GCSE
PHYSICS
8463/1F

Paper 1 Foundation Tier

Mark scheme

June 2022

Version: 1.0 Final Mark Scheme

2 2 6 G 8 4 6 3 / 1 F / M S

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 © 2022 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 their 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 (for example, a scientifically correct answer that could not reasonably be expected from a student's knowledge of the specification).

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**.
Alternative words in the mark scheme are shown by a solidus 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** magnetic materials.

[2 marks]

Student	Response	Marks awarded
1	iron, steel, tin	1
2	cobalt, nickel, nail*	2

3.2 Use of symbols / formulae

If a student writes a chemical symbol / formula instead of a required chemical name, or uses symbols to denote quantities in a physics equation, 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. At any point in a calculation students may omit steps from their working. If a subsequent step is given correctly, the relevant marks may be awarded.

Full marks are **not** awarded for a correct final answer from incorrect working.

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

An error can be carried forward from one question part to the next and is shown by the abbreviation 'ecf'.

Within an individual question part, an incorrect value in one step of a calculation does not prevent all of the subsequent marks being awarded.

3.6 Phonetic spelling

Marks should be awarded if spelling is not correct but the intention is clear, **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.

3.11 Numbered answer lines

Numbered lines on the question paper are intended to support the student to give the correct number of responses. The answer should still be marked as a whole.

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, if necessary, 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. 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	gravitational potential kinetic	this order only	1 1	AO1 4.1.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.2	$E_e = 0.5 \times 120\,000 \times 0.015^2$ $E_e = 13.5$ (J)		1 1	AO2 4.1.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.3	$E = 540$ (J)	allow their answer from question **01.2** x 40	1	AO2 4.1.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.4	$E_k = 0.45 \times 600$ $E_k = 270$ (J)		1 1	AO2 4.1.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5	energy is transferred to the surroundings		1	AO2 4.1.1.1

Total Question 1		**8**

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	tape measure **or** metre rule	allow ruler ignore metre stick	1	AO3 4.1.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.2	$E_p = 50 \times 9.8 \times 1.7$ $E_p = 833$ (J)		1 1	AO2 4.1.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	$P = \frac{1800}{1.44}$ $P = 1250$ (W)		1 1	AO2 4.1.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.4	stop-clock C		1	AO3 4.1.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.5	$E_k = 0.5 \times 70 \times 2.0^2$ $E_k = 140$ (J)		1 1	AO2 4.1.2.1

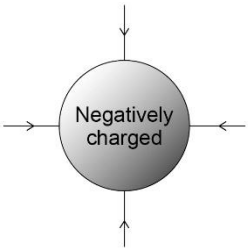
Total Question 2		**8**

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	electrons electrons		1 1	AO1 4.2.5.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	a positive charge		1	AO1 4.2.5.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.3	a force of repulsion the rods have the same charge **or** the rods are both negatively charged	dependent on scoring first marking point	1 1	AO1 4.2.5.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.4			1	AO1 4.2.5.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.5	 **A**		1	AO1 4.2.5.2

Total Question 3		**7**

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	2 protons and 2 neutrons		1	AO1 4.4.2.1

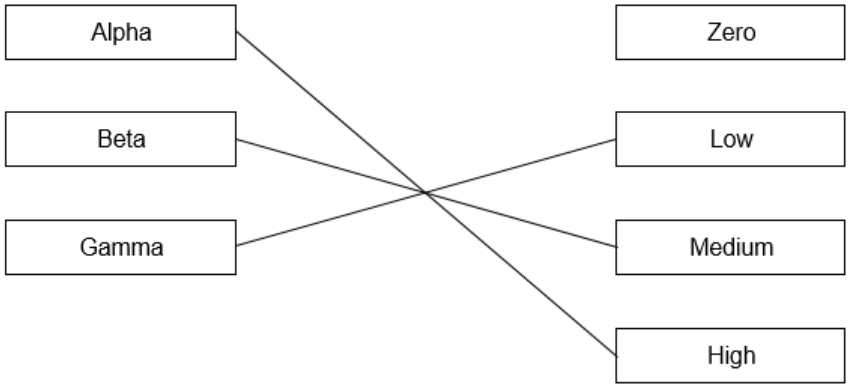
Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.2	an electron		1	AO1 4.4.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.3	$^{85}_{36}Kr \longrightarrow {}^{85}_{37}Rb + {}^{0}_{-1}e$		1	AO1 4.4.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4			3	AO1 4.4.2.1

Type of radiation	Most radiation is stopped by:		
	the sheet of paper	the sheet of aluminium	the block of lead
Alpha	Yes	Yes	Yes
Beta	No	Yes	Yes
Gamma	No	No	Yes

1 mark for each correct row
allow ticks and crosses in place of yes and no
any incorrect answer on a row negates the mark for the row

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.5	 **1** mark for each correct line if more than one line drawn from radiation type list principle applies		1 1 1	AO1 4.4.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.6	nuclear accidents		1	AO1 4.4.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.7	number = $\frac{2.0}{0.005}$ number = 400		1 1	AO2 4.4.3.1

Total Question 4		**12**

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	balance		1	AO3 4.3.2.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2	control variable		1	AO3 4.3.2.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3	use tongs / gloves **or** use a heatproof mat	allow other sensible methods of avoiding contact with hot beaker eg using a cloth allow wait for the beaker (and hot water) to cool down	1	AO2 4.3.2.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.4	25 200 = 0.0090 L $L = \frac{25\ 200}{0.0090}$ L = 2 800 000 **or** $L = 2.8 \times 10^6$ J/kg		1 1 1 1	AO2 AO2 AO2 AO1 4.1.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.5	the transfer of thermal energy from the water to the surroundings		1	AO3 4.3.2.3 4.1.2.1

Total Question 5		**8**

Question 6

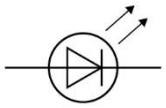
Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	parallel		1	AO1 4.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.2	S_1		1	AO1 4.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.3	S_1, S_2 and S_3		1	AO2 4.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.4	energy transferred = power × time **or** $E = P \times t$		1	AO1 4.2.4.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.5	3600 = 1200 × *t* $t = \frac{3600}{1200}$ *t* = 3 (s)		1 1 1	AO2 4.2.4.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.6			1	AO1 4.2.1.1

Total Question 6		**8**

Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	<table><tr><th>Energy resources</th><th>Renewable</th><th>Non-renewable</th></tr><tr><td>biofuel</td><td>✓</td><td></td></tr><tr><td>coal</td><td></td><td>✓</td></tr><tr><td>nuclear</td><td></td><td>✓</td></tr><tr><td>tides</td><td>✓</td><td></td></tr></table> 4 correct scores **2** marks 3 correct scores **1** mark		2	AO1 4.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.2	potential difference current energy potential difference	this order only allow p.d.	1 1 1 1	AO1 4.2.4.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.3	charge flow = current × time **or** $Q = It$		1	AO1 4.2.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.4	t = 300 (s)		1	AO2
	Q = 130 000 × 300	allow a correct substitution using an incorrectly / not converted value of t	1	AO2
	Q = 39 000 000 ***or*** $Q = 3.9 \times 10^7$	allow a correct calculation using an incorrectly / not converted value of t	1	AO2
	coulombs / C		1	AO1 4.2.1.2

Total Question 7		**11**

Question 8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.1	0.1 ºC		1	AO3 4.1.2.1 RPA2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.2	a bigger		1	AO3 4.1.2.1 RPA2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.3	identifies 75 (ºC) **and** 62.5 (ºC)		1	AO2 4.1.1.3 RPA2
	$\Delta\theta$ = 12.5 (ºC)	allow a correct calculation of temperature change from misread values	1	
	E = 0.12 × 4200 × 12.5	allow a correct substitution using an incorrect temperature change	1	
	E = 6300 (J)	allow an answer consistent with an incorrect temperature change	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.4	point at 7 minutes for material **X** ringed		1	AO3 4.1.2.1 RPA2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.5	any **two** from: • water wrapped in material X cooled more slowly • material X is a better insulator **or** the thermal conductivity of material X is lower • the rate of cooling decreased with time (for both X and Y)	allow converse answers for material Y allow water wrapped in material X transfers less energy to the surroundings (in 10 minutes) allow water wrapped in material X has a higher final temperature allow material X is a worse (thermal) conductor allow temperature decreased with time (for both X and Y)	2	AO3 4.1.2.1 RPA2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.6	the rate of cooling would be lower		1	AO3 4.1.2.1 RPA2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.7	the temperature would be higher		1	AO3 4.1.2.1 RPA2

Total Question 8		**11**

Question 9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.1	*P* = 696 000 000 (W) *P* = 1200 (W)	 allow an answer consistent with their incorrectly / not converted value of *P*	1 1	AO2 4.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.2	any **2** from: • wind is unreliable • wind turbines don't turn when the wind is too strong/weak • there are not enough wind turbines (in the UK)	 allow it was not windy (on that day) allow some wind turbines may be offline for maintenance allow energy from wind may not be enough (to generate 34 000 MW) ignore weather conditions unqualified	2	AO2 4.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.3	the efficiency would increase because the percentage / proportion / amount of energy usefully transferred would increase **or** because the percentage / proportion / amount of energy wasted would decrease (because) less (work is done against) friction	 ignore more electricity generated allow less energy wasted	1 1 1	AO3 AO1 AO1 4.1.2.1 4.1.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.4	more efficient devices waste less energy **or** more efficient devices need a lower energy input (for the same energy output)	ignore use less electricity	1	AO3 4.1.2.2 4.1.3
	which would minimise the electricity / energy demand **or** which would minimise the environmental impact from (fossil fuel) electricity generation	allow less electricity needs to be generated allow lower energy / electricity bill allow examples of environmental impact e.g. lower CO_2 emissions ignore 'better for the environment' unless qualified ignore answers that discuss 'saving energy' unless qualified ignore answers that discuss alternative methods of generating electricity	1	

Total Question 9		**9**

Question 10

Question	Answers	Mark	AO / Spec. Ref.
10.1	**Level 3**: The method would lead to the production of a valid outcome. All key steps are identified and logically sequenced.	5–6	AO1 4.3.1.1 RPA5
	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: • measure mass using a balance / scales • part fill a measuring cylinder with water and measure initial volume • place rock in water and measure final volume • volume of rock = final volume − initial volume • fill a displacement / eureka can with water level with spout • place rock in water and collect displaced water • measuring cylinder used to determine volume of displaced water • volume of rock = volume of displaced water • use mass and volume to calculate density • use of: density = $\frac{\text{mass}}{\text{volume}}$		

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.2	maximum density = 2.65 (g/cm^3) minimum density = 2.45 (g/cm^3)	both required	1	AO3 4.3.1.1 RPA5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.3	chalk or flint		1	AO3 4.3.1.1 RPA5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.4	a mean can be calculated which reduces the effect of random errors	 allow anomalies can be identified / removed	1 1	AO3 4.3.1.1 RPA5

Total Question 10		**10**

Question 11

Question	Answers	Extra information	Mark	AO / Spec. Ref.
11.1	$P = V \times I$		1	AO1 4.2.4.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
11.2	$4.4 = 40 \times I$ $I = \frac{4.4}{40}$ $I = 0.11$ (A)		1 1 1	AO2 4.2.4.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
11.3	efficiency = $\frac{\text{useful power output}}{\text{total power input}}$		1	AO1 4.1.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
11.4	$0.85 = \frac{P}{4.0}$ $P = 0.85 \times 4.0$ $P = 3.4$ (W)		1 1 1	AO2 4.1.2.2

Total Question 11		8