Mark scheme

June 2024 | 8463/1H | Original Q10

Question 10

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.1	brown		1	AO1 4.2.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.2			1	AO1 4.2.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.3	t = 0.400 (s)		1	AO2 4.2.1.2
	2.0 = I × 0.400	allow a correct substitution of an incorrectly / not converted value of t	1	
	$I = \frac{2.0}{0.400}$	allow a correct rearrangement using an incorrectly / not converted value of t	1	
	I = 5.0 (A)	allow an answer consistent with an incorrectly / not converted value of t	1	

4.3.2.3 Changes of state and specific latent heat

Answer 08 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.4	L = 60 000 (J/kg)	allow full credit for a correct method using E = 0.00102 (kJ)	1	AO2 4.3.2.3
	1.02 = m × 60 000	allow a correct substitution of an incorrectly / not converted value of L	1	
	$m = \frac{1.02}{60\,000}$	allow a correct rearrangement using an incorrectly / not converted value of L	1	
	m = 1.7 × 10^{-5} (kg)	allow an answer consistent with an incorrectly / not converted value of L	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.5	time taken would increase		1	AO3
	more energy would need to be transferred (in total)	MP2 dependent on scoring MP1	1	AO1 4.1.2.1 4.3.2.3

Total Question 10	**12**

4.3.2.3 Changes of state and specific latent heat

Answer 09 · Mark scheme

June 2025 | 8463/1H | Original Q8

Question 8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.1	m = 0.050 (kg)	all subsequent marks can score using an incorrectly / not converted value of m	1	AO2 4.3.2.3
	9950 = 0.050 × L		1	
	$L = \frac{9950}{0.050}$		1	
	L = 199 000 (J/kg)		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.2	the potential energy of the particles increases		1	AO1 4.3.2.1
	(but) the kinetic energy of the particles does not change (as temperature does not change)		1	
	(so the) internal energy increases	MP3 dependent on MP1 **and** MP2	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.3	the *(mean)* kinetic energy of the gas particles increased	allow the *(mean)* speed of the gas particles increased	1	AO1 4.3.3.1
	(so) particles exert a greater force on the walls of the container during each collision		1	
	(and) the frequency of collisions of the particles and the walls of the container increases	allow 'rate of' for 'frequency'	1	
	(so) pressure increases	this mark is dependent on scoring at least 1 other mark	1	

Total Question 8	11

Question 11

Question **11.1** was answered poorly, with many students mixing up specific heat capacity and specific latent heat in their answers, and referring to incorrect parts of the graph. Around a third of students scored a mark on **11.2** and **11.3**. Question **11.4** discriminated well with a good spread of marks. The unit conversion was often performed incorrectly, which led to a 'power of ten' error and prevented students gaining a mark. Few students gave the correct unit, even though the equation needed is on the equations sheet.

Concluding Remarks

This paper was broadly similar to papers from previous series. The errors that students made in calculations were common errors, usually involving incorrect unit conversions or failing to convert units.

An area of the specification that stood out as being particularly poorly answered was section 4.2 which was tested in the Required Practical Activity in question 3 and again in question 10.

Most of the students understand the importance of showing clear working out when completing a calculation. This is crucial in the more complex calculations.

Similar to previous series, a significant number of the students were unable to read values from graphs accurately and failed to realise when numerical values were not given in standard SI units.

4.3.2.3 Changes of state and specific latent heat

Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the Results Statistics page of the AQA Website.

4.3.2.3 Changes of state and specific latent heat

Answer 07 · Examiner comments

June 2023 | 8463/1H | Original Q3

Question 3 (Standard Demand)

03.1 Very few correct answers, only 11 % of students scored a mark. Many students gave answers in terms of charge flow and current which were insufficient. The specification does not mention alternating or direct current, only alternating or direct p.d. Answers like ‘ the potential difference flows in one direction’ were insufficient to score.
. Saying the potential difference only travels/goes in one direction was insufficient, as this suggested charge flow. Saying that ‘the potential difference is always positive’ or ‘the potential difference doesn’t go negative’ were creditworthy. ‘The potential difference is in one direction’ was creditworthy. ‘The potential difference isn’t alternating’ was insufficient.

03.2 Almost all students answered correctly. In this exam series, students were provided with all the equations on an Equations Sheet.

03.3 98% of students scored 3 marks on this calculation question

03.4 95% of students scored 3 marks. A small minority of students scored 2 marks, usually due to a spurious conversion of mass from kg to g.

03.5 To score in Level 2, students needed to make comparisons of the movement and arrangement of particles in ice and liquid water. In addition to this, for students to score a Level 3 mark they needed to discuss either the change of state at constant temperature increasing the potential energy of the particles or how the warming of liquid water increased the kinetic energy of the particles. For 6 marks, both these aspects needed discussion. Students found this question difficult with only 9 % scoring 5 or 6 marks and48 % scoring 3 or 4 marks. The mean mark was 3.

4.3.2.3 Changes of state and specific latent heat

Answer 08 · Examiner comments

June 2024 | 8463/1H | Original Q10

Question 10 (Standard/High Demand)

10.1 72% of students correctly identified the colour of the live wire insulation.

10.2 66% of students scored the mark on this question. Students who made the box for the answer into a fuse symbol did not score the mar nor did a fuse symbol added to any side of the box .

.

10.3 A grade 6-7 calculation of current. 57% of students scored all 4 marks. 36% of students scored 3 marks, usually for incorrectly converting, or not converting, the unit.

10.4 A grade 6-7 calculation of mass. 61% of students scored 4 marks. 31% of students scored 3 marks for either incorrectly converting, or not converting, the unit.

10.5 40% of students scored 2 marks on this question recognising that the time would be longer because more energy in total would need to be transferred. An answer of 'less energy is melting the wire' was just enough to score the second mark. 15% of students scored zero on this question.

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4.3.2.3 Changes of state and specific latent heat

Answer 08 · Examiner comments

Mark Ranges and Award of Grades

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4.3.2.3 Changes of state and specific latent heat

Answer 09 · Examiner comments June 2025 | 8463/1H | Original Q8

08.1

Just fewer than 90 % of the students scored 4 marks on this calculation of specific latent heat. Students who did not convert or incorrectly converted the mass could score a maximum of 3 marks.

08.2

Most students did not refer to the energy of the particles in terms of kinetic and potential energy, so scoring no marks. Many students thought the kinetic energy of the particles changed which limited them to scoring only the first marking point. Only about 3 % of the students scored 2 or 3 marks, while just over 10 % of the students scored 1 mark.

08.3

Students made good attempts at answering this challenging question about gas pressure. Technical accuracy was important for the second and third marking points, so it needed to be clear that particle collisions with the container walls were more frequent, more often or at a greater rate of collision. More frequent collisions between particles was insufficient for the second mark. The third marking point needed to reference the forces involved in collisions with the container walls, an implied greater force per collision was acceptable, but not a macroscopic force linked to force and area as that was not being tested. Almost half of the students scored 3 or 4 marks, while almost 40 % of the students scored 1 or 2 marks.

4.3.2.3 Changes of state and specific latent heat

AQA

GCSE
PHYSICS

8463/1H: Paper 1 (Higher tier)
Report on the Examination

8463
June 2022

Version: 1.0

4.3.2.3 Changes of state and specific latent heat

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4.3.2.3 Changes of state and specific latent heat

General

Grade 4-5 calculation questions ask for students to recall an equation, before using it in a subsequent calculation. In the 2022 series, students were given an Equations Sheet which had all the equations printed on it. Subsequently, the performance on the more straightforward calculations has improved on previous years.

The multistep calculations targeted at candidates working at grades 8-9, questions **09.1** and **10.1**, were well attempted with many students answering correctly. Of these two questions, students were slightly more successful on question **09.1** with about 55% of students scoring full marks, whereas for question **10.1** approximately 45% of students scored full marks.

Question **02.1** was generally well attempted and students who had carried out the density required practical had an advantage over those who hadn't. For this question, about 35% of students scored 6 marks and approximately 25% of students scored 5 marks.

Handwriting continues to be a problem for a number of students, making it very difficult for examiners to read what has been written. Students who have handwriting that is difficult to read may benefit from a scribe or from word processing their answers in exams.

Question 11

Due to incorrect Advance Information guidance being issued for this question, and to avoid students being disadvantaged, Question 11 was discounted and all students were awarded full (9) marks.

Levels of demand

Questions are set at three levels of demand for this paper:

- **Standard demand** questions are designed to broadly target grades 4–5.
- **Standard/high demand** questions are designed to broadly target grades 6–7.
- **High demand** questions are designed to broadly target grades 8–9.

A student's final grade, however, is based on their attainment across the qualification as a whole, not just on questions that may have been targeted at the level at which they are working.

4.3.2.3 Changes of state and specific latent heat

Question 1 (Standard demand)

01.1 About 55% of students scored 2 marks. The unit conversion caused a problem for many students and powers of 10 errors were frequently seen. A correct calculation using an incorrectly or not converted value for power would score 1 mark.

01.2 Students were generally successful at answering this question with approximately 40% scoring 2 marks and about 50% scoring 1 mark. Most students wrote variations of the first and third bullet points in the markscheme. A number of students wrote that the turbines may be broken, which was enough to score a mark for the idea of maintenance.

01.3 'Turbine will rotate faster' was insufficient to score a mark. 'Rotate more smoothly' was not enough to score the 'less friction' mark. Students who stated that 'no energy was wasted' did not score the second marking point. Approximately 35% of students scored 3 marks, 35% of students scored 2 marks and 20% of students scored 1 mark.

01.4 About 30% of students scored 2 marks, while approximately 50% of students scored 1 mark. Many students answered in terms of 'saving energy' which was insufficient. Other students answered in terms of absolute statements which did not score, 'energy efficient appliances waste no energy' for example.

Question 2 (Standard demand)

02.1 Generally very well answered with about 35% of students gaining 6 marks and 25% scoring 5 marks. Students were told that this required practical would appear in the 2022 series via the Advance Information. A number of students quoted the density equation incorrectly, although this was given on the Equations Sheet for the 2022 series. There were extremely few students who didn't attempt the question and less than 1% of students who attempted the question scored zero.

02.2 Approximately 85% of students answered this question correctly. Of the incorrect answers seen, a significant proportion gave the maximum and minimum values the wrong way round. Another common mistake was to write maximum: 2.55 and minimum 0.10, which showed a clear misunderstanding of expressing an uncertainty.

02.3 About 95% of students answered this question correctly.

02.4 Approximately 45% of students scored 2 marks and 40% scored 1 mark. 'In case an error / mistake was made the first time' was insufficient. 'To check the repeatability of the data' was ignored, as this wouldn't improve the accuracy of the data. 'Get rid of anomalies' was assumed to mean 'remove anomalies', but 'stops anomalies from occurring' did not score. Likewise 'stops random errors' did not score.

4.3.2.3 Changes of state and specific latent heat

Question 3 (Standard demand)

03.1 Over 99% of students answered this question correctly as they had all the Physics equations on the Equations Sheet for the 2022 series.

03.2 Nearly 95% of students answered this question correctly. In this series all students were given all the equations on the Equations Sheet. The first mark is for the substitution into the equation as it appears on the equations sheet. Some students failed to score any marks by incorrectly rearranging the equation, then substituting into the incorrectly rearranged equation.

03.3 Over 99% of students answered this question correctly as they had all the Physics equations on the Equations Sheet for the 2022 series.

03.4 95% of students answered this question correctly. In this series all students were given all the equations on the Equations Sheet. The first mark is for the substitution into the equation as it appears on the Equations Sheet. Some students failed to score any marks by incorrectly rearranging the equation, then substituting into the incorrectly rearranged equation.

Question 4 (Standard/High demand)

04.1 A large number of students found it difficult to identify the independent and dependent variables in the investigation that was described. Control variables appeared often in students' answers. 'Temperature change' seemed to be the most common incorrect answer for the dependent variable. About 50% of students scored 2 marks and approximately 35% of students scored 1 mark.

04.2 65% of students answered correctly. The most common incorrect answer was 87.4 °C.

04.3 About 35% of students answered this question correctly. Common incorrect answers referred to the resolution, or just repeated the question and said 'difficult to read' which was insufficient.

04.4 Approximately 75% of students scored 3 marks and about 10% of students scored 2 marks. Power of 10 errors were common and usually resulted in 2 marks being scored for an incorrectly or not converted value of energy.

04.5 Many students found relating the time for the temperature to decrease to thermal conductivity difficult. About 15% of students scored 2 marks, while 40% scored 1 mark. Answers in terms of good / bad insulators were insufficient to score a mark.

4.3.2.3 Changes of state and specific latent heat

Question 5 (Standard/High demand)

05.1 Approximately 45% of students scored 1 mark, with about 5% of students scored 3 marks. Around 30% of students scored no marks. The first marking point of this explanation was most likely to score, the third marking point was least likely to score.

05.2 About 30% of students scored all 3 marks for this explanation. 10% of students scored 2 marks and 10% scored 1 mark. A lot of student answers were not creditworthy, with mixed up descriptions of ion transfer, electron transfer, proton transfer, protons weighing more than electrons and transfer of electrons increasing the mass of the rod on the balance. As a result about 50% of students scored zero.

05.3 Approximately 60% of students scored the mark. Some students evidently did not know what a zero error was. Answers like 'it means there is no error' being a good example of this. Some answers were insufficient, 'the actual mass of the rod is not required' being not enough to score the mark. 'Weight' was allowed for 'mass' when used correctly as the reading on the balance does depend on the weight of the object. An answer of 'only the change in weight was needed' would have scored the mark.

05.4 Some very good explanations were seen and about 10% of students scored all 3 marks. The first marking point was least likely to score. The third marking point needed to be linked to the second marking point before it could be scored.

Question 6 (Standard/High demand)

06.1 This question discriminated well between students. About 15% scored 4 marks with 20% gaining 3 marks. The first two marking points were most commonly scored. Students who said that 'no energy was lost' as a consequence of the step-up transformer's effect did not score the third marking point.

06.2 Approximately 55% of students scored 2 marks, while 15% of students scored 1 mark. Students who scored no marks usually confused the quantity that was decreased (pd) with the quantity that increased (current). Some student answers lacked technical accuracy referring to energy, power or charge incorrectly.

06.3 Two thirds of students scored 4 marks for this calculation, whereas about 20% of students scored 3 marks. A common mistake was to try to multiply the answer by the number of seconds in a day, which would probably only score the significant figure mark if correct, as the Physics equations were applied incorrectly.
Common mistakes were to round the answer to 1 400 000 000 C, which would score 3 marks if the full s.f. answer was seen, or round the answer to 141, which would score 3 marks for the supporting calculations if seen. A common error was to miscount the number of zeroes, so would only score 3 marks.

4.3.2.3 Changes of state and specific latent heat

Question 7 (Standard/High demand)

07.1 54% of students could state what an alpha particle consists of. The list principle was applied when students wrote '2 protons and 2 neutrons – a helium atom', which did not score.

07.2 65% of students completed the nuclear equation correctly, scoring 2 marks, whereas 24% scored just 1 mark.

07.3 Students generally made good attempts to answer this question and marking points 1, 2 and 4 were seen most often. To score the 5th marking point students need to make a comparative statement, internal versus external damage. The third marking point was least likely to score, as students rarely referred to dose or the living cells / tissues / organs inside the body. Some students incorrectly thought that ionisation was a process that happened to cells, rather than atoms, so often didn't score the fifth marking point for this reason. Very few students scored 5 marks and the question discriminated well between students of differing ability.

Question 8 (Standard/High demand)

08.1 About 90% of students gave the correct measuring instrument. While it wasn't seen often, an answer of a 'volumetric pipette' was also creditworthy. 'Pipette' was insufficient.

08.2 Around 90% of students correctly identified the hazard in the investigation.

08.3 For this calculation, about 45% of students scored 5 marks and 20% of students scored 4 marks. A common mistake was to calculate *L* using one of the masses given in the question, rather than the change in mass. The resulting numerical answer would score zero as the equation was not being used correctly.

08.4 About 15% of students scored 2 marks for this explanation and 10% of students scored 1 mark. Many students reached incorrect conclusions and many students simply reworded the information given in the question.

08.5 7% of students scored 2 marks and 3% of students scored 1 mark. Many students reached incorrect conclusions and many students reworded the information given in the question without adding to it.

4.3.2.3 Changes of state and specific latent heat

Question 9 (High demand)

09.1 Approximately 55% of students scored 5 marks, but in the 2022 series students were provided with an Equations Sheet with all the equations. A commonly seen answer was 73 500, which scored 4 marks for not converting the height into metres.

09.2 5% scored 2 marks and about 30% scored 1 mark. Many students failed to score a mark by pointing to the 'inaccuracy of the measured mass / height / gravitational field strength', or referring to the measurements as being 'low resolution'. 'Mass may have been greater than 60 kg' or 'time may have been longer / shorter than 1.40 seconds' were other common incorrect answers.

09.3 About 75% of students identified the correct conclusion.

Question 10 (High demand)

10.1 About 45% of students scored 6 marks for this extended calculation, but in the 2022 series students were provided with an Equations Sheet with all the equations. Therefore, students were supported when it came to attempting this question. With an alternative approach using equations from paper 2, students' answers were marked on whichever approach brought them closest to the correct final answer. An answer of 6 m/s with no supporting working did not score full marks as students could achieve this answer by multiplying the spring constant and the extension together, which would give them the maximum force acting on the toy aeroplane.

10.2 About 65% of students scored the mark. The most common incorrect answers seen were gravitational potential or elastic potential.

10.3 Approximately 20% of students scored a mark. Many students failed to score a mark because they gave a factor without a specific change e.g. 'extension of spring', rather than 'increase the extension of the spring'.

Question 11 (High demand)

Due to incorrect Advance Information guidance being issued for this question, and to avoid students being disadvantaged, Question 11 was discounted and all students were awarded full (9) marks.

4.3.2.3 Changes of state and specific latent heat

Use of statistics

Statistics used in this report may be taken from incomplete processing data. However, this data still gives a true account of how students have performed for each question.

Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the Results Statistics page of the AQA Website.