GCSE
PHYSICS
8463/2F

Paper 2 Foundation Tier

Mark scheme

June 2019

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196A8463/2F/MS

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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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 3 with a small amount of level 4 material it would be placed in level 3 but be awarded a mark near the top of the level because of the level 4 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.

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, level of demand 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.

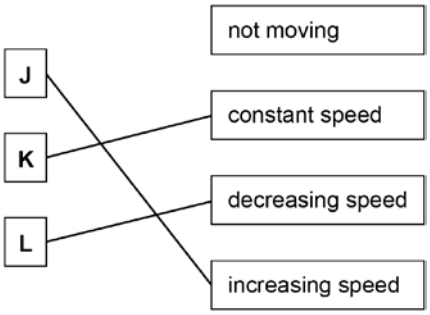
3.9 Ignore

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.

Question 1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
1.1	equal to	allow the symbol = allow a correct answer indicated in the box provided the answer space is blank	1	AO1/1 4.5.6.2.3 WS 1.2
1.2	J -------- increasing speed K--------- constant speed L --------- decreasing speed	all three lines correct allow **1** mark for **1** line correct more than three lines are drawn scores **0**  	2	AO1/1 4.5.6.1.4
1.3	25 (m)		1	AO2/2 4.5.6.1.4
1.4	av speed $= \frac{100}{12.5}$ av speed = 8(.0) (m/s) OR av speed $= \frac{100}{12.6}$ av speed = 7.93… (m/s)	an answer of 8(.0) (m/s) scores **2** marks allow 7.9 or 7.94	1 1	AO2/1 4.5.6.1.2
1.5	3.0		1	AO1/1 4.5.6.1.2
Total			**7**	

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
2.1	wavelength	allow a correct answer indicated in the box provided the answer space is blank	1	AO1/1 4.8.2 iso
2.2	C		1	AO3/1a 4.8.2
2.3	C		1	AO3/1a 4.8.2
2.4	Very dense and extremely hot		1	AO1/1 4.8.2 iso
2.5	Scientific evidence supports the theory		1	AO1/1 4.8.2 WS1.2
2.6	Z any **one** from • (only one) shows the universe is expanding • (only one) shows the universe began (very) small	 only scores if Z is chosen	1 1	AO3/1b 4.8.2
Total			**7**	

Question 3

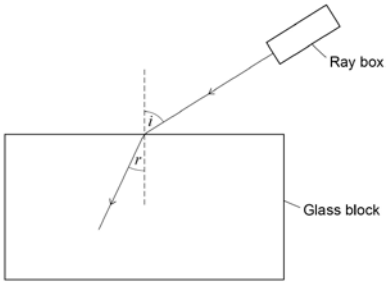
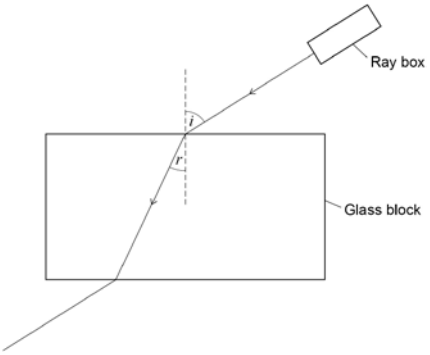
Question	Answers	Extra information	Mark	AO / Spec. Ref.
3.1	both arrows pointing horizontally and to the right	judged by eye	1	AO1/1 4.7.1.2
3.2	(two south) poles would repel so the coat would not be held together	allow magnets would repel allow so the coat would not fasten	1 1	AO1/1 AO2/1 4.7.1.1
3.3	C		1	AO1/1 4.7.2.1
3.4	steel rod		1	AO1/1 4.7.2.1
3.5	electromagnet exerts a downwards force on the iron bar	allow electromagnet pulls the iron (bar) down(wards) allow electromagnet attracts the iron (bar)	1	AO1/1 4.7.2.1
3.6	1.5 (cm)		1	AO2/2 4.5.3
3.7	 F = 0.18 × 1.5 OR F = 0.18 × their 3.6 F = 0.27 (N)	an answer 0.27 (N) scores **2** marks allow 0.18 × their 3.6 correctly calculated	 1 1	AO2/1 4.5.3
3.8	it increases and reaches a maximum	 allow and then does not change any change other than current causing strength to increase scores **0**	1 1	AO3/1a 4.7.2.1 WS3.5
Total			**11**	

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
4.1	B		1	AO1/1 4.6.2.1
4.2	electrical heating		1	AO1/1 4.6.2.4
4.3	orange	allow a correct answer indicated in the box provided the answer space is blank	1	AO3/1a 4.6.2.4 WS3.5
4.4	becomes (more) red	allow changes from mainly orange to mainly red	1	AO3/2a 4.6.2.4 WS3.5
4.5	the independent	allow a correct answer indicated in the box provided the answer space is blank	1	AO2/2 4.6.2.2 WS2.2
4.6	pour (hot) water into the (hollow metal) cube point the IR detector at each / a side and take a reading keep the detector the same distance from each surface	 allow point the IR detector at the cube and take a reading allow IR detector touching the surface and take a reading allow take the temperature for take a reading	1 1 1	AO1/2 4.6.2.2 WS2.2
4.7	0.1 °C		1	AO2/2 4.6.2.2 WS2.3
4.8	one bar drawn to 68.0 (°C) one bar drawn to 28.0 (°C) tallest bar labelled Matt black and shortest bar labelled Shiny silver	ignore the position of the bars on the x-axis	1 1 1	AO2/2 4.6.2.2 WS3.1

4.9	any **one** from: • (matt) black is the best emitter • shiny silver is the worst emitter	 allow matt white and shiny black are (almost) the same at emitting allow black is a good emitter allow silver is a poor emitter allow an answer in terms of highest / lowest temperature ignore any reference to absorption / reflection	1	AO3/2b 4.6.2.2 WS3.5
Total			**13**	

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
5.1	correct angle labelled	answer must indicate the angle, the letter **r** on it's own is insufficient  	1	AO1/1 4.6.2.2
5.2	58 (degrees)	allow 57 to 59 inclusive	1	AO2/2 4.6.2.2
5.3	ray continues in a straight line to the edge of the block ray refracts away from the normal both rays in the air should be parallel	 judge by eye	1 1 1	AO1/1 4.6.2.2
5.4	random	allow a correct answer indicated in the box provided the answer space is blank	1	AO3/2a 4.6.1.3 WS3.7
5.5	25		1	AO2/2 4.6.1.3
5.6	less than	allow a correct answer indicated in the box provided the answer space is blank	1	AO3/2b 4.6.1.3 WS3.5
5.7	there is no data/results outside of that range	allow that is all the student measured	1	AO3/1b 4.6.1.3 WS2.7

5.8	light would not pass through an opaque block **or** light will pass through a transparent block	an answer which does not refer to either transparent or opaque should be taken as referring to transparent	1	AO1/1 4.6.2.6
5.9	The angles of incidence tested		1	AO3/3b 4.6.1.3 WS2.7
Total			**11**	

Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
6.1	B		1	AO1/1 4.5.6.2.1
6.2	horizontal line drawn from (40, 20) to (300, 20) straight line drawn from the point where line B finishes to 0 m/s finishing on the x-axis at 360 s	 allow a straight line showing time to decelerate as 60s	1 1 1	AO2/2 4.5.6.1.5
6.3	acceleration = $\frac{\text{(change in) velocity}}{\text{time (taken)}}$	allow a = $\frac{(\Delta)v}{t}$	1	AO1/1 4.5.6.1.5 iso
6.4	$1.15 = \frac{\Delta v}{22}$ $\Delta v = 1.15 \times 22$ $\Delta v = 25.3$ (m/s)	an answer 25.3 scores **3** marks	1 1 1	AO2/1 4.5.6.1.5
Total			**8**	

Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
7.1	crate		1	AO1/1 4.5.4
7.2	centre of mass		1	AO1/1 4.5.1.3
7.3	the pointer is vertical	allow unable to see the pointer allow the bar is horizontal	1	AO3/1a 4.5.4
7.4	P		1	AO2/1 4.5.4
7.5	moment (of a force) = force x distance	allow M = F d	1	AO1/1 4.5.4
7.6	$0.15 = W \times 0.06$ $W = \frac{0.15}{0.06}$ $W = 2.5$ (N)	an answer 2.5 (N) scores **3** marks	1 1 1	AO2/1 4.5.4
7.7	weight = mass × gravitational field strength	allow W = m g	1	AO1/1 4.5.1.3
7.8	$2.5 = m \times 9.8$ $m = 2.5 / 9.8$ mass rice = 0.215 (kg)	an answer 0.215 or 0.22 (kg) scores **3** marks allow ecf from 07.6 an answer of 0.255 or 0.26 (kg) scores **2** marks	1 1 1	AO2/1 4.5.1.3
Total			**12**	

Question 8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
8.1	focal length	this answer only	1	AO1/1 4.6.2.5
8.2	one correct line drawn from the top of the object, passing through the lens and crossing or meeting given line inverted image drawn at the correct position and length	ignore any arrow drawn on the line if two lines are drawn, both must be correct arrowhead required	1 1	AO2/2 4.6.2.5
8.3	similarity (both are) diminished difference concave is <u>virtual</u> and convex is <u>real</u> **or** concave is upright and convex is inverted	 allow smaller for diminished a comparison must be made ignore reference to positions of images	1 1	AO3/2a 4.6.2.5
8.4	$6.0 = \frac{9.0}{\text{object height}}$ $\text{object height} = \frac{9.0}{6.0}$ object height = 1.5 (mm)	an answer of 1.5 (mm) scores **3** marks provided working can be seen, an attempt to convert 9.0 mm to cm or m with all other steps correct scores **2** marks	 1 1 1	AO2/1 4.6.2.5
Total			**8**	

Question 9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
9.1	metre rule	allow metre ruler allow tape measure do not accept ruler do not accept metre stick	1	AO1/2 4.6.1.2 RPA8
9.2	(wave) speed = frequency × wavelength	allow v = f λ	1	AO1/1 4.6.1.2 RPA8
9.3	 80cm = 0.8m v = 55 × 0.8 v = 44 (m/s)	an answer of 44 (m/s) scores **3** marks this mark may be awarded if wavelength is incorrectly or not converted allow correct calculation using an incorrectly or not converted wavelength an answer of 4400 (m/s) scores **2** marks	 1 1 1	AO2/1 4.6.1.2 RPA8
9.4	move the (wooden) bridge to the right OR change the mass/weight (on the string) scores **1** mark add more masses/weights (to the string) scores both marks	 dependent on 1st mp being scored	1 1	AO2/2 4.6.1.2 RPA8

9.5	**Level 2:** The design/plan would lead to the production of a valid outcome. All key steps are identified and logically sequenced.	3–4	AO3/3a 4.6.1.2 RPA8
	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	
	No relevant content	0	
	Indicative content add or take away masses from the string (ignore any stated values) adjust frequency using the signal generator and/or move the wooden bridge observe a steady / stationary pattern measure the wavelength calculate wave speed from frequency and wavelength a Level 1 answer should include a way of changing tension a complete Level 2 answer would include either changing frequency and/or moving the bridge		
Total		**11**	

Question 10

Question	Answers	Mark	AO/ Spec. Ref
10.1	**Level 3**: Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.	5–6	AO1/1 AO2/1 4.5.6.3.2 4.5.6.3.3
	Level 2: Relevant points (reasons / causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear.	3–4	
	Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.	1–2	
	No relevant content	0	
	Indicative content • reaction time explained in terms of longer reaction times increase thinking distance (from a given speed) • taking drugs • drinking alcohol • tiredness • age • distractions explained in terms of effect on driver's reaction time • speed explained in terms of the faster the vehicle the greater the distance travelled in the driver's reaction time (or converse) **OR** explained in terms of increased speed increases KE so increases work done to stop the vehicle • condition of the tyres • condition of road surface • wet/icy roads explained in terms of condition of tyres and road surface (including weather considerations) affecting <u>friction</u> (between tyres and road) • condition of brakes explained in terms of effect on braking force (applied to the wheels) or reduced <u>friction</u>		

	• mass / weight of vehicle explained in terms of deceleration force or kinetic energy or change in momentum answers do not need to reference thinking / braking distance a Level 1 answer would list factors only **or** one factor with one linked explanation a Level 2 answer lists at least three factors with one linked explanation **or** two factors with two linked but different explanations a Level 3 answer lists at least three factors with at least two linked but different explanations			
10.2	work (done) = force × distance	allow W = F s	1	AO1/1 4.5.2
10.3	 900 000 = 60 000 × distance distance = $\frac{900\ 000}{60\ 000}$ distance = 15 (m)	an answer 15 (m) scores **3** marks	 1 1 1	AO2/1 4.5.2
10.4	brakes overheating **or** brakes locking (causing) loss of control **or** (causing) a skid	allow brake fade allow wheels locking allow increasing the stopping / braking distance **ONLY** if the first marking point scored ignore any effects on passengers or possible accidents	1 1	AO1/1 4.5.6.3.4
Total			**12**	