GCSE
PHYSICS

8463/2F – PAPER 2 FOUNDATION 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 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 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	Milky Way		1	AO1 4.8.1.1
01.2	distance = 300 000 × 500 d = 150 000 000 (km)	an answer of 150 000 000 scores **2** marks	1 1	AO2 4.5.6.1.2
01.3	3		1	AO1 4.8.1.1
01.4	accept any number greater than 1.0 and less than 12.0		1	AO3 4.8.1.1
01.5	$\frac{9}{0.6}$ 15	an answer of 15 scores **2** marks	1 1	AO2 4.8.1.3
Total			**7**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	B		1	AO1 4.6.2.5
02.2	upright virtual		1 1	AO1 4.6.2.5
02.3	 image height = 9.5(mm) object height = 24(mm) magnification = $\frac{9.5}{24}$ **or** $\frac{\text{their image height}}{\text{their object height}}$ magnification = 0.4 **or** $\frac{\text{their image height}}{\text{their object height}}$ correctly calculated	an answer of 0.4 scores **4** marks allow any value between 9 and 10 inclusive allow 5 (squares) allow 12 (squares) allow an answer that rounds to 0.4 provided both object height and image height are correct ignore any units	 1 1 1 1	AO2 4.6.2.5
02.4	decrease		1	AO2 4.6.2.5
Total			**8**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	increased		1	AO1 4.6.1.2
03.2	(count) how many waves pass a point		1	AO1 4.6.1.2
	in one second	this is dependent on the first mark point being awarded	1	
	or			
	(count) number of waves that pass a point in a given time **or** (count) number of waves that are produced in a given time (1)	allow a specific time for a given time		
	and divide by that time in seconds (1)	this is dependent on the first mark point being awarded allow an answer in terms of measuring the frequency of the vibrating bar		
03.3		an answer of 0.2 scores **2** marks		
	period = $\frac{1}{5}$		1	AO2 4.6.1.2
	period = 0.2		1	AO2 4.6.1.2
	seconds / s		1	AO1 4.6.1.2
Total			**6**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	top of each paper clip labelled N / north **and** bottom of each paper clip labelled S / south	both parts required	1	AO2 4.7.1.1
04.2	so the paper clips have the same weight / mass which allows the results for different numbers of turns to be compared (fairly)	 allow fair test allow the control variable (is the weight / mass of a paper clip) allow to obtain valid results ignore accurate results	1 1	AO3 4.7.2.1
04.3	as the number of turns increases so does the number of paper clips (held) in a linear pattern	allow positive correlation directly proportional scores **2** marks allow a correct description of directly proportional for **2** marks	1 1	AO3 4.7.2.1
04.4	some of the paper clips were already magnetised		1	AO3 4.7.2.1

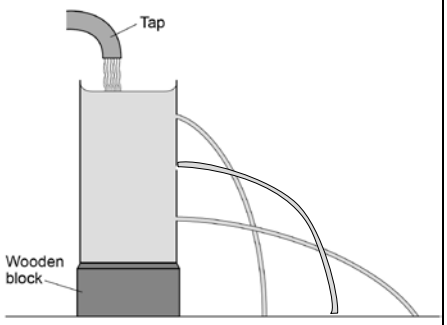
Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.5	discount the result of 18	ignore repeat experiment / measurements	1	AO3 4.7.2.1
	as the three new results are similar (and not close to 18)		1	
	and use 15 (the mean of the new results)	allow find the mean of the remaining results (16,14 and 15) if no other marks have been awarded: calculate the mean (of all four results) (1) round down to 15 (1) – this mark only scores if the mean of 15.75 has been calculated	1	
04.6	keep number of turns constant	allow a specific number of turns	1	AO3 4.7.2.1
	(use the variable resistor to) change the current (several times)	change the p.d. is insufficient	1	
	(for each current value) count how many paper clips the electromagnet will hold		1	
Total			**12**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	glass vase		1	AO2 4.6.2.6
05.2	transmit		1	AO1 4.6.2.6
05.3	the T-shirt reflects all wavelengths / colours of light (equally)	allow T-shirt reflects (white / all) light	1	AO1 4.6.2.6
05.4	changes from red to black as the cap absorbs (all) the (blue) light **or** as the cap does not reflect the (blue) light	it appears black it is darker is insufficient	1 1	AO2 4.6.2.6
05.5	C ——— distance D ✕ the I time	all 3 lines correct allow **1** mark for 1 line correct if more than one line drawn from a variable all of those lines do not score	2	AO2 4.6.2.2
05.6	the (infrared) heater	allow infrared (radiation) do **not** accept answers where burning yourself is given as the hazard	1	AO2 4.6.2.2
05.7	answer must be a comparison, eg the matt / black surface is the better absorber (of infrared radiation)	matt black is a good absorber is insufficient	1	AO3 4.6.2.2
Total			**9**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	C		1	AO1 4.5.5.1.2
06.2	weight = 2.5 × 9.8 weight = 24.5 (N)	an answer of 24.5 scores **2** marks an answer of 24.5 rounded to 25 scores **2** marks	1 1	AO2 4.5.1.3
06.3	the upthrust is the same as the weight		1	AO1 4.5.5.1.2
06.4	(resultant) force = mass × acceleration	allow F = m a	1	AO1 4.5.6.2.2
06.5	4.0 = 2.5 × a $a = \frac{4.0}{2.5}$ a = 1.6 (m/s^2)	an answer of 1.6 scores **3** marks	1 1 1	AO2 4.5.6.2.2
Total			**8**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	work done = 11 500 × 2.60 work done = 29 900 (J)	an answer of 29 900 scores **2** marks	1 1	AO2 4.5.2
07.2	13 800		1	AO2 4.5.4
07.3	moment (of a force) = force x distance	allow M = F d	1	AO1 4.5.4
07.4	13 800 = 11 500 × distance distance = $\frac{13\ 800}{11\ 500}$ distance = 1.2(0 m)	of an answer 1.2(0) scores **3** marks	1 1 1	AO2 4.5.4
Total			**7**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.1	C		1	AO1 4.6.2.1
08.2	radio waves have a longer wavelength than ultraviolet		1	AO1 4.6.2.1
08.3	(risk of) skin cancer **or** (prematurely) ageing skin	cancer is insufficient skin damage is insufficient ignore kills skin cells	1	AO1 4.6.2.3
08.4	risk is higher (for X-ray of uds than X-ray of chest) by a factor of 50 **or** risk calculated for each type of X-ray chest X-ray = 1:200 000 (1) uds = 1:4000 (1)		1 1	AO2 4.6.2.3
Total			**5**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.1	$p = \frac{27}{0.009}$	an answer of 3000 scores **2** marks	1	AO2 4.5.5.1.1
	p = 3000		1	AO2 4.5.5.1.1
	Pa		1	AO1 4.5.5.1.1
09.2		the water path hits the surface somewhere between the other two paths	1	AO3 4.5.5.1.2
09.3	pressure increases with depth	allow when the pressure is higher, the water travels further	1	AO3 4.5.5.1.1
09.4	pressure acts in all directions **or** pressure causes a force on (all) the surfaces	ignore liquids cannot be compressed	1	AO3 4.5.5.1.1
Total			**6**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.1	uniform acceleration	allow constant / steady acceleration allow velocity / speed increasing at a constant rate ignore reference to direction acceleration scores **1** mark **or** velocity / speed is increasing scores **1** mark do **not** accept acceleration increases	2	AO1 4.5.6.1.5
10.2	up(wards)		1	AO1 4.5.6.1.5
10.3	a group of objects that interact		1	AO1 4.1.1.1
10.4	velocity just after bounce is less than just before bounce **or** the height at the top of the bounce is less than the height from which it was dropped	allow velocity is less / decreases allow speed for velocity velocity decreases to zero – on its own scores zero	1	AO3 4.5.6.1.5
	so the ball has lost energy		1	AO1 4.1.1.2
	correct reference to (loss of) ke or (reduced) gpe		1	AO1 4.1.2.1
	total energy of ball and Earth / ground is constant	allow 'a system' for ball and Earth allow energy is conserved	1	AO1 4.1.2.1
Total			**8**	

Question	Answers	Mark	AO/ Spec. Ref
11.1	**Level 3:** The method would lead to the production of a valid outcome. All key steps are identified and logically sequenced.	5–6	AO1 4.5.3
	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 set up a clamp stand with a clamp hang the spring from the clamp use a second clamp and boss to fix a (half) metre ruler alongside the spring record the metre ruler reading that is level with the bottom of the spring hang a 2 N weight from the bottom of the spring record the new position of the bottom of the spring calculate the extension of the spring measure the extension of the spring add further weights to the spring so the force increases 2 N at a time up to 10 N for each new force record the position of the bottom of the spring and calculate / measure the extension **possible source of inaccuracy** not fixing the ruler in position but simply holding the ruler next to the spring not clamping the ruler vertical misjudging the position of the bottom of the spring parallax error allow any other sensible suggestion that could reasonably lead to inaccuracy in the data allow a description that would increase accuracy repeating the measurements is insufficient		

Question	Answers	Extra information	Mark	AO / Spec. Ref.
11.2	to identify any anomalous results **or** to reduce the effect of random error	allow calculate an average for the spring constant allow (more) accurate to obtain an average is insufficient to be able to draw a graph is insufficient	1	AO3 4.5.3
11.3	both points plotted correctly correct line of best fit drawn	 to pass through (0,0) and (10,20)	1 1	AO2 4.5.3
11.4	force = spring constant × extension	allow F = ke	1	AO1 4.5.3
11.5	 extension = 0.2 10 = k × 0.2 $k = \frac{10}{0.2}$ k = 50	an answer of 50 scores **4** marks allow 0.035 / 0.08 / 0.125 / 0.16 force value must match extension this mark may be awarded if e is in cm allow correct transformation of their chosen values this mark may be awarded if e is in cm an answer 0.5 scores **3** marks	 1 1 1 1	 AO2 AO2 AO2 AO2 4.5.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
11.6	the line is straight and passes through the origin	allow the line does not curve this mark is dependent on scoring the first mark allow a correct description of direct proportionality for **2** marks ignore the line shows they are directly proportional	1 1	AO3 4.5.3
Total			**16**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
12.1	Regrettably, this part of the question assessed content that we had stipulated would only be assessed on the Higher tier. All students were awarded full marks for this part of the question.		1	
12.2	0.4		1	AO2 4.6.1.2
12.3	wave speed = frequency × wavelength	allow $v = f \lambda$	1	AO1 4.6.1.2
12.4	$7200 = 0.4 \times$ 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 **12.2** a method shown as $7200 \times 2.5 = 18\,000$ scores **0** marks	 1 1 1	AO2 4.6.1.2
12.5	Regrettably, this part of the question assessed content that we had stipulated would only be assessed on the Higher tier. All students were awarded full marks for this part of the question.		2	
Total			**8**	