GCSE
PHYSICS
8463/2F

Paper 2 Foundation Tier

Mark scheme

June 2021

Version: 1.0 Final Mark Scheme

216G8463/2F/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 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.

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

Copyright information

AQA retains the copyright on all its publications. However, registered schools/colleges for AQA are permitted to copy material from this booklet for their own internal use, with the following important exception: AQA cannot give permission to schools/colleges to photocopy any material that is acknowledged to a third party even for internal use within the centre.

Copyright © 2021 AQA and its licensors. All rights reserved.

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.

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 1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	transverse		1	AO1 4.6.1.1
01.2	the water at point **X** moves up and down		1	AO2 4.6.1.1
01.3	$v = 2.0 \times 0.032$ $v = 0.064$ (m/s) m/s		1 1 1	AO2 AO2 AO1 4.6.1.2
01.4	energy		1	AO1 4.6
01.5	**D**		1	AO1 4.6.1.2
01.6	**B**		1	AO1 4.6.1.2
Total			**8**	

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	friction		1	AO1 4.5.1.2
02.2	air resistance		1	AO1 4.5.1.2
02.3	**A = B**		1	AO1 4.5.6.2.2
02.4	$M = 150 \times 0.24$ $M = 36$ (Nm)		1 1	AO2 4.5.4
02.5	chain		1	AO2 4.5.4
02.6	5.8 m/s		1	AO2 4.5.6.1.5
02.7	$a = \frac{5.8}{20}$ $a = 0.29$ (m/s^2)	allow their v from question **02.6** allow a correctly calculated value using their v from question **02.6**	1 1	AO2 4.5.6.1.5
02.8	Deceleration		1	AO3 4.5.6.1.5
02.9	straight arrow drawn between home and school pointing towards school.		1	AO1 4.5.6.1.1
Total			**11**	

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	**B**		1	AO1 4.6.2.1
03.2	a control		1	AO1 4.6.2.2 RPA10
03.3	record the initial temperature of the two thermometers in each flask	allow initial temperature is a control variable **or** ensure initial temperature is the same in both flasks	1	AO1 4.6.2.2 RPA10
	switch the infrared heater on and start the stop clock (at the same time)	allow switch on the power supply for switch on the heater	1	
	after five minutes record the (final) temperature from both flasks	allow calculate the temperature increase / change after five minutes	1	
	see / check if the temperature inside the flasks had increased by different amounts		1	
03.4	27 (°C)	allow 27 (°C) identified on the table allow test 3	1	AO3 4.6.2.2 RPA10
03.5	ignore (the result)	allow repeat (the result)	1	AO1 4.6.2.2 RPA10
03.6	(33/3 =) 11		1	AO2 4.6.2.2 RPA10

03.7	the black flask absorbed the most infrared during the five minutes		1	AO3 4.6.2.2 RPA10

Total			**10**

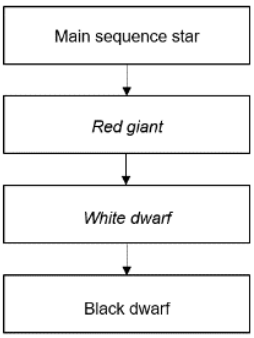
Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	30 (°)		1	AO2 4.5.2
04.2	zero error		1	AO3 4.5.2
04.3	subtract 0.5 N from each measurement		1	AO3 4.5.2
04.4	points plotted correctly	allow 5 correctly plotted for **2** marks, 2–4 correctly plotted for **1** mark allow ± half a square ignore any attempt at a line of best fit	2	AO2 4.5.2
04.5	the long ramp has a smaller angle (so) less force is needed (to hold the wheelchair stationary on the ramp)	allow description (eg shallower gradient / less steep) allow (so) less force is needed to move the wheelchair up the ramp	1 1	AO3 4.5.2
04.6	$W = 160 \times 2.5$ $W = 400$ (J)		1 1	AO2 4.5.2
Total			**9**	

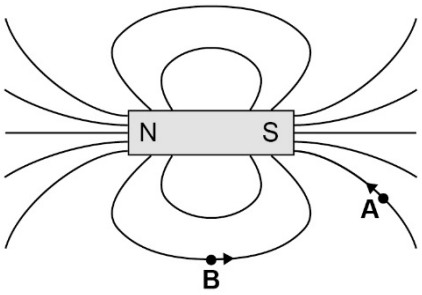
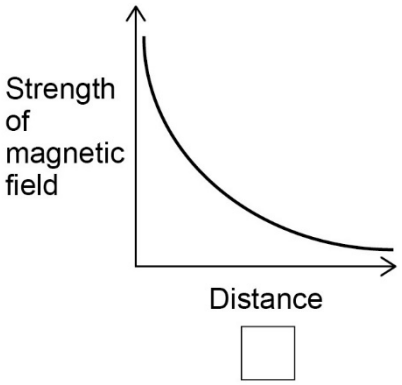
Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	convex		1	AO1 4.6.2.5
05.2	image height = 0.8 (cm) **and** object height = 2 (.0 cm)	both correct for **1** mark	1	AO2 4.6.2.5
05.3	magnification = $\frac{0.8\ (cm)}{2\ (.0\ cm)}$ magnification = 0.4(0)	allow their measured object and image heights from question **05.2**	1 1	AO2 4.6.2.5
05.4	inverted real		1 1	AO3 4.6.2.5
05.5	black green	this order only	1 1	AO1 4.6.2.6
Total			**8**	

Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	$g = \frac{750}{2.5}$ g = 300.0 (N/kg)		1 1	AO2 4.5.1.3
06.2	electrostatic		1	AO1 4.5.1.2
06.3	red giant white dwarf	this order only 	1 1	AO1 4.8.1.2
06.4	Z only stars about the same/smaller size/mass as the Sun become Black dwarfs	reason only scores if Z chosen allow converse	1 1	AO3 4.8.1.2
06.5	supernova		1	AO1 4.8.1.2
Total			**8**	

Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	both arrows correct		1	AO1 4.7.1.2
07.2	a permanent magnet		1	AO1 4.7.1.1
07.3	third box ticked any **one** from • (the only graph) that shows the magnetic field getting weaker (as distance increases) • both other graphs show the magnetic field getting stronger (as the distance increases)	 only scores if correct box is chosen	1 1	AO3 4.7.1.2
07.4	steel cans are attracted to the electromagnet and are transferred to the container (by the conveyor belt) aluminium cans are not attracted to the electromagnet		1 1	AO1 4.7.1.2

	and are left behind on the table	If no other mark scored: Steel cans are attracted (to the electromagnet) but aluminium cans are not – scores one mark		
07.5	raise the height of the table use a larger potential difference / current **or** use a stronger electromagnet	allow longer legs on the table allow put a (non-magnetic) box on top of the table allow lower the electromagnet allow more turns on the coil (of the electromagnet) do **not** accept insert a (soft) iron core	1 1	AO3 4.7.2.1
07.6	distance travelled = speed × time **or** $s = v\,t$		1	AO1 4.5.6.1.2
07.7	$3.3 = 1.7 \times t$ $t = \frac{3.3}{1.7}$ $t = 1.941$ (s) $t = 1.9$ (s)	 allow a calculation using the given data incorrectly but correctly rounded to 2 sig figs	1 1 1 1	AO2 4.5.6.1.2
Total			**13**	

Question 8

Question	Answers	Mark	AO/ Spec. Ref
08.1	**Level 2:** Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.	3–4	AO1 4.5.6.3.3 4.5.6.3.4 4.1.1.2
	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 Factors • poor condition of tyres • poor road surface • wet or icy road • poor/worn brakes Explanation • because of decreased friction Factors • increased mass of car/passengers Explanation • increases kinetic energy of car • more work needs to be done to stop car • increases momentum of the car Factor • road slopes downhill Explanation • (a component of) gravity opposes the braking force • resultant (braking) force is reduced allow answers in terms of reducing braking distance throughout A single factor with no related explanation is insufficient to score a mark		

08.2	resultant force = mass × acceleration		1	AO1 4.5.6.2.2

08.3	7200 = 1600 × *a* $a = \frac{7200}{1600}$ *a* = 4.5 (m/s^2)	ignore negatives throughout	1 1 1	AO2 4.5.6.2.2

08.4	15 (m) 38 (m) = 53 (m)	two correct values identified allow the correct addition of a misread braking distance and /or a misread thinking distance taken from the graph	1 1	AO3 4.5.6.3.1

08.5	$p = \frac{F}{A}$		1	AO1 4.5.5.1.1

08.6	120 000 = $\frac{60}{A}$ $A = \frac{60}{120\,000}$ *A* = 0.0005 *A* = 5 (.0) × 10^{-4} m^2	 allow an answer given to 2 sig figs from an incorrect calculation using the given data	1 1 1 1 1	AO2 AO2 AO2 AO2 AO1 4.5.5.1.1

Total			**16**

Question 9

Question	Answers	Extra information	Mark	AO/ Spec. Ref
09.1	will return to its original shape/length		1	AO2 4.5.3
	when the force is removed	allow (when) the child gets off the second mark is dependent on scoring the first mark	1	
09.2	**Level 3:** The method would lead to the production of a valid outcome. The 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 rule alongside the spring • record the ruler reading that is level with the bottom of the spring • hang a 1 N / a known 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 1 N at a time up to 5 N • for each new force record the position of the bottom of the spring and calculate / measure the extension Indicative content continues on the next page…			

	Risk Assessment Hazard: Clamp (stand, boss and masses) might fall off desk Risk: injury to feet Precaution: Use clamp to fix apparatus to the bench **or** Ensure that the slotted masses hang over the base/foot of the stand **or** Ensure that the boss is screwed tightly into the stand and clamp **or** Put (heavy) masses on the base/foot of the stand **or** Stand up so that you can move out of the way Hazard: Spring could break / come loose Risk: damage eye Precaution: Wear safety goggles If a risk assessment / hazard is not given, the answer can still reach level 3, but not full marks. Full marks may be awarded for alternative feasible methods.			

09.3	force = spring constant × extension		1	AO1 4.5.3

09.4	5.00 0.125 $k = \frac{5.00}{0.125}$ k = 40 (N/m)	allow any correct pair of values from the graph allow a misread value(s) from the graph allow a correct calculation using their incorrect value(s)	1 1 1	AO2 4.5.3

09.5	the line is straight and passes through the origin	allow the line does not curve allow a constant gradient	1 1	AO3 4.5.3

09.6	e = 0.20 m $E_e = 0.5 \times 13 \times 0.20^2$ E_e = 0.26 (J)	 allow an incorrectly / not converted value of e use of two incorrectly/not converted values scores a máximum of 1 mark	1 1 1	AO2 4.5.3

Total			**17**