GCSE
PHYSICS
8463/1H

Paper 1 Higher Tier

Mark scheme

June 2020

Version: 1.0 Final Mark Scheme

206G8463/1h/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.

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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.

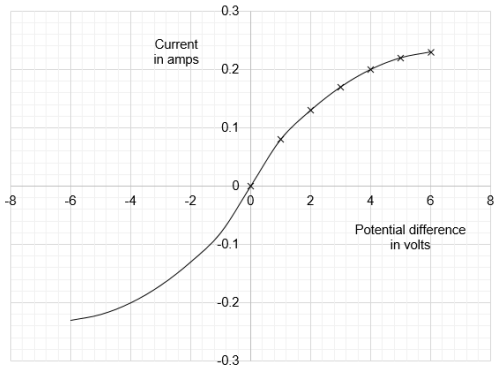
You may well need to read back through the answer as you apply the mark scheme to clarify points and assure yourself that the level and the mark are appropriate.

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.

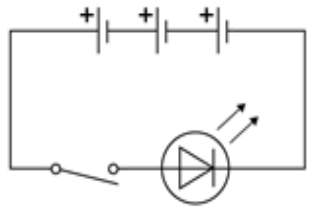
An answer which contains nothing of relevance to the question must be awarded no marks.

Question 1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	ammeter and voltmeter symbols correct voltmeter in parallel with lamp ammeter in series with lamp		1 1 1	AO1 4.2.1.1 RPA 4
01.2	smooth curved line of correct shape passing through - 4.0 V, - 0.2 A ***or*** *– 6.0 V, - 0.23 A*  	do not accept a line that becomes horizontal 2nd mark conditional on scoring 1st mark	1 1	AO2 4.2.1.4 RPA 4
01.3	potential difference = current × resistance **or** *V = IR*		1	AO1 4.2.1.3 RPA 4
01.4	I = 0.08 (A) 1.0 = 0.08 × R $R = \frac{1.0}{0.08}$ R = 12.5 (Ω)	 allow 1.0 = their I × R provided their I has been obtained from the graph allow $R = \frac{1.0}{\text{their I}}$ allow an answer consistent with their I	1 1 1 1	AO2 4.2.1.3 RPA 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5	ammeter displays a reading when not connected (to a circuit)		1	AO3 4.2.1.4 RPA 4
Total			**11**	

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1			1	AO1 4.2.1.1
02.2	charge flow = current × time **or** $Q = It$		1	AO1 4.2.1.2
02.3	I = 0.050 (A) Q = 0.050 × 14 400 Q = 720 (C)	 allow a correct substitution using an incorrectly/not converted value of I allow a correct calculation using an incorrectly/not converted value of I	1 1 1	AO2 4.2.1.2
02.4	there is no current in a diode (in the reverse direction) **or** charge will not flow through a diode (in the reverse direction) (because) a diode has a (very) high resistance (in the reverse direction)	allow diode will not conduct (electric charge) do not accept the circuit is not complete	1 1	AO1 4.2.1.4 4.2.1.3
02.5	Efficiency = $\frac{\text{Useful power output}}{\text{Total power input}}$		1	AO1 4.1.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.6	$0.75 = \frac{\text{Useful power output}}{0.24}$ Useful power output = 0.75 × 0.24 Useful power output = 0.18 (W)		1 1 1	AO2 4.1.2.2
Total			**11**	

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	density = $\frac{\text{mass}}{\text{volume}}$ **or** $\rho = \frac{m}{V}$		1	AO1 4.3.1.1
03.2	$998 = \frac{\text{m}}{6\ 500\ 000}$ m = 998 × 6 500 000 m = 6 487 000 000 m = 6.487 × 10^9 (kg)	 allow a correct conversion of their calculated value of mass into standard form	1 1 1 1	AO2 4.3.1.1
03.3	energy transferred = power × time **or** $E = Pt$		1	AO1 4.2.4.2
03.4	t = 18 000 (s) **or** t = 5 × 60 × 60 E = 1.5 × 10^9 × 18 000 E = 2.7 × 10^{13} (J)	 allow a correct substitution using an incorrectly/not converted value of t allow a correct calculation using an incorrectly/not converted value of t	1 1 1	AO2 4.2.4.2
03.5	the variation in demand is (much) greater than 1.5 × 10^9 W demand remains high for longer than 5 hours	allow the increase in demand is greater than the (power) output of the (hydroelectric) power station allow 04:00 to 16:00 is 12 hours allow 04:00 to 16:00 is greater than 5 hours	1 1	AO3 4.1.3
Total			**11**	

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	% increase = $\frac{(10\,000 - 3200)}{3200} \times 100$		1	AO3 4.1.3
	% increase = 212.5 (%)		1	
04.2	Any **two** from: • no sulfur dioxide released • doesn't cause acid rain • no particulates released • doesn't cause global dimming • less carbon dioxide released (per kg of fuel burned) • less global warming • no solid waste • gas mining is less destructive than coal mining	allow less climate change allow less greenhouse gases ignore less air pollution	2	AO1 4.1.3
04.3	mean sea surface temperature shows a (steady) increase		1	AO3 4.1.3
	over the time period on the graph **or** from 16.45 (°C) to 16.96 (°C)	conditional on scoring 1st marking point allow between a correct pair of dates at least 10 years apart allow a correct pair of temperatures at least 10 years apart	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	thermistor C		1	AO3 4.2.1.4
	(because) the change in resistance is greatest	conditional on scoring 1st marking point allow the gradient is highest allow more sensitive to temperature change	1	
	between 0 and 25 ºC	conditional on scoring 2nd marking point allow between 16 and 17 ºC	1	
		if thermistor C is not chosen, allow for 1 mark each: not thermistor A because there is no/little change in resistance not thermistor B as there is only a small change in resistance not thermistor D as there is no data available between 0 and 40 ºC		
Total			**9**	

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	Any **one** from: • (medical) x-rays • radiotherapy • nuclear weapons (testing) • named nuclear disaster eg Chernobyl / Fukushima / Three Mile Island.	allow CT scans allow nuclear fallout ignore radioactive / nuclear waste	1	AO1 4.4.3.1
05.2	uranium / plutonium	ignore any number given allow thorium	1	AO1 4.4.4.1
05.3	neutron absorbed by a uranium nucleus nucleus splits into two parts and (2 / 3) neutrons (are released) and gamma rays (are emitted)	allow an atom splits into two parts if 1st marking point doesn't score	1 1 1 1	AO1 4.4.4.1
05.4	lighter nuclei join to form heavier nuclei some of the mass (of the nuclei) is converted to energy (of radiation)	allow specific examples	1 1	AO1 4.4.4.2
05.5	activity decreases quickly risk of harm decreases quickly	allow nuclei / waste will decay at a greater rate ignore waste is radioactive for less time allow burial site doesn't need to be monitored for as long **or** doesn't need to be buried underground for as long **or** may not need to be buried underground	1 1	AO3 4.4.2.3
Total			**10**	

Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	Length of sled Time for sled to pass light gate		1 1	AO2 4.1.1.2
06.2	E_p = 8330 (J) 8330 = m × 9.8 × 17.0 $m = \frac{8330}{9.8 \times 17.0}$ m = 50.0 (kg)	 allow a correct substitution using an incorrectly/not converted value of E_p allow a correct rearrangement using an incorrectly/not converted value of E_p allow a correct calculation using an incorrectly/not converted value of E_p	 1 1 1 1	AO2 4.1.1.2
06.3	½ mv^2 = mgh **or** decrease in E_p = increase in E_k masses cancel on both sides of the equation **or** v^2 = 2gh (final) speed only depends on vertical height (and gravitational field strength) variations will be due to air resistance/friction **or** different initial speed		1 1 1 1	AO1 4.1.1.2
Total			**10**	

Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	the heating element of the kettle takes time to heat up	allow the kettle takes time to heat up	1	AO3 4.1.1.3
07.2	ΔΘ = 78 (°C) 155 000 = m × 4200 × 78 $m = \frac{155\,000}{4200 \times 78}$ m = 0.4731 (kg) m = 0.47 (kg)	 allow a correct substitution using an incorrect value of ΔΘ allow a correct rearrangement using an incorrect value of ΔΘ allow a correct calculation of mass using an incorrect value of ΔΘ	1 1 1 1 1	AO2 4.1.1.3 4.3.2.2
07.3	Gradient = $\frac{\Delta\theta}{t}$ Pt = mcΔΘ P = gradient × mc	allow gradient = rate of temperature increase allow calculation of gradient	1 1 1	AO1 4.1.1.3 4.3.2.2 4.1.1.4
Total			**9**	

Question 8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.1	$15.7 = \frac{15.8 + 15.3 + \mathbf{X}}{3}$ **X** = 16.0 (Ω)		1 1	AO2 4.2.1.3 RPA 3
08.2	precise results show little variation the 4th result was further away from the mean than the other values	allow the range of values has increased ignore the 4th result was an anomaly	1 1	AO3 4.2.1.3 RPA 3
08.3	two pairs of values of n and R showing that $n \times R$ = constant third pair of values of n and R showing that $n \times R$ = constant (so) $n \times R$ = constant (showing the student was correct)	eg 2 × 24 = 48, 3 × 16 = 48 4 × 12 = 48, 5 × 9.5 = 47.5 6 × 8 =48 allow 1 mark each for two statements relating the change in number of resistors to the change in (mean total) resistance allow 1 mark for use of data from graph to confirm at least one statement	1 1 1	AO3 4.2.1.3 RPA 3
08.4	multiple paths for charge / electrons to flow total current is greater (for the same potential difference when more resistors are added)	allow current for charge	1 1	AO1 4.2.1.3 RPA 3
Total			**9**	

Question 9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.1	$5.75 = I \times 230$ $I = \frac{5.75}{230}$ $I = 0.025$ (A) $230 = 0.025 \times R$ **or** $R = \frac{230}{0.025}$ $R = 9200$ (Ω)	allow a correct substitution using an incorrect value of I **or** allow a correct rearrangement using incorrect value of I allow a correct calculation of resistance using an incorrect value of I alternative approach for 4th and 5th marks: $5.75 = 0.025^2 \times R$ (1) **or** $R = \frac{5.75}{0.025^2}$ R = 9200 (Ω) (1) alternative approach: $5.75 = \frac{230^2}{R}$ (3) $R = \frac{230^2}{5.75}$ (1) R = 9200 (Ω) (1)	1 1 1 1 1	AO2 4.2.4.1 4.2.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.2	one wire in the switch is live	allow the switch / circuit is live allow one wire is at a potential of 230 V	1	AO1 4.2.3.2
	the electrician is earthed **or** the electrician is at earth potential		1	
	(so) there will be a (large) potential difference between the live wire and the electrician / earth (if the electrician touched the wire)		1	
09.3	50 Hz has the lowest (maximum) let-go current		1	AO3 4.2.3.1
	a higher / lower / different frequency would allow people to let go at a greater current	allow a specific numerical example as opposed to a trend	1	
Total			**10**	

Question 10

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.1	The particles move in random directions. The particles move with a range of speeds.		1 1	AO1 4.3.3.1
10.2	100 000 × 0.030 = 3000 p × 0.025 = 3000 $p = \frac{3000}{0.025}$ p = 120 000 (Pa)	 allow a correct substitution using an incorrectly calculated value using pV = constant allow a correct rearrangement using an incorrect value of the constant allow a correct calculation using an incorrect value of the constant allow correct substitution into $p_1V_1 = p_2V_2$ for first 2 marking points	 1 1 1 1	AO2 4.3.3.2
10.3	particles would have a higher (mean) kinetic energy (so) increased number of collisions with the walls of the balloon per second greater forces exerted in collisions (between particles and balloon walls) greater force exerted on same area	allow particles would have a higher (mean) speed do not accept particles vibrate more allow greater frequency of collisions with the walls of the balloon allow greater rate of change of momentum (of particles) allow description using p=F/A	1 1 1 1	AO1 4.3.3.1
Total			**10**	