



GCSE
PHYSICS
8463/1H

Paper 1 Higher Tier

Mark scheme

June 2026

Version: 1.0 Final

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 Examiner.

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.

No student should be disadvantaged on the basis of their gender identity and/or how they refer to the gender identity of others in their exam responses.

A consistent use of 'they/them' as a singular and pronouns beyond 'she/her' or 'he/him' will be credited in exam responses in line with existing mark scheme criteria.

Further copies of this mark scheme are available from aqa.org.uk

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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 their 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 (for example, a scientifically correct answer that could not reasonably be expected from a student's knowledge of the specification).

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**.
Alternative words in the mark scheme are shown by a solidus 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 errors / 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** magnetic materials.

[2 marks]

Student	Response	Marks awarded
1	iron, steel, tin	1
2	cobalt, nickel, nail*	2

3.2 Use of symbols / formulae

If a student writes a chemical symbol / formula instead of a required chemical name, or uses symbols to denote quantities in a physics equation, 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. At any point in a calculation students may omit steps from their working. If a subsequent step is given correctly, the relevant marks may be awarded.

Full marks should be awarded for a correct numerical answer, without any working shown. Full marks are **not** awarded for a correct final answer from incorrect working.

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

An error can be carried forward from one question part to the next and is shown by the abbreviation 'ecf'.

Within an individual question part, an incorrect value in one step of a calculation does not prevent all of the subsequent marks being awarded.

3.6 Phonetic spelling

Marks should be awarded if spelling is not correct but the intention is clear, **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 not 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.

3.11 Numbered answer lines

Numbered lines on the question paper are intended to support the student to give the correct number of responses. The answer should still be marked as a whole.

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, if necessary, 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. With practice and familiarity you will find that for better answers you will be able to quickly skip through the lower levels of the mark scheme.

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 1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	series		1	AO1 4.2.2
	parallel		1	

Question	Answers	Mark	AO / Spec. Ref.
01.2	straight line between -1.0 and 0.6 V, then curved line through points	1	AO2 4.2.1.4 RPA4

Question	Answers	Mark	AO / Spec. Ref.
01.3	Level 3: The design/plan would lead to the production of a valid outcome. All key steps are identified and logically sequenced.	5–6	AO1
	Level 2: The design/plan would not necessarily lead to a valid outcome. Most steps are identified, but the plan is not fully logically sequenced.	3–4	AO1
	Level 1: The design/plan would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.	1–2	AO1
	No relevant content	0	
	Indicative content - take measurements using the ammeter and voltmeter - current measured with an ammeter - pd measured with a voltmeter - variable resistor (or variable power pack or variable number of cells) used to vary current in and pd across the diode - range of pd of -1 to 1 V - interval of pd of 0.1 V - reverse connections to power supply to obtain negative values - take repeat readings and calculate a mean - discard anomalies A Level 3 answer must include a method to obtain negative values. To score 6 marks the range or interval should be referred to in the answer.		4.2.1.4 RPA4

Question	Answers			Mark	AO / Spec. Ref.
01.4	Potential difference across the diode	High resistance	Low resistance	2	AO3 4.2.1.4 RPA4
	-1.0 V	✓			
	-0.5 V	✓			
	+0.5 V	✓			
	+1.0 V		✓		
2 marks for 4 correct ticks 1 mark for 3 correct ticks					

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5	diode may overheat / melt / burn / break	'it' is the diode allow diode will become hot allow (risk of) burns ignore current is high ignore diode will explode ignore wires will melt ignore electric shock	1	AO3 4.2.1.4 RPA4

Total Question 1	12
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Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	mass		1	AO1 4.3.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.2	$46\,000 = 0.020 \times L$		1	AO2 4.3.2.3
	$L = \frac{46\,000}{0.020}$		1	
	$L = 2\,300\,000 \text{ (J/kg)}$		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	$E = P \times t$ or energy transferred = power $\times$ time		1	AO1 4.2.4.2 4.1.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.4	$46\,000 = 115 \times t$		1	AO2 4.2.4.2 4.1.1.4
	$t = \frac{46\,000}{115}$		1	
	$t = 400 \text{ (s)}$		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.5	the beaker of water was not insulated		1	AO3 4.1.1.1 4.1.2.1
	thermal energy was transferred to the surroundings		1	

Total Question 2	10
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Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	133		1	AO1 4.4.2.2
	55		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	number of half-lives = 3		1	AO2 4.4.2.3
	proportion remaining = $(\frac{1}{2})^3$		1	
	or proportion remaining = 0.125			
	or proportion remaining = 1/8			
	percentage remaining = 12.5 (%)		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.3	xenon(-133) has a shorter half-life (than krypton-85)	allow 5 days is less than 11 years	1	AO3 4.4.3.2 4.4.2.3
	so xenon(-133) has a higher initial activity (than krypton-85)	allow xenon(-133) has a higher initial rate of decay (than krypton-85)	1	
	(but) the activity / mass of xenon(-133) decreases quickly or (but) the activity / mass of krypton(-85) decreases slowly	allow more xenon(-133) nuclei will decay than krypton(-85) nuclei in a given time period	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.4	one neutron shown colliding with a uranium-235 (nucleus) which splits and releases more neutrons and two smaller nuclei	do not accept neutrons colliding with Xe or Sr nuclei causing fission	1	AO1 4.4.4.1
		MP2 dependent on MP1 if no other mark awarded allow 1 mark for a diagram with no labels showing another fission reaction	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.5	(nuclear) explosion / meltdown / disaster	allow examples of disasters e.g. Chernobyl / Fukushima / Three Mile Island	1	AO1 4.4.4.1

Total Question 3	11
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Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	friction	allow rubbing for friction	1	AO1 4.2.5.1
	(causes) <u>electrons</u> to move	do not accept child having / gaining positive charge do not accept positively charged electrons	1	
	to the child (from the slide)	MP3 dependent on MP2	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.2	$Q = \frac{E}{V}$		1	AO1 4.2.4.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.3	$V = 35\,000\text{ (V)}$	all subsequent marks may be awarded using an incorrectly / not converted value of V	1	AO2 4.2.4.2
	$Q = \frac{0.21}{35\,000}$ or $0.21 = Q \times 35\,000$		1	
	$Q = 6.0 \times 10^{-6}\text{ (C)}$ or $Q = 0.0000060\text{ (C)}$		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	metal is a(n electrical) conductor	allow metal is not an insulator	1	AO1 4.2.5.1
	(so) no / less build-up of charge (on the child) or (so) the charge / child is earthed	ignore description of charge transfer	1	AO3

Total Question 4	9
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Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	the force is greatest when distance (between the alpha particle and the nucleus) is smallest	ignore alpha particle colliding with gold nucleus	1	AO3 4.2.5.2 4.4.1.3
	(because) there is an electric field (between the alpha particle and the nucleus)	ignore field unqualified	1	AO1
	or both the alpha particle and the gold nucleus are positively charged	allow both the alpha particle and the nucleus have the same type of charge		
	(and) the electric field (strength) is strongest when the distance is smallest	allow strength of electric field increases as distance decreases	1	AO3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2	most of the atom is empty space		1	AO1 4.4.1.3
	most of the mass of atom concentrated at the centre / nucleus	allow nucleus is small and dense	1	
	nucleus is charged	allow positively charged ignore mention of protons and/or neutrons	1	
	(negatively charged) electrons orbit the nucleus	do not accept a description of energy levels	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3	the electron loses energy (by emitting electromagnetic radiation)		1	AO1 AO3 4.4.1.1
	(so) electron moves to energy level A	allow electron moves closer to the nucleus MP2 dependent on MP1 ignore lower energy level unqualified if no other mark awarded allow 1 mark for electron moves (back) down to energy level A	1	
Total Question 5			9	

Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	control (variable)		1	AO1 4.1.1.3 4.3.2.2 RPA1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.2	energy has to transfer through the block (before the thermometer temperature increases)	allow metal / iron for block allow conduction has to take place through the block allow the heater / block has to heat up (before the thermometer temperature increases)	1	AO2 4.1.1.3 4.3.2.2 RPA1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.3	$E = 14\,400 \text{ (J)}$	all subsequent marks may be awarded using an incorrectly / not converted value of E	1	AO2 4.1.1.3 4.3.2.2 RPA1
	$\Delta\theta = 42 - 22$	allow $\Delta\theta = 20 \text{ (}^\circ\text{C)}$	1	
	$c = \frac{14\,400}{(1.5 \times 20)}$	allow a correct rearrangement using an incorrect temperature change using data from the graph	1	
	$c = 480$	allow a correctly calculated value of c using their $\Delta\theta$	1	
	J/kg $^\circ\text{C}$		1	AO1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.4	straight line drawn from 22 °C below line of best fit on Figure 10		1	AO3 4.1.1.3 4.3.2.2 RPA1
	line passes through 300 s, 32 °C	MP2 dependent on MP1	1	

Total Question 6	9
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Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	$I = 0.006 \text{ (A)}$	all subsequent marks can score using an incorrectly / not converted value of I	1	AO2 4.2.1.3
	$120 = 0.006 \times R$		1	
	$R = \frac{120}{0.006}$		1	
	$R = 20\,000 \text{ (}\Omega\text{)}$		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.2	$t = 250 \times 10^{-6} \text{ (s)}$	all subsequent marks can score using an incorrectly / not converted value of t	1	AO2 4.2.1.2
	$2.8 \times 10^{-6} = I \times 250 \times 10^{-6}$		1	
	$I = \frac{2.8 \times 10^{-6}}{250 \times 10^{-6}}$		1	
	$I = 0.0112 \text{ (A)}$	allow $I = 0.011 \text{ (A)}$	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.3	doctor is at earth potential or doctor is earthed	allow doctor is at 0 volts	1	AO1 4.2.3.2
	(so there is a) potential difference between the doctor and electrical pads	ignore charge / electrons jumping from electrical pads to doctor	1	

Total Question 7	10
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Question 8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.1	gravitational potential energy (store of the carriages) increases	ignore energy transfers between start position and position A		AO1 4.1.1.1
		allow E_p for gravitational potential energy	1	
		allow E_k for kinetic energy	1	
		ignore energy dissipation to surroundings allow 2 marks for kinetic energy is transferred to gravitational potential energy		

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.2	$E_p = 35\,000 \times 9.8 \times 65$		1	AO2 4.1.1.2
	$E_p = 22\,295\,000 \text{ (J)}$		1	
	$22\,295\,000 = 0.5 \times 35\,000 \times v^2$	the equation $E_p = mgh$ must have been used for the award of subsequent marks	1	
	$v = \sqrt{\frac{22\,295\,000}{0.5 \times 35\,000}} \quad (= \sqrt{1274})$	allow $v^2 = \frac{22\,295\,000}{0.5 \times 35\,000}$	1	
	$v = 35.693\dots$		1	
	$v = 36 \text{ (m/s)}$	allow an answer given to 2 sf using all the data in the question	1	
		an answer using $v^2 = 2gh$ may be awarded full marks		
		do not accept a calculation using $v^2 - u^2 = 2as$		

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.3	the kinetic energy (store of the carriages) decreases	ignore changes to gravitational potential energy	1	AO1 4.1.1.1
	thermal / internal energy (store) of the brakes increases	allow thermal / internal energy increases and is dissipated (to the surroundings)	1	
		allow 2 marks for kinetic energy is transferred to thermal / internal energy of the brakes		
Total Question 8			10	

Question 9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.1	injury to foot / leg / hand / arm	allow (weight may) land on foot / leg / hand / arm	1	AO3 4.3.3.2
	position equipment in middle of desk	allow stand up (so falling weights can be avoided)	1	
		allow a method to make the clamp stand more stable		
		allow wear reinforced shoes		

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.2	two calculations of $p \times V$ for corresponding pairs of values	eg: $150 \times 40 = 6000 \text{ (kPa cm}^3\text{)}$ $140 \times 43 = 6020$ $130 \times 46 = 5980$ $120 \times 50 = 6000$ $110 \times 54.5 = 5995$ $100 \times 60 = 6000$	1	AO3 4.3.3.2
	calculation of $p \times V$ for a third corresponding pair of values		1	
	calculated values of $p \times V$ are similar	allow calculated values of $p \times V$ are the same allow 2 marks for use of data showing that as the volume decreases by a factor of 1.5, the pressure increases by a factor of 1.5	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.3	particles collide more frequently	do not accept speed of particles increasing or kinetic energy of particles increasing for MP1 and MP2	1	AO1 4.3.3.2 4.3.3.1
	with container walls	MP2 dependent on scoring MP1	1	
	so total force (on walls) is greater		1	
	and pressure is force per unit area	allow force acts on a smaller area allow $p = \frac{F}{A}$ with quantities defined	1	
Total Question 9			9	

Question 10

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.1	$0.18 = 1.5 \times I$	the equation $P = VI$ must have been used for the award of subsequent marks	1	AO2 4.2.1.3 4.2.4.1
	$I = \frac{0.18}{1.5}$		1	
	$I = 0.12 \text{ (A)}$		1	
	$0.18 = 0.12^2 \times R$		1	
	or $R = \frac{0.18}{0.12^2}$			
	or $1.5 = 0.12 \times R$			
	or $R = \frac{1.5}{0.12}$			
	$R = 12.5 \text{ (}\Omega\text{)}$		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.2	current in the battery is twice as big as the current in the resistor	allow the current in the resistor and the thermistor is the same	1	AO2 4.2.1.1 4.2.2
	because the current splits equally between the branches		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.3	ammeter reading increases		1	2 × AO1
	(because) thermistor resistance decreases	allow total resistance decreases MP2 dependent on MP1	1	2 × AO2 4.2.1.1 4.2.1.3 4.2.2
	voltmeter reading stays the same		1	
	(because) pd is the same as the battery pd	MP4 dependent on MP3	1	
Total Question 10			11	