AQA GCSE Physics | 8463

SPECIFICATION POINT 4.7.3.1

Induced potential (HT only)

Mark schemes and examiner comments

Tier	**Higher**
Question groups	**7**
Available paper years	**2009–2023**

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.

4.7.3.1 Induced potential (HT only)

Answer 01 · Mark scheme June 2009 | PHY3H | Original Q2 | Legacy

Question 2

question	answers	extra information	mark
2(a)	C → B (1st two boxes) D → A (end two boxes)	allow**1** mark for either linkage in any position	1 1
2(b)	any **two** from: • more powerful / stronger magnet • smaller gap between coil and magnet • coil with more turns / longer coil • coil with bigger area	do **not** accept just bigger magnet accept more coils do **not** accept just bigger coil do **not** accept just more wire do **not** accept shake faster do **not** accept shake for longer	2
2(c)(i)	the longer the torch is shaken, the longer the light lasts	accept the converse accept it is a (strong) positive (non-linear) relationship do **not** accept '.... are (directly) proportional ....'	1

Question 2 is continued on the next page . . .

4.7.3.1 Induced potential (HT only)

PHY3H

Question 2

question	answers	extra information	mark
2(c) (ii)	any **two** from: • if this investigation is repeated the result would not be the same • rate / amplitude / angle of shaking could vary • personal judgement when the LED / light has 'gone out' • results / data / measurements have not been repeated / averaged		2
Total			**7**

4.7.3.1 Induced potential (HT only)

Answer 01 · Mark scheme

June 2009 | PHY3H | Original Q2 | Legacy

PHY3H

4.7.3.1 Induced potential (HT only)

Answer 02 · Mark scheme January 2010 | PHY3H | Original Q6 | Legacy

Question 6

question	answers	extra information	mark
6(a)	greater	accept bigger / larger / higher	1
6(b)	magnetic field / flux (1) cuts through the coil (1) p.d varies as the distance between magnet and coil changes / as the magnet rotates (1)	 **or** the converse accept voltage for p.d. accept varies for changes	3
6(c)	any **two** from: • move coil closer to the rim / wheel • more powerful magnet • more turns (on the coil) • coil with greater area • using an <u>iron</u> core	 **or** smaller gap between rim / wheel and coil accept extra magnets do **not** accept more coils	2
Total			**6**

4.7.3.1 Induced potential (HT only)

Answer 02 · Mark scheme

January 2010 | PHY3H | Original Q6 | Legacy

PHY3H

4.7.3.1 Induced potential (HT only)

Answer 03 · Mark scheme

June 2018 | 8463/2H | Original Q3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	P-waves are longitudinal and S-waves are transverse		1	AO1 4.6.1.5
03.2	0.4		1	AO2 4.6.1.2
03.3	wave speed = frequency × wavelength	allow v = f λ	1	AO1 4.6.1.2
03.4	7200 = 0.4 × wavelength wavelength = $\frac{7200}{0.4}$ wavelength = 18 000 (m)	an answer 18 000 scores **3** marks allow up to full marks for ecf using their answer to question **03.2** a method shown as 7200 × 2.5 = 18 000 scores **0** marks	 1 1 1	AO2 4.6.1.2
03.5	because S-waves cannot travel through a liquid and S-waves do not travel through the (outer) core	 allow some (seismic) waves cannot travel through a liquid and do not go through the core for **1** mark	1 1	AO1 4.6.1.5
03.6	magnetic field around the coil changes **or** the magnetic field (lines) cut by the coil	allow the generator effect	1	4.7.3.1 AO2

4.7.3.1 Induced potential (HT only)

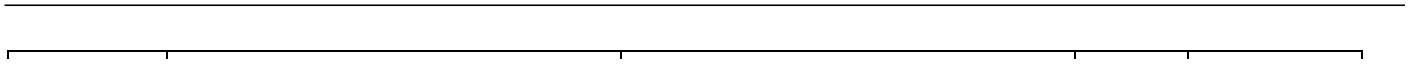
Answer 03 · Mark scheme June 2018 | 8463/2H | Original Q3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.7	because the magnet changes direction		1	4.7.3.1 AO2
03.8	stationary		1	4.7.3.1 AO2
03.9	any **two** from: • stronger magnetic field • more turns on the coil • turns pushed closer together • spring with a lower spring constant	 allow stronger magnet allow heavier magnet bigger magnet is insufficient bigger coil is insufficient do **not** accept more coils of wire allow less stiff spring allow weaker spring do **not** accept add an iron core	2	4.7.3.1 AO2
Total			**13**	

4.7.3.1 Induced potential (HT only)

Answer 03 · Mark scheme

June 2018 | 8463/2H | Original Q3



4.7.3.1 Induced potential (HT only)

Answer 04 · Mark scheme

November 2020 | 8463/2H | Original Q7

Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	to vary the (output) potential difference so that you don't need a different generator for each type of device	allow different devices require different potential differences allow so that it is compatible with different devices do **not** allow answers in terms of power	1 1	AO3 4.7.3.4
07.2	$\frac{1.5}{5.0} = \frac{150}{N_s}$ $N_s = \frac{150}{0.3}$ $N_s = 500$		1 1 1	AO2 4.7.3.4
07.3	the coil moves through the magnetic field **or** the coil cuts magnetic field lines a potential difference is induced (across the coil) there is a complete circuit, so a current is induced (in the coil) every half turn the potential difference reverses direction so (every half turn) the current changes direction		1 1 1 1 1	AO1 4.7.3.1 4.7.3.2
07.4	provides a continuous / moveable contact / connection (between the coil and the transformer / contacts / brushes) **or** stops the wires from twisting together		1	AO3 4.7.3.2

4.7.3.1 Induced potential (HT only)

Answer 04 · Mark scheme

November 2020 | 8463/2H | Original Q7

07.5	(after disconnection) there is no induced current so no magnetic field (produced around / by the coil) to oppose the movement of the coil		1 1 1	AO1 4.7.3.1
Total			**14**	

4.7.3.1 Induced potential (HT only)

Answer 05 · Mark scheme

June 2022 | 8463/1H | Original Q3

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	$P = V \times I$		1	AO1 4.2.4.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	$4.4 = 40 \times I$ $I = \frac{4.4}{40}$ $I = 0.11$ (A)		1 1 1	AO2 4.2.4.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.3	efficiency = $\frac{\text{useful power output}}{\text{total power input}}$		1	AO1 4.1.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.4	$0.85 = \frac{P}{4.0}$ $P = 0.85 \times 4.0$ $P = 3.4$ (W)		1 1 1	AO2 4.1.2.2

Total Question 3		8

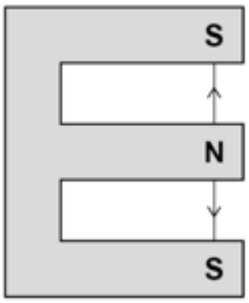
4.7.3.1 Induced potential (HT only)

Answer 06 · Mark scheme

June 2023 | 8463/2H | Original Q4

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	current **or** potential difference	allow charge flow	1	AO1 4.7.3.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.2			1	AO1 4.7.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.3	an induced magnet is a material that becomes a magnet when it is placed in a magnetic field **or** an induced magnet loses most / all of its magnetism (quickly) when removed from a magnetic field	allow 'when close to another magnet' for 'when it is placed in a magnetic field' allow 'no magnets are nearby' for 'removed from a magnetic field' 'temporary magnet' alone is insufficient	1	AO1 4.7.1.1

4.7.3.1 Induced potential (HT only)

Answer 06 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	motor effect		1	AO1 4.7.2.2 4.7.2.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.5	16 mA = 0.016 A	allow 1.6×10^{-2} (A)	1	AO2 4.7.2.2
	$0.013 = B \times 0.016 \times 6.5$	allow correct substitution using incorrectly / not converted current	1	
	$B = \frac{0.013}{0.016 \times 6.5}$	allow correct re-arrangement using incorrectly / not converted current	1	
	$B = 0.125$ (T)	allow correct calculation using incorrectly / not converted current allow 0.13 (T)	1	

4.7.3.1 Induced potential (HT only)

Answer 06 · Mark scheme

June 2023 | 8463/2H | Original Q4

Question	Answers	Mark	AO / Spec. Ref.
04.6	**Level 2**: Scientifically relevant features are identified; the way(s) in which they are similar / different is made clear and (where appropriate) the magnitude of the similarity / difference is noted.	3-4	AO3 4.6.1.4
	Level 1: Relevant features are identified and differences noted.	1-2	
	No relevant content	0	
	Indicative content: • for all three people, the minimum sound level that can be heard increases as frequency increases **Age** • the minimum sound level that can be heard increases with age • between 2000 and 3000 Hz the minimum sound level that can be heard increases more in **B** compared to **C** • **C** has very little variation in the minimum sound level that can be heard at all frequencies **Working in a loud environment:** • increases the minimum sound level that can be heard at all frequencies above 2000 Hz compared to working in a quiet environment • the minimum sound level that can be heard increases more as frequency increases from 2000 to 4000 Hz compared to working in a quiet environment • doesn't affect the minimum sound level that can be heard at 2000 Hz to access **level 2** the answer must include at least **one** comparison for age **and one** comparison for working in a loud environment, using supporting data/information from the graph		

Total Question 4	**12**

4.7.3.1 Induced potential (HT only)

Answer 07 · Mark scheme

June 2023 | 8463/2H | Original Q9

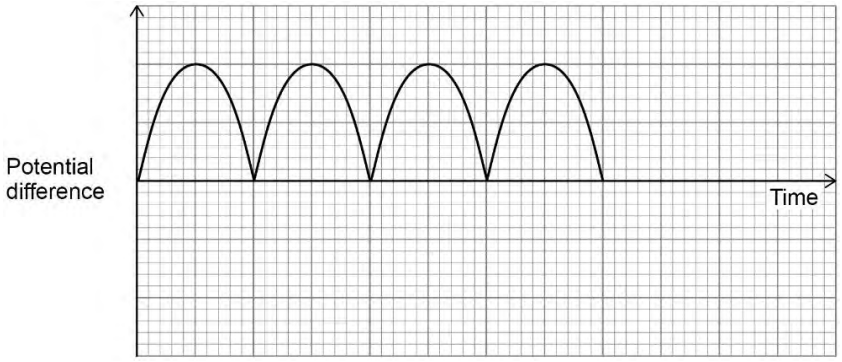
Question 9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.1	the coil moves through the (magnetic) field **or** the coil cuts (magnetic) field lines		1	AO1 4.7.1.2 4.7.3.1 4.7.3.2
	a potential difference is induced (across the coil)		1	
	there is a complete circuit, so a current is induced (in the coil)		1	
	(because) each half-revolution, the two ends of the coil swap from one brush to the other **or** each half-revolution, (the two halves of) the commutator switch brushes / contacts	(because) the half of the coil connected to each brush always moves in the same direction	1	
	(so) the direction of the (induced) current / potential difference does not reverse every half rotation	allow the direction of the (induced) current / potential difference is the same every half rotation	1	

4.7.3.1 Induced potential (HT only)

Answer 07 · Mark scheme

June 2023 | 8463/2H | Original Q9

Question	Answers	Mark	AO / Spec. Ref.
09.2	 allow a correct graph showing a negative output potential difference only	1	AO1 4.7.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.3	(after disconnection) there is no (induced) current		1	AO1 4.7.3.1
	(so) no magnetic field (produced around / by the coil)		1	
	to oppose the movement of the coil	allow no force opposes the movement of the coil	1	

Total Question 9	9

4.7.3.1 Induced potential (HT only)

Answer 03 · Examiner comments — June 2018 | 8463/2H | Original Q3

Question 3 (Standard demand)

03.1 Just over 50% of the students scored this mark

03.2 Only 30% of students were able to use the information in Figure 3 to calculate the frequency of the wave.

03.3 Just over 75% of the students were able to write the correct equation.

03.4 Nearly 70% of the students who could recall the equation calculated the wavelength correctly.

03.5 This is a topic new to this specification. 19% of the students knew that S-waves do not travel through a liquid and could relate this to the Earth having a liquid (outer) core.

03.6 23% of the students scored the mark, generally for simply stating 'generator effect'.

Answer 03 · Examiner comments — June 2018 | 8463/2H | Original Q3

03.7 37% of students realised that this was to do with the movement of the magnet.

03.8 This was well answered with just over 76% of students choosing the correct answer.

03.9 Just over half of the students scored zero. Answers such as 'bigger magnet' or 'more coils' were too vague to gain credit.

Answer 04 · Examiner comments — November 2020 | 8463/2H | Original Q7

Question 7 (Standard/high and high demand)

07.1 Many of the students scored one mark for the idea of being able to provide a variable potential difference. A significant number of the students thought incorrectly that it would be the power output that is varied.

07.2 55% of students scored zero, often due to incorrect substitution into the chosen equation.

07.3 This was very poorly answered with very few of the students showing any knowledge of how an alternator works. The vast majority of the students started the explanation by stating that a current flows through the coil, going on to explain with varying degrees of clarity how an electric motor works. A number of the students simply described an alternating current.

07.4 There were many vague answers with only 9% of the students realising the function of the slip rings.

4.7.3.1 Induced potential (HT only)

Answer 04 · Examiner comments

November 2020 | 8463/2H | Original Q7

07.5 Very few of the students appeared to understand the question asked. A minority gained one mark for stating that there would be no current. A significant number of the students wrote that the current would be reduced. A statement referring to 'magnetic field' was made by a number of students but usually it was not clear which magnetic field was being referred to - that of the permanent magnets or that produced around the coil.

Concluding Remarks

Students appeared to have enough time to answer this paper and the majority had taken the time to learn the required equations.

4.7.3.1 Induced potential (HT only)

Answer 04 · Examiner comments

Mark Ranges and Award of Grades

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

4.7.3.1 Induced potential (HT only)

Answer 06 · Examiner comments June 2023 | 8463/2H | Original Q4

04.1

31% of students gained this mark. Many students responded with a selection of random Physics terms.

04.2

74% of students recognised the direction of the magnetic field.

Answer 06 · Examiner comments June 2023 | 8463/2H | Original Q4

04.3

51% of students knew what an induced magnet is. Responses sometimes confused magnets and magnetic materials. Most correct answers were to do with placing a material into a field to become a magnet, compared with removing the material from the field.

04.4

88% of students knew that it is the motor effect that causes the coil to move..

04.5

46% of students scored all 4 marks for this calculation. There were a wide variety of incorrect conversions of mA, which gained 3 out of the 4 marks.

04.6

Most students were able to make generic statements about how age and environment affect hearing. 35% of students were able to use the data in the graph to support their statements. Some responses just gave information about person A, B and C, without any comparisons. Students did not use the patterns in the graph to back up conclusions. There was some confusion over sensitivity, and a number tried to explain the variables to the extent that the response became incorrect. Examples of this included saying that a higher minimum sound level shows better hearing.
A proportion of the responses mentioned ideas about being "used to a loud sound" so "could hear loud sounds better" and younger people not having had the experience of a full range of frequencies due to their age. Alternatively, the idea that being in a quiet environment means you can only hear quiet sounds was another misunderstanding which was often seen.

4.7.3.1 Induced potential (HT only)

Answer 07 · Examiner comments June 2023 | 8463/2H | Original Q9

09.1

The topic of how motors, dynamos, generators and transformers work has always proved a challenging one, with 2% of students gaining 5 marks for this explanation. There were a number of excellent responses showing clear understanding. Many students scored some marks for describing how the coil cuts the field lines, inducing a potential difference and causing current to flow in a complete circuit. ,Only a few could clearly describe the action of the commutator and brushes swapping the connections every half-turn so the current to the lamp is only in one direction. Some students confused the dynamo for a motor or wrote answers that combined elements of both motor and dynamo. 75% of students scored at least one mark.

4.7.3.1 Induced potential (HT only)

09.2

17% of students could correctly draw four half-cycles to represent the output of two complete turns of the dynamo. Most drew a sine wave or an incorrect number of half-cycles.

09.3

A small number of students were able to write that without a current in the coil, there would be no magnetic field in the coil; fewer were able to state that this would remove the opposing force. Some thought there would still be a current in the coil , or that the current would increase creating an attractive force between the coil and magnets. Some students thought that friction at the brushes or the resistance of the lamp were the factors that had been reduced. 15% of students scored at least one mark on this question, with 3% getting full marks.

Mark Ranges and Award of Grades

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

4.7.3.1 Induced potential (HT only)

AQA

GCSE
PHYSICS

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

8463
June 2022

Version: 1.0

4.7.3.1 Induced potential (HT only)

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4.7.3.1 Induced potential (HT only)

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.

4.7.3.1 Induced potential (HT only)

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.

4.7.3.1 Induced potential (HT only)

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.

4.7.3.1 Induced potential (HT only)

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.

4.7.3.1 Induced potential (HT only)

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.

4.7.3.1 Induced potential (HT only)

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.

4.7.3.1 Induced potential (HT only)

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.