GCSE
PHYSICS
8463/1H

Paper 1 Higher Tier

Mark scheme

June 2021

Version: 1.1 Final 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

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	the polarity (of the supply) does not change	allow potential difference in one direction (only)	1	AO1 4.2.3.1
01.2	energy transferred = power × time		1	AO1 4.1.1.4 4.2.4.2
01.3	162 000 000 = 7200 × t $t = \frac{162\,000\,000}{7200}$ t = 22 500 (s)		1 1 1	AO2 4.1.1.4 4.2.4.2
01.4	$V = I \times R$		1	AO1 4.2.1.3
01.5	480 = 15 × R $R = \frac{480}{15}$ R = 32 (Ω)		1 1 1	AO2 4.2.1.3
01.6	time taken using system **A** is double the time of system **B**		1	AO3 4.2.4.1
Total			**10**	

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	nuclei decreases	do not accept atoms	1 1	AO1 4.4.4.2
02.2	m = 0.004 (kg) E = 0.004 × 5200 × 50 000 000 E = 1.04 × 10^9 (J) **or** E = 1 040 000 000 (J)	 allow a correct substitution of an incorrectly/not converted value of m allow a correct calculation using an incorrectly/not converted value of m	1 1 1	AO2 4.3.2.2 4.1.1.3
02.3	any **two** from: • to make sure the fusion process is possible • to develop an understanding of the process • to make adaptations to the process • to assess the efficiency of the process • to make predictions • assess safety risks • to assess environmental impact • set-up cost is lower (for small scale experiments)		2	AO3 4.1.3

02.4	releases carbon dioxide which causes global warming **OR** releases particulates which causes global dimming **or** which causes breathing problems **OR** releases sulfur dioxide which causes acid rain **OR** releases nitrogen oxides which causes breathing problems **or** which causes acid rain	allow releases greenhouse gases allow which causes climate change	1 1	AO1 4.1.3
Total			**9**	

Question 3

Question	Answers	Mark	AO/ Spec. Ref
03.1	**Level 3**: The method would lead to the production of a valid outcome. All key steps are identified and logically sequenced.	5–6	AO1 4.2.1.4 RPA4
	Level 2: The method would not necessarily lead to a valid outcome. Most steps are identified, but the plan 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 the current in **R** using the ammeter • measure the p.d. across **R** using the voltmeter • vary the resistance of the variable resistor (or vary the number of cells or use a variable power supply) • record a range of values of current and p.d. • ensure current is low to avoid temperature increase • switch circuit off between readings • reverse connection of **R** to power supply • repeat measurements of I and V in negative direction • plot a graph of current against p.d.		

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	current and p.d. would not be directly proportional **or** I-V graph would not be straight **or** I-V graph would be curved (because) resistance of **R** would increase		1 1	AO3 4.2.1.4 RPA4
03.3	0.2 (A)		1	AO3 4.2.2 RPA4
03.4	any **one** from: • less chance of misreading • no parallax error • it can give a reading closer to the true value	 allow position of eye(s) does not affect reading allow 'it is more accurate' ignore 'no human error' ignore 'easier to read'	1	AO3 4.2.2 RPA4
Total			**10**	

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	balance / scales		1	AO1 4.3.1.1 RPA5
04.2	density = $\frac{\text{mass}}{\text{volume}}$ **or** $\rho = \frac{m}{V}$		1	AO1 4.3.1.1 RPA5
04.3	$0.68 = \frac{85}{V}$ $V = \frac{85}{0.68}$ $V = 125$ (cm^3)		1 1 1	AO2 4.3.1.1 RPA5
04.4	repeat readings (of volume) need taking (of each fruit) to show that the readings are close together	allow 'the same' for 'close together'	1	AO3 4.3.1.1 RPA5
Total			**6**	

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	$E = \frac{1.25\times10^{18}}{3.16\times10^{7}}$		1	AO2 4.1.1.4
	$E = 3.96 \times 10^{10}$ (J)	an answer that rounds to 3.96×10^{10} (J) scores **1** mark	1	
05.2	t = 86 400 (s)		1	AO2 4.2.1.2
	27 000 = I × 86 400	allow a correct substitution of an incorrectly/not converted value of t	1	
	$I = \frac{27\ 000}{86\ 400}$	allow a correct rearrangement using an incorrectly/not converted value of t	1	
	I = 0.3125 (A)	allow a correct calculation using an incorrectly/not converted value of t allow a correctly calculated answer rounded to 2 or 3 sf	1	
05.3	$0.15 = \frac{\text{useful power output}}{7800}$	allow a correct substitution of an incorrectly/not converted value of total power input	1	AO2 4.1.2.2
	useful power output = 0.15 × 7800	allow a correct rearrangement using an incorrectly/not converted value of total power input	1	
	useful power output = 1170 (W)	this answer only but allow 1200 (W) if correct working shown	1	
05.4	a really large area of land would need to be covered with solar cells		1	AO2 4.1.3
	due to the low useful power output of the solar cells	allow due to the low efficiency of the solar cells	1	

		or number of hours of daylight is too low (in UK) **or** low solar intensity (in UK) **or** solar radiation (in UK) is too low **or** material for construction of solar cells and/or lithium batteries is in limited supply		

Total			**11**

Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	148		1	AO1 4.4.1.2
06.2	D and E		1	AO1 4.4.1.2
06.3	line between B and 86 protons same line between B and 222 mass number		1 1	AO2 4.4.2.2
06.4	can't predict which nucleus will decay next **or** can't predict when a (particular) nucleus will decay		1	AO1 4.4.2.3
06.5	one alpha decay would decrease proton number by 2 two beta decays would increase proton number by 2 so the proton / atomic number of the final nucleus is the same as the proton / atomic number of the original nucleus	 this mark is dependent on scoring the first two marks	1 1 1	AO1 4.4.2.2
Total			**8**	

Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	I = 0.08 (A)	an incorrect value of I from the graph can score all subsequent marks	1	AO2 4.2.4.1
	0.230 = 0.08 × V	allow a correct substitution of an incorrectly/not converted value of P	1	
	$V = \frac{0.230}{0.08}$	allow a correct rearrangement using an incorrectly/not converted value of P	1	
	V = 2.875 (V) **OR** I = 0.08 (A) (1) V = 0.08 × 36 (2) V = 2.88 (V) (1) **OR** 0.230 = I^2 × 36 (1) I = 0.08 (A) (1) V = 0.08 × 36 (1) V = 2.88 (V) (1)	allow a correct calculation using an incorrectly/not converted value of P	1	
07.2	the product of current and resistance = a constant		1	AO2
	calculation of constant (2.88) using three or more pairs of values	if no other marks scored allow for one mark a statement that doubling one quantity (R or I) halves the other quantity	1	AO3 4.2.1.3

07.3	current would be (almost) zero (in the variable resistor)		1	AO1
	(because) the switch has (effectively) zero resistance **or** the potential difference across the variable resistor is (effectively) zero	the switch's resistance is much lower than the variable resistor allow the switch creates a short circuit	1	AO2 4.2.2 4.2.1.3

Total			**8**

Question 8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.1	the total energy of the racing track and the car is constant.		1	AO1 4.1.2.1
08.2	$E_p = 0.040 \times 9.8 \times 0.90$	allow a correct substitution of an incorrectly/not converted value of h	1	AO2 4.1.1.1 4.1.1.2
	$E_p = 0.3528$ (J)	this answer only	1	
	$0.3528 = 0.5 \times 0.040 \times v^2$	allow a correct substitution of a calculated E_p	1	
	$v^2 = \frac{0.3528}{0.5 \times 0.040}$	allow a correct rearrangement using a calculated E_p	1	
	v = 4.2 (m/s)	allow an answer consistent with their calculated E_p	1	
08.3	more than 0.20 J		1	AO3 4.1.1.1
	(because) the car needs to be moving at the top of the loop **or** (because) the car needs to be moving to complete the loop **or** not all E_k at **B** will be transferred to E_p at **C**	this mark is dependent on scoring the first mark allow energy dissipated to the surroundings	1	
Total			**8**	

Question 9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.1	0(.0) to 12(.0)	allow 2(.0) to 12(.0) (N)	1	AO1 4.3.3.2
09.2	mass of gas (in the syringe) **or** temperature (of the gas)		1	AO3 4.3.3.2
09.3	constant = 60 × 45 **or** constant = 2700 2700 = p × 40 $p = \frac{2700}{40}$ p = 67.5 (kPa)	 allow 68 (kPa)	1 1 1 1	AO2 4.3.3.2

09.4	there is more time between collisions of particles and the walls of the syringe **or** there are less frequent collisions between the particles and the walls of the syringe		1	AO1 4.3.3.2
	(causing) a lower (average) force on the walls of the syringe		1	
	(and) pressure is the total force per unit area		1	

Total			**9**

Question 10

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.1	(very high p.d. means) very low currents		1	AO1 4.2.4.3
	which means less (thermal) energy is transferred to surroundings	allow less power loss in cables	1	
	which increases the efficiency of power transmission		1	
10.2	electric field strength is very high		1	AO1 4.2.5.2
	causing the air to become ionised	allow the air breaks down allow the air becomes a conductor allow the air conducts charge	1	
	(the kite / string) conducts charge to the person / earth	ignore answers referring to the kite touching the power cables	1	
10.3	straight line passing through the origin		1	AO3 4.2.5.2
	line drawn below existing line for all values		1	
10.4	the potential difference across the wires/cable is the same		1	AO1 4.2.2 4.2.1.4
	(but) the resistance of the steel wire is greater (and so less current in the steel)		1	
Total			**10**	

Question 11

Question	Answers	Extra information	Mark	AO / Spec. Ref.
11.1	the gradient for ice is steeper than the gradient for water (liquid)	allow the temperature of the ice increased faster than the temperature of the water	1	AO3 4.3.2.2
	which means that less energy is needed to increase the temperature by a fixed amount		1	
11.2	water took more time to vaporise than the ice took to melt		1	AO3 4.3.2.3
	which means that less energy is needed to change the state from solid to liquid (than from liquid to vapour)		1	
11.3	any **two** from: • ice/water would take more time to increase in temperature • ice/water would take more time to change state • the change in temperature with time would not be linear	allow gradients would be less steep allow horizontal lines would be longer	2	AO3 4.3.2.2 4.3.2.3 RPA1

11.4	E = 69 000 (J)		1	AO2 4.3.2.3
	69 000 = 0.030 × L	allow a correct substitution of an incorrectly/not converted value of E	1	
	$L = \frac{69\,000}{0.030}$	allow a correct rearrangement using an incorrectly/not converted value of E	1	
	L = 2 300 000 **or** L = 2.3×10^6	allow a correct calculation using an incorrectly/not converted value of E	1	
	J/kg	allow a unit consistent with their numerical answer eg 2300 kJ/kg	1	

Total			**11**