GCSE
PHYSICS
8463/2F

Paper 2 Foundation Tier

Mark scheme

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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 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

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.

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	B to D		1	AO2 4.5.6.1.2
01.2	metre rule	allow tape measure allow ruler	1	AO1 4.5.6.1.2
01.3	so that each piece falls the same distance	allow to stop them from building up at the bottom	1	AO3 4.5.6.1.2
01.4	$\frac{34 + 37 + 34}{3}$ 35 (s)	allow $\frac{105}{3}$	1 1	AO2 4.5.6.1.2
01.5	cone the (mean) time is the lowest	 reason only scores if correct shape is selected allow it fell the fastest allow it had the most streamlined shape ignore reference to surface area	1 1	AO3 4.5.6.1.2
01.6	Time through air would be less.		1	AO3 4.5.6.1.2
01.7	w = 0.050 × 9.8 w = 0.49 (N)		1 1	AO2 4.5.1.3
01.8	Electrostatic force Magnetic force		1 1	AO1 4.5.1.2
Total			**12**	

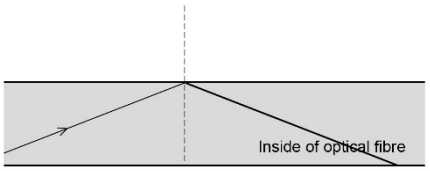
Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	Milky Way		1	AO1 4.8.1.1
02.2	gravitational (force)	allow gravity	1	AO1 4.8.1.3
02.3	it decreases		1	AO3 4.8.1.1
02.4	answer between -60 and -160 (degrees Celsius)		1	AO3 4.8.1.1
02.5	Three		1	AO1 4.8.1.1
02.6	It orbits a planet.		1	AO1 4.8.1.3
02.7	Their orbits are circular. They do not emit visible light.		1 1	AO1 4.8.1.3
02.8	d = 13 000 × 110 d = 1 430 000 (km)	 allow $1.4(3) \times 10^6$ allow a rounded answer (eg 1 400 000)	1 1	AO2 4.8.1.1
Total			**10**	

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	R		1	AO1 4.6.1.2
03.2	S		1	AO1 4.6.1.2
03.3	$T = \frac{1}{0.20}$ T = 5(.0 s)		1 1	AO2 4.6.1.2
03.4	The wavelength decreases		1	AO1 4.6.1.2
03.5	Time taken by the wave to travel the length of the tray		1	AO1 4.6.1.2 RPA8
03.6	Depth of water		1	AO1 4.6.1.2 RPA8
03.7	as the depth increases, the speed increases	allow positive correlation (between speed and depth)	1	AO3 4.6.1.2 RPA8
03.8	0.49 (m/s)		1	AO2 4.6.1.2
Total			**9**	

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	Microwaves Radio waves		1 1	AO1 4.6.2.4
04.2	normal		1	AO1 4.6.1.3
04.3	reflected ray drawn to the right of the normal correct ray of light drawn using a ruler with i = r	ignore arrows  	1 1	AO2 4.6.1.3
04.4	they need to be flexible	ignore bendy / ductile / malleable / elastic	1	AO3 4.6.2.4
04.5	transmitted absorbed absorbed		1 1 1	AO1 4.6.2.6
Total			**9**	

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	(the north pole of the floating magnet is) repelled from the north pole (of the fixed magnet) and attracted to the south pole (of the fixed magnet)	 allow following a magnetic field line for **1 mark** if no other marks scored	1 1	AO3 4.7.1.1 4.7.1.2
05.2	it was attracted (to the fixed magnet)	allow it sticks / joins to the (fixed) magnet allow it becomes an induced magnet allow it becomes magnetised	1	AO1 4.7.1.2
05.3	**Level 2:** The design/plan would lead to the production of a valid outcome. All key steps are identified and logically sequenced.		3–4	AO1 4.7.1.2
	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: • mark where the compass points on the paper • move the compass to the marked point • repeat until you go back to the magnet • join up the points • add an arrow pointing from the north pole to the south pole • repeat for positions (above and below the bar magnet)			
05.4	C B A	 allow **1** mark for one letter in the correct box	2	AO2 4.7.2.1
05.5	$E_e = 0.5 \times 200 \times 0.040^2$ $E_e = 0.16$ (J)		1 1	AO2 4.5.3
Total			**11**	

Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	D		1	AO1 4.6.2.1
06.2	Any **one** from: • mutation (of genes/DNA/ chromosomes) • cancer/tumour • cell death	allow can damage OR destroy genes/DNA/chromosomes ignore damage/destroy cells/ tissues/organs ignore mutates cells allow kills cells	1	AO1 4.6.2.1
06.3	the risk of harm is lower from the X-ray by a factor of 60		1 1	AO3 4.6.2.3
06.4	0.0060 sieverts		1	AO1 4.6.2.3
06.5	$\frac{0.1}{2.5} \times 100$ 4 (%)	 allow 0.04 for **1** mark	1 1	AO2 4.6.2.3
Total			**7**	

Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	velocity includes direction	allow velocity is a vector (quantity) **and** speed is a scalar (quantity)	1	AO1 4.5.6.1.3
07.2	(an equal) force from the air pushes on the engine/aircraft in the opposite direction	 only scores if first marking point scored accept to the left **or** forwards if no other marks scored, allow **1** mark for pushes the engine forwards	1 1	AO2 4.5.6.2.3
07.3	correct value for distance and corresponding time (eg 12 000 m and 50 s) $v = \frac{\text{their change in distance}}{\text{their change in time}}$ speed = 240 (m/s)	 this mark may be awarded if distance and/or time are incorrectly read **from the graph** allow a correctly calculated answer using their values of distance and time **from the graph**	1 1 1	AO2 4.5.6.1.4
07.4	acceleration = $\frac{\text{change in velocity}}{\text{time taken}}$ **or** $a = \frac{\Delta v}{t}$		1	AO1 4.5.6.1.5

07.5	250 – 68 = 182 $0.14 = \frac{182}{t}$ $t = \frac{182}{0.14}$ t = 1300 (seconds)	 this mark may be awarded if the change in velocity is incorrectly/not calculated this mark may be awarded if the change in velocity is incorrectly/not calculated allow a correctly calculated answer using a change in velocity incorrectly/not calculated	1 1 1 1	AO2 4.5.6.1.5
07.6	work done = force × distance **or** W = F s		1	AO1 4.5.2
07.7	140 000 000 = force × 2000 $\text{force} = \frac{140\,000\,000}{2000}$ force = 70 000 (newtons)		1 1 1	AO2 4.5.2
Total			**15**	

Question 8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.1	Move the wooden block to the left.		1	AO3 4.5.6.2.2 RPA7
08.2	use a pulley (on the edge of the bench)	allow any feasible method to stop the string from rubbing	1	AO3 4.5.6.2.2 RPA7
08.3	suitable scale points plotted correctly line of best fit	 allow 5 correctly plotted for **2** marks **OR** 3–4 correctly plotted for **1** mark	1 2 1	AO2 4.5.6.2.2 RPA7
08.4	(directly) proportional	allow a correct description of direct proportionality ignore positive correlation allow weight (added to mass holder) for force allow f = ma for **1** mark	1	AO3 4.5.6.2.2 RPA7
08.5	repeat the measurements/investigation ignore anomalies **and** calculate the mean / average		1 1	AO3 4.5.6.2.2 RPA7
08.6	resultant force = mass × acceleration **or** F = m a		1	AO1 4.5.6.2.2 RPA7

08.7	0.375 = 0.60 × a $a = \frac{0.375}{0.60}$ a = 0.625 (m/s^2) a = 0.63 (m/s^2)		1 1 1 1	AO2 4.5.6.2.2 RPA7
Total			**14**	

Question 9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.1	(force of) gravity fusion	do **not** allow weight	1 1	AO1 4.8.1.1
09.2	distance = speed × time **or** s = vt	allow a correct re-arrangement do **not** allow d = st	1	AO1 4.5.6.1.2
09.3	$1.5 \times 10^{11} = 3.0 \times 10^8 \times t$ $t = \frac{1.5 \times 10^{11}}{3.0 \times 10^8}$ t = 500 (s)		1 1 1	AO2 4.5.6.1.2

09.4	**Level 3**: Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account.		5–6	AO1 4.8.1.2
	Level 2: Scientifically relevant facts, events or processes are identified and their relevance is clear. The account is not fully accurate.		3–4	
	Level 1: Facts, events or processes are identified and simply stated but their relevance is not clear.		1–2	
	No relevant content		0	
	Indicative content: • fusion (processes in stars) produce new elements • cloud of gas / hydrogen **and** dust **OR** nebula • pulled together by gravity • causing increasing temperature (to start the fusion process) • (to become a) protostar • hydrogen nuclei fuse to form helium nuclei • and the star becomes main sequence • hydrogen begins to run out • helium nuclei fuse to make heavier elements • up to iron • the star expands (to become a) • red super giant • (the star collapses rapidly) and <u>explodes</u> • called a supernova • creating elements heavier than iron • and distributing them throughout the universe • leaving behind a neutron star • or a black hole.			
09.5	Temperature		1	AO1 4.6.3.2
Total			**13**	