

INTERNATIONAL GCSE CORE PHYSICS

9223

Paper 1

Mark scheme

Specimen paper

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.

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Level of response marking instructions

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 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. 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 and not look to pick holes in 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 and then 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.

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

Question	Answer	Extra information	Mark	AO / Spec. Ref.
01.1	Two neutrons and two protons		1	AO1 3.7.2e

Question	Answer	Extra information	Mark	AO / Spec. Ref.
01.2	has a long half-life so source does not need changing or has a long half-life so provides a constant power supply	allow so source remains active for a long time allow (can provide power for) the length of time as a person will live for	1	AO3 3.7.2h

Question	Answer	Extra information	Mark	AO / Spec. Ref.
01.3	an electron emitted from the nucleus		1	AO1 3.7.2e

Question	Answer	Extra information	Mark	AO / Spec. Ref.
01.4	beta will pass through plastic	allow beta is not stopped by plastic	1	1xAO3 1xAO2 3.7.2g
	so will enter the body	allow causes cancer	1	

Question	Answer	Extra information	Mark	AO / Spec. Ref.
01.5	electric cells do not emit radiation	allow people concerned about nuclear radiation allow radioactive source difficult to dispose of	1	AO1 3.7.2g
	needs changing more often		1	

Total Question 1			Marks	7
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Question	Answer	Extra information	Mark	AO / Spec. Ref.
02.1	the point at which the mass may be thought to be concentrated		1	AO1 3.1.7a

Question	Answer	Extra information	Mark	AO / Spec. Ref.
02.2	directly below the pin		1	AO3 3.1.7b

Question	Answer	Extra information	Mark	AO / Spec. Ref.
02.3	(the centre of mass is located at) the point where the two lines cross.		1	AO3 3.1.7a

Question	Answer	Extra information	Mark	AO / Spec. Ref.
02.4	hang the card from another point and mark the position of the string again		1	AO4 3.1.7a

Question	Answer	Extra information	Mark	AO / Spec. Ref.
02.5	2 or 3 straight lines drawn connecting opposite corners		1	AO3 3.1.7c

Question	Answer	Extra information	Mark	AO / Spec. Ref.
02.6	weight is the force of gravity (on the object)	allow weight is a force	1	AO2 3.1.7c
	mass is the amount of matter (in the object)		1	

Total Question 2			Marks	7
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Question	Answer	Extra information	Mark	AO / Spec. Ref.
03.1	it has an equal number of protons and electrons	allow it has 1 proton and 1 electron	1	AO3 3.7.1d
	protons and electrons have opposite charge	allow proton is positive and electron is negative	1	
	OR equal number of positive charges and negative charges (1) therefore the charge adds up to zero (1)	allow charge cancels		

Question	Answer	Extra information	Mark	AO / Spec. Ref.
03.2	ions		1	AO1 3.7.1e

Question	Answer			Extra information	Mark	AO / Spec. Ref.
03.3						
	Particle	Relative mass	Relative charge	2 marks if all 3 are correct 1 mark if 1 or 2 are correct	2	AO1 3.7.1c
	proton	1	1			
	neutron	1	0			
	electron	very small	-1			

Question	Answer	Extra information	Mark	AO / Spec. Ref.
03.4	Level 2: Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account.		3-4	2xAO2 3.7.1cf
	Level 1: Facts, events or processes are identified and simply stated but their relevance is not clear.		1-2	2xAO3 3.7.1cf
	No relevant content		0	
	Indicative content: - oxygen has 2 more protons/carbon has 2 fewer protons - oxygen has 2 more neutrons/carbon has 2 fewer neutrons (neutral) oxygen has 2 more electrons/(neutral) carbon has 2 fewer electrons - oxygen atom has more mass/carbon atom has less mass - oxygen atom is larger/carbon atom is smaller - oxygen has 4 more particles in its nucleus/carbon has 4 fewer particles in its nucleus - oxygen has 16 particles in its nucleus - carbon has 12 particles in its nucleus - oxygen has 8 protons in its nucleus, carbon has 6 protons in its nucleus - oxygen has 8 neutrons in its nucleus, carbon has 6 neutrons in its nucleus - oxygen has 8 electrons, carbon has 6 electrons			
Total Question 3			Marks	9

Question	Answer	Extra information	Mark	AO / Spec. Ref.
04.1	differences any two from: • electromagnetic waves travel much faster than sound waves • electromagnetic waves have a much larger range of frequencies / wavelengths • electromagnetic waves can travel through a vacuum and sound waves need a medium to travel through		2	AO1 3.3.1e
	similarities any two from: • both transfer energy/information • both can be diffracted • both can be refracted • both can be reflected		2	

Question	Answer	Extra information	Mark	AO / Spec. Ref.
04.2	$300\,000\,000 = 750\,000\,000 \times \lambda$		1	1xAO1 3xAO2 3.3.1h
	$\lambda = 300\,000\,000 / 750\,000\,000$		1	
	$\lambda = 0.4$		1	
	m		1	

Question	Answer	Extra information	Mark	AO / Spec. Ref.
04.3	(24 000 -) 20 000		1	AO2 3.3.3a
	4 000		1	

Total Question 4			Marks	10
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Question	Answer	Extra information	Mark	AO / Spec. Ref.
05.1	gravity		1	AO1 3.8.1a

Question	Answer	Extra information	Mark	AO / Spec. Ref.
05.2	energy is released by the fusion of hydrogen nuclei to make helium nuclei		1	AO1 3.8.1b

Question	Answer	Extra information	Mark	AO / Spec. Ref.
05.3	Level 2: Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account. Level 1: Facts, events or processes are identified and simply stated but their relevance is not clear. No relevant content Indicative content: Similarities - both stars are formed from dust and gas brought together by gravitational forces - both stars form a protostar - both stars then become main sequence stars - in both stars hydrogen fuses to form helium - both stars run out of hydrogen - both stars cool and expand Differences - Betelgeuse becomes a red supergiant - Sun becomes a red giant - Betelgeuse explodes / supernova - Sun does not undergo a supernova - Betelgeuse forms a neutron star - Sun becomes a white dwarf - if Betelgeuse is massive enough - Betelgeuse forms a black hole - Sun becomes a black dwarf for Level 2 answers must have at least 2 correct stages for each star and at least 1 similarity		4-6 1-3 0	3xAO1 f 3xAO2 3.8.1fghj

Total Question 5			Marks	8
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Question	Answer	Extra information	Mark	AO / Spec. Ref.
06.1	Level 2: The design / plan would lead to the production of a valid outcome. All key steps are identified and logically sequenced.		3-4	AO4 3.1.1h
	Level 1: The design / plan would not necessarily lead to a valid outcome. Most steps are identified, but the plan is not fully logically sequenced.		1-2	AO4 3.1.1h
	No relevant content Indicative content: • note original position of the marker • add a slotted mass • measure the distance between the original position and the new position using the ruler • record the extension • readings taken at eye level • repeat with more masses • range 0–10 100 g masses • suggests repeat readings • determine the weight of the masses • mean values calculated for each force / weight • plot graph (of force on the y-axis and extension on the x-axis) • draw line of best fit • gradient = $\Delta y / \Delta x$		0	

Question	Answer	Extra information	Mark	AO / Spec. Ref.
06.2	9.3 (N/kg) to 10.2 (N/kg)		1	AO3 3.1.1e

Question	Answer	Extra information	Mark	AO / Spec. Ref.
06.3	the value 9.3		1	AO4 3.1.1e
	is a lot lower than the other consistent values		1	

Question	Answer	Extra information	Mark	AO / Spec. Ref.
06.4	$\frac{(10.1+10.2+10.0+10.1)}{4}$	allow 1 mark for a correct calculation including 9.3	1	AO2 3.1.1e
	10.1 (N/kg)		1	

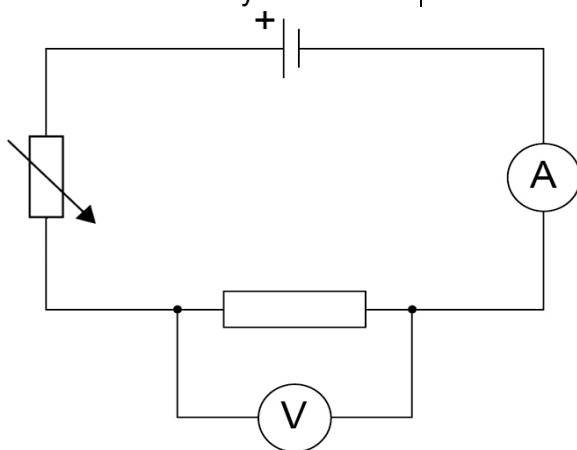
Question	Answer	Extra information	Mark	AO / Spec. Ref.
06.5	zero the balance		1	AO4 3.1.1e

Question	Answer	Extra information	Mark	AO / Spec. Ref.
06.6	$m = 0.158 \text{ kg}$		1	3xAO2 1xAO3 3.1.1e
	$W = 0.158 \times 9.8$		1	
	$W = 1.5484$		1	
	$W = 1.5 \text{ (N)}$		1	

Total Question 6			Marks	14
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Question	Answer	Extra information	Mark	AO / Spec. Ref.
07.1	ammeter	must be in this order	1	AO1 3.5.1g
	voltmeter		1	

Question	Answer	Extra information	Mark	AO / Spec. Ref.
07.2	resistor, variable resistor, battery/cell, ammeter, voltmeter, (switch) voltmeter and ammeter connected correctly	allow a variable power supply if variable resistor is omitted allow 1 mark if 1 symbol is omitted or incorrect	2	AO4 3.5.1g
			1	



Question	Answer	Extra information	Mark	AO / Spec. Ref.
07.3	$I = 0.16 \text{ (A)}$		1	AO2 3.5.1h
	$3.6 = 0.16 \times R$		1	
	$R = \frac{3.6}{0.16}$		1	
	$R = 22.5 \text{ (}\Omega\text{)}$		1	

Question	Answer	Extra information	Mark	AO / Spec. Ref.
07.4	as current in the filament increases the temperature increases causing the ions in the metal to vibrate with greater amplitude greater frequency of collisions between free electrons and ions which increases the resistance (so the graph curves)		1 1 1 1	AO1 3.5.1m
Total Question 7			Marks	13

Question	Answer	Extra information	Mark	AO / Spec. Ref.
08.1	section A to B	allow speed for velocity throughout		4xAO2 2xAO3 3.1.3bcdg
	the resultant force is forwards	allow thrust is greater than drag	1	
	so the car accelerates	allow velocity increases	1	
	section B to C	allow thrust and drag have the same magnitude but act in opposite directions	1	
	resultant force is zero		1	
	so the car travels at a constant velocity	allow terminal velocity for constant velocity	1	
	section C to D			
	the resultant force is in the opposite direction to motion	allow drag is greater than thrust	1	
	so the car decelerates	allow velocity decreases for decelerates	1	

Question	Answer	Extra information	Mark	AO / Spec. Ref.
08.2	$a = \frac{45 - 0}{1.4 - 0}$	allow use of any point on line AB	1	AO1 2xAO2 3.1.3e
	$a = 32$	allow a correct answer to any number of significant figures	1	
	m/s^2		1	

Question	Answer	Extra information	Mark	AO / Spec. Ref.
08.3	distance travelled during acceleration $0.5 \times 137.5 \times 4.3$ 295.625 (m) distance travelled during constant speed $137.5 \times 2.2 = 302.5 \text{ (m)}$ total distance = 295.625 + 302.5 = 598.125 (m)		1 1 1 1	AO2 3.1.3f
Total Question 8			Marks	13

Question	Answer	Extra information	Mark	AO / Spec. Ref.
09.1	if a fault causes a large current	allow if the current exceeds the fuse rating	1	AO1 3.6.3e
	fuse wire gets hotter and melts		1	
	fuse wire breaks and disconnects the circuit	allow which stops the current in the circuit in the kettle	1	

Question	Answer	Extra information	Mark	AO / Spec. Ref.
09.2	operates faster than a fuse		1	AO1 3.6.3e
	can be reset		1	

Question	Answer	Extra information	Mark	AO / Spec. Ref.
09.3	plastic is an insulator	allow the kettle is double insulated	1	AO1 AO2 3.6.3f 1 x 4-5 1 x 6-7
	so the case cannot become live	allow touching the plastic case will not result in the user receiving an electric shock	1	

Question	Answer	Extra information	Mark	AO / Spec. Ref.
09.4	water surrounding heating element is heated and particles become further apart		1	AO3 3.4.2a 6-7
	heated water is less dense and rises to the surface, cooler water is denser and falls		1	
	a convection current is set up which heats all the water in the kettle		1	

Question	Answer	Extra information	Mark	AO / Spec. Ref.
09.5	calculation of energy transferred to the kettle $P = 230 \times 11$ $P = 2530 \text{ (W)}$ $E = (2530 \times 180 =) 455\,400 \text{ (J).}$ calculation of energy transferred to the water $E = 1.2 \times 4200 \times 80$ $E = 403\,200 \text{ (J)}$ wasted energy = $455\,400 - 403\,200 = 52\,200 \text{ (J)}$		1 1 1 1 1 1	AO2 3.6.5cb 3.4.1b 8-9
Total Question 9			Marks	16