GCSE
Physics

8463/1H – PAPER 1 – HIGHER TIER

Mark scheme

8463

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Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Assessment Writer.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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Information to Examiners

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement
- the Assessment Objectives and specification content that each question is intended to cover.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example: where consequential marking needs to be considered in a calculation; or the answer may be on the diagram or at a different place on the script.

In general the right-hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening and underlining

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following bullet points is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.

2.4 Any wording that is underlined is essential for the marking point to be awarded.

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which students have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error / contradiction negates each correct response. So, if the number of error / contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

Example 1: What is the pH of an acidic solution?

[1 mark]

Student	Response	Marks awarded
1	green, 5	0
2	red*, 5	1
3	red*, 8	0

Example 2: Name two planets in the solar system.

[2 marks]

Student	Response	Marks awarded
1	Neptune, Mars, Moon	1
2	Neptune, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a student writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Marks should be awarded for each stage of the calculation completed correctly, as students are instructed to show their working. Full marks can, however, be given for a correct numerical answer, without any working shown.

3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward is kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation ecf in the marking scheme.

3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.7 Brackets

(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

3.8 Allow

In the mark scheme additional information, 'allow' is used to indicate creditworthy alternative answers.

3.9 Ignore

Ignore is used when the information given is irrelevant to the question or not enough to gain the marking point. Any further correct amplification could gain the marking point.

3.10 Do <u>not</u> accept

Do **not** accept means that this is a wrong answer which, even if the correct answer is given as well, will still mean that the mark is not awarded.

4. Level of response marking instructions

Extended response questions are marked on level of response mark schemes.

- Level of response mark schemes are broken down into levels, each of which has a descriptor.
- The descriptor for the level shows the average performance for the level.
- There are two marks in each level.

Before you apply the mark scheme to a student's answer, read through the answer and annotate it (as instructed) to show the qualities that are being looked for. You can then apply the mark scheme.

Step 1: Determine a level

Start at the lowest level of the mark scheme and use it as a ladder to see whether the answer meets the descriptor for that level. The descriptor for the level indicates the different qualities that might be seen in the student's answer for that level. If it meets the lowest level then go to the next one and decide if it meets this level, and so on, until you have a match between the level descriptor and the answer.

When assigning a level you should look at the overall quality of the answer. Do **not** look to penalise small and specific parts of the answer where the student has not performed quite as well as the rest. If the answer covers different aspects of different levels of the mark scheme you should use a best fit approach for defining the level.

Use the variability of the response to help decide the mark within the level, ie if the response is predominantly level 2 with a small amount of level 3 material it would be placed in level 2 but be awarded a mark near the top of the level because of the level 3 content.

Step 2: Determine a mark

Once you have assigned a level you need to decide on the mark. The descriptors on how to allocate marks can help with this.

The exemplar materials used during standardisation will help. There will be an answer in the standardising materials which will correspond with each level of the mark scheme. This answer will have been awarded a mark by the Lead Examiner. You can compare the student's answer with the example to determine if it is the same standard, better or worse than the example. You can then use this to allocate a mark for the answer based on the Lead Examiner's mark on the example.

You may well need to read back through the answer as you apply the mark scheme to clarify points and assure yourself that the level and the mark are appropriate.

Indicative content in the mark scheme is provided as a guide for examiners. It is not intended to be exhaustive and you must credit other valid points. Students do **not** have to cover all of the points mentioned in the indicative content to reach the highest level of the mark scheme.

You should ignore any irrelevant points made. However, full marks can be awarded only if there are no incorrect statements that contradict a correct response.

An answer which contains nothing of relevance to the question must be awarded no marks.

Question	Answers	Extra information	Mark	AO/ Spec. Ref
01.1	transfer of <u>electrons</u>	mention of positive charge moving negates both marks	1	AO1 4.2.5.1
	from the carpet to the student		1	
01.2	three arrows perpendicular to sphere's surface with all arrows directed inwards and distributed evenly around sphere		1	AO1 4.2.5.2
01.3	there is a potential difference between the student and the tap	do **not** accept the tap / sink is charged	1	AO1 4.2.1.2 4.2.1.3
	which causes electrons / charges to transfer from the student **or** which causes electrons / charges to transfer to the tap		1	4.2.5.1
	which earths the charge	allow the tap is earthed	1	
01.4	carpet / copper has a low resistance	allow carpet is a conductor **or** copper is a conductor	1	AO3 4.2.5.1 4.2.1.3
	lower / no build-up of charge (on the student) **or** (so there is a) smaller / no potential difference between student and tap / earth		1	
Total			**8**	

Question	Answers	Extra information	Mark	AO/ Spec. Ref
02.1	count rate = $\frac{819}{60}$ count rate = 13.65 corrected count rate = 13.35 (per second)	an answer of 13.35 (per second) scores **3** marks an answer of 13.95 (per second) scores **2** marks an answer of 801 (per second) scores **2** marks allow an answer of background = 0.30 × 60 = 18 (per minute) corrected count rate = 819 – 18 corrected count rate = 801 per minute	1 1 1	AO2 4.4.2.1 4.4.3.1
02.2	activity = 1250 × 180 activity = 225 000 (Bq)	an answer of 225 000 (Bq) scores **2** marks	1 1	AO2 4.4.2.1
02.3	yearly dose = 0.003 × 365 which is << 100 (mSv) **or** (well) below the lowest dose with evidence of causing cancer / harm	allow yearly dose = 1.095 (mSv)	1 1	AO3 4.4.3.1

Question	Answers	Extra information	Mark	AO/ Spec. Ref
02.4	people are able to compare a radiation risk / dose / hazard to the radiation dose from (eating) bananas		1	AO3 4.4.2.4
Total			**8**	

Question	Answers	Extra information	Mark	AO/ Spec. Ref
03.1	ammeter and voltmeter symbols correct voltmeter in parallel with wire ammeter in series with wire		1 1 1	AO1 4.2.1.1 4.2.1.3

03.2	**Level 3:** The method would lead to the production of a valid outcome. All key steps are identified and logically sequenced.	5–6	AO1 4.2.1.3
	Level 2: The method would not necessarily lead to a valid outcome. Most steps are identified, but the method is not fully logically sequenced.	3–4	
	Level 1: The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.	1–2	
	No relevant content	0	
	Indicative content: • length measured • length varied • current measured • potential difference measured • repeat readings • calculate resistance for each length • resistance = $\frac{\text{potential difference}}{\text{current}}$ • plot a graph of resistance against length • hazard: high current • may cause wire to melt / overheat • may cause burns (to skin) • use low currents		

Question	Answers	Extra information	Mark	AO/ Spec. Ref
03.3	the temperature of the wire would not change		1	AO3 4.2.1.3
03.4	the accuracy of the student's results would be higher		1	AO3 4.2.1.3
	the resolution of the length measurement would be higher		1	
Total			**12**	

Question	Answers	Extra information	Mark	AO/ Spec. Ref
04.1	chemical	in this order only	1	AO1 4.1.1.1
	equal to	allow the same as	1	
04.2	power = $\frac{\text{work done}}{\text{time}}$	allow P = $\frac{W}{t}$	1	AO1 4.1.1.4
04.3		an answer of 360 000 (J) scores **3** marks		AO2 4.1.1.4
	200 = $\frac{W}{1800}$		1	
	W = 200 × 1800		1	
	W = 360 000 (J)		1	
04.4		an answer that rounds to 15.8 (%) scores **2** marks		AO2 4.1.1.1
	11 – 9.5 = 1.5 (m/s)	allow a change in speed between 1.2 and 1.5 (m/s)	1	
	$\left(\frac{1.5}{9.5}\right)$ × 100 = 15.8 (%)	allow an answer consistent with their change in speed	1	
		an answer of 16 (%) scores **2** marks		
04.5	maximum speed is lower		1	AO1 4.1.1.4
	because maximum power output of cyclist is constant	allow maximum force on pedals is constant	1	
	(but) additional work is done (against gravity) **or** gravitational potential energy (of cyclist) is increased	do **not** accept additional work done against friction or air resistance	1	
Total			**11**	

Question	Answers	Extra information	Mark	AO/ Spec. Ref
05.1	potential difference	in this order only allow p.d. allow voltage	1	AO1 4.2.1.4
	temperature		1	
05.2	the current increases (when the potential difference increases)		1	AO1 4.2.1.4
	(which) causes the temperature of the filament to increase		1	
	(so) the resistance increases	do **not** accept resistance increases and then levels off	1	
05.3	a higher proportion / percentage of the (total) power / energy input is usefully transferred **or** higher (useful) power / energy output for the same (total) power / energy input	wastes less energy is insufficient	1	AO2 4.1.2.2
05.4	potential difference increases		1	AO2 4.2.2
	current decreases		1	AO1 4.2.2
05.5	1000 (Ω)	reason only scores if R =1000 (Ω)	1	AO2 4.2.1.3
	potential difference is shared in proportion to the resistance	allow a justification using a correct calculation	1	

Question	Answers	Extra information	Mark	AO/ Spec. Ref
05.6		an answer of 1.7×10^{-3} (A) scores **4** marks		AO2 4.2.1.3
	$12 = I \times 7000$		1	
	$I = \frac{12}{7000}$		1	
	$I = 1.71 \times 10^{-3}$ (A)	an answer that rounds to 1.7×10^{-3} (A) scores **3** marks	1	
	$I = 1.7 \times 10^{-3}$ (A) **or** $I = 0.0017$ (A)	this answer only	1	
		an answer of 2.4×10^{-3} (A) scores **2** marks		
		if no other marks scored allow **1** mark for calculation of total resistance (7000 Ω)		
Total			**14**	

Question	Answers	Extra information	Mark	AO/ Spec. Ref
06.1	smoke absorbs / stops alpha radiation	allow alpha particles for alpha radiation alpha radiation does not reach the detector is insufficient	1	AO2 4.4.2.1
06.2	alpha radiation is not very penetrating **or** alpha radiation does not penetrate skin	allow alpha particles for alpha radiation allow alpha radiation does not travel very far (in air)	1	AO1 4.4.2.1
06.3	beta and gamma radiation will penetrate smoke no change (in the count rate) would be detected	allow beta and gamma radiation will not be stopped by smoke allow the change detected (in the count rate) would be too small	1 1	AO2 4.4.2.1
06.4	(a long half-life means) the count rate is (approximately) constant **or** a short half-life means the count rate decreases quickly until 1.3 half-lives the count rate is above 80 per second **or** until 1.3 half-lives the count rate is above the threshold for the smoke alarm to be activated **or** after 1.3 half-lives the smoke alarm will be activated all the time	allow activity of source is (approximately) constant allow after 1.3 half-lives the count rate is below 80 per second so don't have to replace source or smoke detector is insufficient	1 1	AO3 4.4.2.3

Question	Answers	Mark	AO/ Spec. Ref
06.5	**Level 2:** Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.	3–4	AO2 4.4.3.3
	Level 1: Relevant points (reasons / causes) are identified, and there are attempts at logically linking. The resulting account is not fully clear.	1–2	AO1 4.4.3.3
	No relevant content	0	
	Indicative content • short half-life or half-life of a few hours • (short half-life means) less damage to cells / tissues / organs / body • low ionising power • (low ionising power means) less damage to cells / tissues / organs / body • highly penetrating • (highly penetrating means) it can be detected outside the body • emits gamma radiation		
Total			**10**

Question	Answers	Extra information	Mark	AO/ Spec. Ref
07.1	any **two** from: • calculate a mean • reduces the effect of random errors • identify / remove anomalies	 reduces human error is insufficient allow to assess the repeatability of the data	2	AO3 4.3.3.2
07.2	random error (because) eye position would not be the same each time (relative to the liquid)	allow a parallax error human error is insufficient allow systematic error only if it is clear that the student always viewed liquid level from above meniscus (or below)	1 1	AO3 4.3.3.2
07.3	(a temperature increase would) increase the pressure in the tube (even if the volume was constant) (because a higher temperature would mean) higher (average) kinetic energy of molecules / particles	 allow higher (average) speed for higher (average) kinetic energy	1 1	AO1 4.3.3.3

Question	Answers	Extra information	Mark	AO/ Spec. Ref
07.4		an answer of 8.0 (cm^3) scores **3** marks		AO2 4.3.3.2
	$1.6 \times 10^5 \times 9.0$ (= 1.44×10^6)		1	
	$1.44 \times 10^6 = 1.8 \times 10^5 \times V$ **or** $V = \frac{1.44 \times 10^6}{1.8 \times 10^5}$	allow for **2** marks $V = \frac{1.6 \times 10^5 \times 9.0}{1.8 \times 10^5}$	1	
	$V = 8.0$ (cm^3)		1	
07.5	work is done on the air (in the tyre)		1	AO1 4.3.3.3
	so the temperature (of the air) increases	allow the (average) kinetic energy of the particles increases	1	
Total			**11**	

Question	Answers	Extra information	Mark	AO/ Spec. Ref
08.1	any **three** from: • no carbon dioxide emitted (to produce electricity) • doesn't cause global warming • nuclear power doesn't cause earthquakes • more energy released per kg of fuel (compared to shale gas)	no greenhouse gases is insufficient allow climate change or greenhouse effect for global warming	3	AO1 AO2 4.1.3
08.2	uranium **or** plutonium	ignore any numbers given	1	AO1 4.4.4.1
08.3	a neutron is absorbed by a (large) nucleus the nucleus splits into two (smaller) nuclei releasing energy (and gamma rays) and (two / three) neutrons	a description in terms of only atoms negates first two marking points	1 1 1 1	AO1 4.4.4.1
Total			**8**	

Question	Answers	Extra information	Mark	AO/ Spec. Ref
09.1	risk of electric shock (if someone touched the case)	allow risk of electrocution (if someone touched the case)	1	AO1 4.2.3.2
09.2		an answer of 11 (A) scores **3** marks		AO2 4.2.4.1
	2530 = I × 230	this mark may be awarded if P is incorrectly / not converted	1	
	$I = \frac{2530}{230}$	this mark may be awarded if P is incorrectly / not converted	1	
	I = 11 (A)	this answer only	1	
		an answer of 0.011 (A) scores **2** marks		
09.3		an answer of 0.12 (kg) **or** an answer that rounds to 0.12 (kg) scores **5** marks		AO2 4.2.4.2 4.1.1.3
	E = 2530 × 14	this mark may be awarded if P is incorrectly / not converted	1	
	E = 35 420 (J)	this answer only	1	
	35 420 = m × 4200 × 70	allow their calculated E = m × 4200 × 70	1	
	$m = \frac{35\,420}{4200 \times 70}$	allow $m = \frac{\text{their calculated E}}{4200 \times 70}$	1	
	m = 0.12 (kg)	allow an answer that is consistent with their calculated value of E	1	
Total			**9**	

Question	Answers	Extra information	Mark	AO/ Spec. Ref
10.1		an answer of 27 600 (kg) scores **3** marks		AO2 4.3.1.1
	$1.2 = \frac{m}{2.3 \times 10^4}$		1	
	$m = 1.2 \times 2.3 \times 10^4$		1	
	m = 27 600 (kg) **or** $m = 2.76 \times 10^4$ (kg)	allow an answer of 28 000 (kg) or 2.8×10^4 (kg)	1	
10.2		allow power output for kinetic energy throughout		AO3 4.1.1.2
	mass of air passing the turbine blades is halved which decreases kinetic energy by a factor of two		1	
	(wind speed is halved) decreasing kinetic energy by a factor of four		1	
	so kinetic energy decreases by a factor of eight		1	
10.3		an answer that rounds to 7.50 (m/s) scores **3** marks		AO2 4.1.1.2
	$388\,000 = 0.5 \times 13\,800 \times v^2$	this mark may be awarded if P is incorrectly / not converted	1	
	$v^2 = \frac{(2 \times 388\,000)}{13\,800}$ **or** $v^2 = \frac{388\,000}{(0.5 \times 13\,800)}$ **or** $v^2 = 56.2$	this mark may be awarded if P is incorrectly / not converted	1	
	v = 7.50 (m/s)	an answer that rounds to 7.50 (m/s) only	1	
Total			**9**	