AQA GCSE Physics | 8463

SPECIFICATION POINT 4.2.5.1

Static charge

Mark schemes and examiner comments

Tier	**Higher**
Question groups	**11**
Available paper years	**2008–2024**

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.

4.2.5.1 Static charge

Answer 01 · Mark scheme January 2008 | PHY2H | Original Q2 | Legacy

Question 2

question	answers	extra information	mark
(a)	clothing and seat rub together	accept friction between clothing and seat	1
	<u>electrons</u> transfer from seat to driver **or** <u>electrons</u> transfer from driver to seat	accept electrons transfer on its own if first mark scores an answer in terms of *rubbing* between clothing and seat **and** *charge* transfer without mention of electrons gains **1** mark an answer in terms of *friction* / *rubbing* **and** *electron transfer* without mention of clothing and seat gains **1** mark	1
(b)(i)	how wet the air is affects charge (build up) **or** damp air is a better conductor **or** damp air has a lower resistance	accept humidity affects charge do **not** accept fair test or as a control unless explained	1
(ii)	No – it was only the lowest under these conditions **or** No – there are lots of other materials that were not tested **or** Yes – the highest value for cotton is smaller than the lowest value for the other materials	accept answer in terms of changing the conditions may change the results do **not** accept results show that it is <u>always</u> less / smallest	1
total			4

4.2.5.1 Static charge

Answer 01 · Mark scheme

January 2008 | PHY2H | Original Q2 | Legacy

PHY2H

4.2.5.1 Static charge

Answer 02 · Mark scheme June 2008 | PHY2H | Original Q6 | Legacy

Question 6

	answers	extra information	mark
(a)(i)	droplets will repel each other even coating of glue/ sand (on the paper)	accept droplets will spread out	1 1
(ii)	sand (becomes) positively charged repelled away from positive / lower plate	accept attract positively charged sand allow attracted to the (negatively) charged glue/ paper opposite charges attract does not score unless qualified	1 1
(b)	0.002 coulombs	allow **1** mark for correct transformation **and** substitution accept C do **not** accept c accept 2mC or 2 milli coulombs for **3** marks	2 1
total			7

4.2.5.1 Static charge

Answer 02 · Mark scheme June 2008 | PHY2H | Original Q6 | Legacy

PHY2H

4.2.5.1 Static charge

Answer 03 · Mark scheme

Question 4

question	answers	extra information	mark
4(a)	soot /ash/ waste gases pass (negatively) charged grid		1
	soot/ash given a negative charge	accept picks up electrons	1
	soot/ash repelled from (negative) grid **or** soot/ash attracted to (positively charged) metal plates		1
4(b)	charge must increase / build up	accept electrons for charge any reference to positive electrons negates this mark	1
	(producing) a large enough potential difference between dome and (earthed) conductor	accept voltage for pd any reference to positive earth negates this mark	1
Total			**5**

4.2.5.1 Static charge

Answer 03 · Mark scheme

January 2009 | PHY2H | Original Q4 | Legacy

PHY2H

4.2.5.1 Static charge

Answer 04 · Mark scheme

Question 2

question	answers	extra information	mark
2(a)(i)	gained electrons		1
2(a)(ii)	see if it exerts a force on another (charged) object **or** see if it will pick up (small) pieces of paper	accept repels another negative(ly charged)object accept attracts a positive(ly charged) object accept attracts or repels a charged object accept any correct way of showing an electrostatic effect i.e. bend a (slow moving) stream of water (from a tap) do **not** accept see if you get an electric shock on its own	1
2(b)(i)	plastic is an insulator stop them discharging **or** stop them being earthed	accept plastic is a poor conductor any mention of heat negates this mark accept keeps the charge on the person accept stop them being grounded do **not** accept so don't get an electric shock accept electricity cannot go to earth	1 1
2(b)(ii)	type of clothing could affect (build up of) charge/data	accept it is a variable/ factor (that needs to be controlled) do **not** accept fair test on its own	1
2(b)(iii)	there is a clear pattern **or** enough precision to tell difference (between the materials) **or** accept none of the results are within 0.1kV of the shock line or each other	accept there is a wide range of results	1

Question 2 continues on the next page . . .

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PHY2H

Question 2 continued . . .

question	answers	extra information	mark
2(b)(iv)	any **two** from: • the material normally used has a value above the p.d likely to cause a shock • use a material that reduces pd (below 3.6 kV) • so people are less likely to be shocked • can put 'non-shock' seating in adverts • may sell more seats/ cars	accept use a material that reduces charge (on the person) accept so people will not feel a shock owtte	2
Total			**8**

4.2.5.1 Static charge

Answer 04 · Mark scheme

June 2009 | PHY2H | Original Q2 | Legacy

PHY2H

4.2.5.1 Static charge

Answer 05 · Mark scheme

Question 3

question	answers	extra information	mark
3(a)(i)	electrons transfer / removed to the cloth / from the rod	do **not** accept negatively charged atoms this only scores if first mark given accept negative charge transfer to the cloth / removed from rod for **1** mark transfer of positive charge / positive electrons scores zero transfer of electrons to the rod scores zero	1 1
3(a)(ii)	TV screen becomes (positively / negatively) charged attracts (negatively / positively charged) dust	if the sign of the charge is given then must be opposites to score both marks do **not** accept TV screen becomes static correct answer in terms of induced charge gains full credit	1 1
3(b)(i)	**J** **O** **K** **P**	**3** marks for 4 correct **2** marks for 2 correct **1** mark for 1 correct	3
3(b)(ii)	to melt the toner	accept to make the toner stick unless a reason is given that infers this is due to attraction of charged particles	1
Total			**8**

4.2.5.1 Static charge

Answer 05 · Mark scheme June 2010 | PHY2H | Original Q3 | Legacy

PHY2H

4.2.5.1 Static charge

Answer 06 · Mark scheme

Question 2

question	answers	extra information	mark
2(a)	3rd box The negative charge in the water is repelled by the rod and the positive charge is attracted.		1
2(b)(i)	friction between bottles and conveyor belt / (plastic) guides charge transfers between bottles and conveyor belt / (plastic) guides	accept bottles rub against conveyor belt / (plastic) guides accept specific reference eg electrons move onto / off the bottles reference to positive electrons / protons negates this mark	1 1
2(b)(ii)	an <u>atom</u> that has lost / gained <u>electron</u>(s)	do **not** accept a charged particle	1
2(b)(iii)	charge will not (easily) flow off the conveyor belt	accept the conveyor belt / bottle is an insulator / not a conductor accept conveyor belt is rubber	1
Total			**5**

4.2.5.1 Static charge

Answer 06 · Mark scheme January 2011 | PHY2H | Original Q2 | Legacy

PHY2H

4.2.5.1 Static charge

Answer 07 · Mark scheme

June 2017 | PH2HP | Original Q6 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
6(a)(i)	electrons transfer/removed from the nylon/rod **or** to the silk/cloth making the nylon positive **and** the silk/cloth negative	positive electrons or protons moving negates first and second mark points	1 1 1	AO1 2.3.1a AO2 2.3.1b AO1 2.3.1b
6(a)(ii)	electrons would transfer from the silk/cloth **or** electrons would transfer to the PVC/rod **or** the silk/cloth would become positive **or** the PVC/rod would become negative	do not accept positive electrons or protons moving "it" refers to the PVC rod	1	AO2 2.3.1b
6(b)	The reading will increase. rods/charges will repel and create a downward / extra force (on the balance)	reason is independent of this mark accept so pushing (bottom) rod downwards do not accept increasing the weight	1 1 1	AO2 AO1 AO1 2.3.1c, d
6(c)(i)	9000 (V)	allow **1** mark for correct substitution ie $V = \frac{27}{3 \times 10^{-3}}$ **or** $27 = V \times 3 \times 10^{-3}$ an answer 9 with the unit changed to kV scores **2** marks	2	AO2 2.3.2b 2.4.2d

4.2.5.1 Static charge

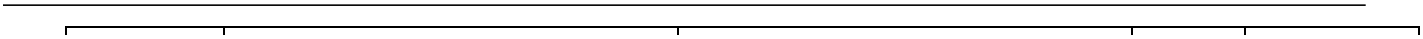
Answer 07 · Mark scheme

6(c)(ii)	not all types of material were tested other factors may affect the charge (on the driver)	accept only tested 3 materials accept a named factor eg material of the seats, temperature, humidity some results may be anomalous is insufficient different vehicle is insufficient	1 1	AO3 2.3.1
Total			**11**	

4.2.5.1 Static charge

Answer 07 · Mark scheme

June 2017 | PH2HP | Original Q6 | Legacy



4.2.5.1 Static charge

Answer 08 · Mark scheme

June 2019 | 8463/1H | Original Q10

Question 10

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.1	non-contact (force)	allow electrostatic (force)	1	4.2.5.2 AO1
	attraction (between hair and balloon)	allow repulsion between the hairs on the head	1	
10.2		an answer of 2.0×10^{-6} (C) scores **3** marks an answer of 2×10^{-3} (C) scores **2** marks		4.2.4.2 AO2
	$0.0050 = Q \times 2500$	this mark may be awarded if pd is incorrectly or not converted	1	
	$Q = \frac{0.0050}{2500}$	this mark may be awarded if pd is incorrectly or not converted	1	
	$Q = 2.0 \times 10^{-6}$ (C) **or** Q = 0.0000020 (C)	these answers only	1	
10.3		an answer of 120 (Ω) scores **5** marks		4.2.1.2 4.2.1.3 AO2
	$0.16 = I \times 4.0 \times 10^{-3}$ **or** $I = \frac{0.16}{4.0 \times 10^{-3}}$	this mark may be awarded if time is incorrectly / not converted	1	
	I = 40 (A)	this value only	1	
	$4800 = 40 \times R$	allow 4800 = their calculated I × R	1	
	$R = \frac{4800}{40}$	allow R = 4800 / their calculated I	1	
	R = 120 (Ω)	allow an answer consistent with their calculated I	1	
Total			**10**	

4.2.5.1 Static charge

Answer 09 · Mark scheme

November 2020 | 8463/2H | Original Q1

Question 1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	Move the wooden block to the left.		1	AO3 4.5.6.2.2 RPA7
01.2	use a pulley (on the edge of the bench)	allow any feasible method to stop the string from rubbing	1	AO3 4.5.6.2.2 RPA7
01.3	suitable scale points plotted correctly line of best fit	 allow 5 correctly plotted for **2** marks **OR** 3–4 correctly plotted for **1** mark	1 2 1	AO2 4.5.6.2.2 RPA7
01.4	(directly) proportional	allow a correct description of direct proportionality ignore positive correlation allow weight (added to mass holder) for force allow f = ma for **1** mark	1	AO3 4.5.6.2.2 RPA7
01.5	repeat the measurements/investigation ignore anomalies **and** calculate the mean / average		1 1	AO3 4.5.6.2.2 RPA7
01.6	resultant force = mass × acceleration **or** F = m a		1	AO1 4.5.6.2.2 RPA7

4.2.5.1 Static charge

Answer 09 · Mark scheme

November 2020 | 8463/2H | Original Q1

01.7	0.375 = 0.60 × a $a = \frac{0.375}{0.60}$ a = 0.625 (m/s^2) a = 0.63 (m/s^2)		1 1 1 1	AO2 4.5.6.2.2 RPA7
Total			**14**	

4.2.5.1 Static charge

Answer 10 · Mark scheme

June 2022 | 8463/1H | Original Q5

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1		any mention of transfer of positive charge scores 0 any mention of positive electrons scores 0		AO1 4.2.5.1
	electrons transferred from the cloth (to the rod)		1	
	electrons are negatively charged	this mark only scores if linked to the first marking point	1	
	(so) there are more positive charges than negative charges on the cloth	ignore more protons than electrons unqualified	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2	there is an additional (downwards) force on the balance (increasing the mass reading)		1	AO3 AO3
	(because) the (held) rod is negatively charged	allow both rods have the same (negative) charge	1	AO1
	(and rods with) like charges repel **or** (and rods with) negative charges repel each other		1	4.2.5.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3	only the change in reading / mass is being observed	allow difference / increase for 'change in'	1	AO3 4.2.5.1

4.2.5.1 Static charge

Answer 10 · Mark scheme

June 2022 | 8463/1H | Original Q5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.4	the (large) potential difference between the two objects	allow (strong) electric field causes breakdown of air do not accept earthed conductor is positively charged	1	AO1 4.2.5.2
	(causes negative) electrons / charges to move (through the air)	allow there is a current in the air (between the two objects)	1	
	(from the rod) to the conductor		1	

Total Question 5		**10**

4.2.5.1 Static charge

Answer 11 · Mark scheme

June 2024 | 8463/1H | Original Q4

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	electrons are transferred to the student		1	AO1 4.2.5.1
	(so) her hair is negatively charged	allow each hair has the same (negative) charge	1	
	(and) like charges repel	do not accept student being positively charged for MP1 and MP2	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.2	the region (around a charged object) where another charged object experiences a force	allow space / area for region allow particle for object	1	AO1 4.2.5.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.3	(electric field strength) decreases		1	AO1 4.2.5.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	$Q = 2 \times 10^{-6}$ (C)		1	AO2 4.2.4.2
	$0.6 = 2 \times 10^{-6} \times V$	allow a correct substitution of an incorrectly / not converted value of Q	1	
	$V = \frac{0.6}{2\times10^{-6}}$	allow a correct rearrangement of an incorrectly / not converted value of Q	1	
	$V = 300\,000$ (V)	allow an answer consistent with an incorrectly / not converted value of Q	1	

4.2.5.1 Static charge

Answer 11 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.5	decreased electrical resistance of air		1	AO3 4.2.5.1

Total Question 4	**10**

4.2.5.1 Static charge

Answer 09 · Examiner comments — November 2020 | 8463/2H | Original Q1

Question 1 (Standard demand)

01.1 Approximately 85% of students identified the correct change to the apparatus.

01.2 To gain credit, the suggestions should be feasible. The most popular correct answers were 'to add a pulley' and 'lubricate the string'.

01.3 Suitable scales should cover at least half of the graph paper and start at the origin. Lines of best fit are either straight as in this case or smooth curves, never 'wiggly' lines. Approximately 70% of students scored all four marks.

01.4 Students should understand that 'direct proportion' and 'positive correlation' do not have the same meaning.

Answer 09 · Examiner comments — November 2020 | 8463/2H | Original Q1

01.5 The question was about improving this investigation and not changing to a different investigation. Those students scoring one mark generally did so for the idea of 'repeating the investigation'. A significant number of students added 'to take a mean' but did not score the mark as the idea of 'ignoring anomalies' was omitted.

01.6 Approximately 88% of students were able to recall this equation.

01.7 This calculation was generally well answered, although a significant number of the students failed to give the answer to 2 significant figures.

4.2.5.1 Static charge

Answer 11 · Examiner comments June 2024 | 8463/1H | Original Q4

Question 4 (Standard/High Demand)

04.1 Students answers were generally very confused with this question and statements about transfer of positive electrons or protons or even neutrons were commonly seen. Students struggled to understand that when you are in contact with a charged object you have the same charge as that object. It was common to see statements about the dome being negative so the student (and her hair) are positively charged. If a student said that the student was positively charged they could not score mark points 1 and 2, but they could still score mark point 3 if they said that like / same charges repel. 10% of students scored 3 marks, while 15% scored 2 marks and 32% scored 1 mark.

04.2 Only 8% of students scored a mark on this question. An answer of 'the area / space / region where an electron experiences a force' was creditworthy as were other examples of charged particles or ions. 'The area where other charged particles experience repulsion or attraction' was also creditworthy. Neither of these examples were seen often, however.

04.3 92% scored a mark for this question. A surprisingly large number of students made statements like 'as you get closer to the dome, the field strength increases' answering the question in the opposite way to the way it was set out. They scored a mark but would have saved a lot of time by writing 'it decreases.'

04.4 Some students did not convert, or incorrectly converted, the unit of charge and scored 3 marks.. Some students incorrectly converted the unit for charge and also spuriously converted the energy by multiplying or dividing by a power of ten. These students made two mistakes, so scored a maximum of 2 marks on this question. 36% of students scored all 4 marks, while 56% of students scored 3 marks for this calculation of potential difference.

04.5 80% of students identified the factor that would increase the distance a spark can jump between two objects.

4.2.5.1 Static charge

AQA

GCSE
PHYSICS

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

8463
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Version: 1.0

4.2.5.1 Static charge

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4.2.5.1 Static charge

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.

4.2.5.1 Static charge

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.

4.2.5.1 Static charge

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.

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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.

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.

4.2.5.1 Static charge

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.

4.2.5.1 Static charge

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.