GCSE
COMBINED SCIENCE: TRILOGY
8464/P/1H

Physics Paper 1H

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 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	geothermal		1	AO1 6.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.2	36×10^9 J		1	AO2 6.1.3

Question	Answers	Mark	AO / Spec. Ref.
01.3	**Level 3:** Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.	5–6	AO3
	Level 2: Relevant points (reasons / causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear.	3–4	AO1
	Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.	1–2	AO2
	No relevant content	0	
	Indicative content **Figure 1** • the power output from wind increased • because more wind turbines were built • the power output from solar increased • because more solar panels were built • power output from wind and solar may have increased due to climate change For 2015 and 2016 • wind power was lower in 2016 than in 2015 • because 2016 was less windy than 2015 **Figure 2** • for most of the year the electricity generated from wind is greater than from solar. • the electricity generated from wind is greater in winter than in summer • because winter is windier than summer • the electricity generated from solar is greater in summer than in winter • because hours of sunlight are longer in summer • because the intensity of sunlight is greater in summer to access Level 3, the answer should describe trends in both graphs, and in solar power and wind power, and give some explanation for changes.		6.1.3

Total Question 1	8

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	voltmeter symbol correct and connected across the resistors		1	AO1 6.2.1.3 6.2.1.1 6.2.1.4 RPA15

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.2	the total resistance must be less than 20 Ω	allow the total resistance cannot be more than 20 Ω	1	AO2
	because the total resistance of the resistors (in parallel) is less than the resistance of the smallest resistor	allow the total resistance of the resistors (in parallel) is less than either resistor	1	AO1 6.2.2 6.2.1.3 RPA15

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	potential difference = current × resistance **or** $V = IR$		1	AO1 6.2.1.3 RPA15

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.4	480 mA = 0.48 A		1	AO2 6.2.1.3
	$V = 0.48 \times 7.5$	allow a correct substitution of an incorrectly / not converted value for current	1	RPA15
	$V = 3.6$ (V)	allow an answer consistent with their incorrectly / not converted value for current	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.5	x-axis labelled resistance of R in Ω **and** y-axis labelled total resistance (of resistors) in Ω		1	AO2 6.2.1.3 RPA15
	both points plotted correctly	points must be plotted within ½ small square	1	
	curved line of best fit drawn	allow a curved line of best fit which ignores an outlier	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.6	reading from graph consistent with their line of best fit	allow an answer within ½ small square	1	AO3 6.2.1.3 RPA15

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.7	random		1	AO3 6.2.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.8	in category A the body water percentage is 61% in category B the body water percentage is 68% if in category A they have a healthy body water percentage **and** if in category B they have an unhealthy body water percentage	allow a value for A between 60% and 62%	1 1 1	AO3 6.2.1.3

Total Question 2	**15**

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	potential difference is increased	allow transformer **X** is a step up transformer	1	AO1 6.2.4.3
	(and) current decreases		1	
	(so) energy/power losses in the transmission cables decrease	allow (so) there is less heating in the transmission cables	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	$11\,000 \times I_s = 400\,000 \times 660$		1	AO2 6.2.4.3
	$I_s = \frac{400\,000 \times 660}{11\,000}$		1	
	$I_s = 24\,000$ (A)		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.3	the street lamps are connected in parallel		1	AO3 6.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.4	resistance (of the LDR) increases	allow resistance (of the circuit) increases	1	AO1
	(so) the current decreases	allow so the LDR has a greater (share of the) potential difference	1	AO3
	(so) the potential difference across R decreases	dependent on MP1	1	AO3 6.2.1.4 6.2.1.3 6.2.2 6.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.5	20 mA = 0.020 A		1	AO2 6.2.4.1
	$6.0 = 0.020^2 \times R$	allow a correct substitution using an incorrectly / not converted value of current.	1	
	$R = \frac{6.0}{0.020^2}$	allow a correct re-arrangement using their incorrectly / not converted value of current.	1	
	R = 15000 (Ω)	allow an answer consistent with their incorrectly / not converted value of current	1	
	OR			
	20 mA = 0.020 A (1)			
	$V = \frac{6.0}{0.020} = 300$ (1)			
	$R = \frac{300}{0.020}$ (1)			
	R = 15000 (Ω) (1)			

Total Question 3	**14**

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	peer review		1	AO1 6.4.2.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.2	it is ionising	ignore references to penetrating ability	1	AO1 6.4.2.4 6.4.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.3	becquerel / Bq		1	AO1 6.4.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	not all the radiation emitted (by the sample) is detected (because) the radiation spreads out **or** (because) some radiation is absorbed before reaching the detector **or** (because) some of the radiation entering the detector is **not** detected	 allow because the radiation is emitted in all directions	1 1	AO1 6.4.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.5	alpha radiation		1	AO1 6.4.2.1
	because the radiation is not detected beyond 5 cm **or** because alpha radiation cannot travel 10 cm (in air) **or** because beta **and** gamma radiation would be detected at 10 cm	dependent on MP1 allow because alpha radiation cannot travel more than a few cm (in air)	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.6	60 minutes is 4 half-lives	allow 15 minutes is 1 half-life allow 1568 → 784 → 392 → 196 → 98 allow $\frac{1568}{98} = 2^4$ allow $\frac{98}{1568} = \frac{1}{2^4}$	1	AO3 6.4.2.3
	30 minutes is 2 half-lives		1	
	X = 392		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.7	radioactive decay is a random process		1	AO1 6.4.2.3

Total Question 4	**11**

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	the measurement will be more accurate	allow parallax error is reduced	1	AO3
	because (in position B) the eye is level with (the maximum height of) the toy		1	AO1 6.1.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2	64 cm = 0.64 m		1	AO2 6.1.1.2
	$0.049 = m \times 9.8 \times 0.64$	allow a correct substitution using an incorrectly / not converted height	1	
	$m = \frac{0.049}{9.8 \times 0.64}$	allow a correct rearrangement using their incorrectly / not converted height	1	
	$m = 0.0078125$ (kg)	allow an answer consistent with their incorrectly / not converted height	1	
	$m = 0.0078$ (kg)	this mark can only be scored if the equation $E_p = m\ g\ h$ has been used	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3	energy from the toy is dissipated (to the surroundings / air)	allow energy from the toy is transferred to the surroundings / air	1	AO1 6.1.2.1 6.1.1.1
	(but) in a closed system the total energy remains constant		1	

Total Question 5	**9**

Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	(air) particles move faster **or** (air) particles have increased kinetic energy		1	AO1 6.3.3.1
	(so air) particles collide more frequently with the wall / chamber **or** (so air) particles collide with more force with the wall / chamber		1	
	(so) the pressure increases	dependent on MP1 or MP2	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.2	(metals) have a high(er) thermal conductivity	allow metals are good/better (thermal) conductors	1	AO1 6.1.2.1
	which allows a greater rate of (thermal) energy transfer	allow (thermal) energy is transferred more quickly	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.3	(a low) specific heat capacity		1	AO1 6.1.1.3 6.3.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.4	any **one** from: • lubrication • use hotter coffee • decrease the temperature of the surroundings	allow oil the device/wheel	1	AO3 6.1.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.5	$1.1 \times 10^3 = \frac{\text{mass}}{1.9 \times 10^{-4}}$		1	AO2 6.1.1.3 6.3.2.2 6.3.1.1
	mass = 0.209 (kg)	allow m = $1.9 \times 10^{-4} \times 1.1 \times 10^3$ the equation density = $\frac{\text{mass}}{\text{volume}}$ must have been used to score subsequent marks	1	
	15 000 = 0.209 × 4200 × Δθ	allow a correct substitution using their calculated value of mass	1	
	$\Delta\theta = \frac{15\,000}{0.209 \times 4200}$	allow a correct re-arrangement using their value of mass and/or an incorrectly / not converted energy value	1	
	$\Delta\theta$ = 17(.088…)	allow a correct calculation using their value of mass and / or an incorrectly / not converted energy value	1	
	final temperature (= 76 – 17.088) = 59 (°C)	allow 58.9… (°C) allow an answer consistent with their value of mass and / or an incorrectly / not converted energy value	1	

Total Question 6	**13**