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.

No student should be disadvantaged on the basis of their gender identity and/or how they refer to the gender identity of others in their exam responses.

A consistent use of 'they/them' as a singular and pronouns beyond 'she/her' or 'he/him' will be credited in exam responses in line with existing mark scheme criteria.

Further copies of this mark scheme are available from aqa.org.uk

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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 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 should be awarded for a correct numerical answer, without any working shown.
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	any **two** from • chemical store (of the fuel) decreases • thermal store (of engine / gases / surroundings) increases • kinetic energy (of the engine / car) increases		2	AO2 6.1.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.2	biofuel	allow a named biofuel allow biogas allow wood ignore fossil fuels	1	AO1 6.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.3	(by a) battery **or** (by) electricity	allow (by an) electric motor	1	AO3 6.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.4	the amount of fossil fuel that is burned to generate electricity each year has decreased		1	AO3 6.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5	many generators are required **or** lots of resources are required	allow named device such as wind turbines for generators ignore unreliable	1	AO3 6.1.3
	so it is expensive		1	
		if no other mark awarded allow **1** mark for lack of political will		

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.6	*hydro-electric power* loss of habitat *wind power* negative visual impact	 allow dangerous for birds allow noise pollution	 1 1	AO1 6.1.3

Total Question 1	9

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	$13\,800 = 0.75 \times c \times 20$		1	AO2 6.1.1.3 RPA14
	$c = \frac{13\,800}{0.75 \times 20}$		1	
	c = 920 (J/kg °C)		1	

Question	Answers	Mark	AO / Spec. Ref.
02.2	**Level 3:** The method would lead to the production of a valid outcome. The key steps are identified and logically sequenced.	5–6	AO1 6.1.1.3 RPA14
	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 **Mass** • use a top pan balance to measure mass of block **Energy transfer** • use a joulemeter to measure energy • connect heater to a joulemeter • measure initial energy and switch on • switch off and measure final energy • calculate the difference between initial and final energy • use an ammeter, voltmeter and stopwatch • calculate energy transferred **Temperature change** • use a thermometer to measure temperature • measure the initial temperature • measure the final temperature • calculate the difference between initial and final temperature for **Level 3** answers must describe all three measurements		

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	the amount of wasted energy is less the temperature increase of the aluminium block is greater		1 1	AO3 6.1.1.3 6.1.2.1 RPA14

Total Question 2	**11**

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	circuit with a cell, (switch) and resistor in series	allow battery for cell	1	AO2
	ammeter in series (with the resistor and the cell)		1	AO1
	voltmeter in parallel with resistor		1	AO1 6.2.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	I = 0.45 (A)	subsequent marks may be awarded if an incorrectly / not converted value of I is used	1	AO2 6.2.1.3
	$2.7 = 0.45 \times R$		1	
	$R = \frac{2.7}{0.45}$		1	
	R = 6 (Ω)	allow 6.0 (Ω)	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.3	straight line through the origin in **both** 1st and 3rd quadrant		1	AO1 6.2.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.4	R = 2200 (Ω)	subsequent marks may be awarded if an incorrectly / not converted value of R is used	1	AO2
	$P = 0.012^2 \times 2200$		1	AO2
	P = 0.3168 (W)	allow P = 0.32 allow P = 0.317	1	AO2
	resistors **A**, **B** and **C**	dependent on MP1 **and** MP3	1	AO3
	OR			6.2.4.1
		the first three marks may be awarded for calculating I_{max} for any of the resistors		
	R = 2200 (Ω) (1)	subsequent marks may be awarded if an incorrectly / not converted value of R is used		
	$2.0 = I^2 \times 2200$ (1)			
	I = 0.030…(1)			
	resistors **A**, **B** and **C** (1)	dependent on MP1 **and** MP3		

Total Question 3	**12**

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	*alpha particle* (a particle consisting of) two neutrons **and** two protons (from the nucleus) *beta particle* (a high-speed) electron (from the nucleus) *gamma ray* (a high frequency / energy) electromagnetic wave / radiation (from the nucleus)	 allow helium nucleus	 1 1 1	AO1 6.4.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.2	198 0 80 –1	**1** mark for the top row **1** mark for the bottom row	1 1	AO1 6.4.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.3	2.75 (days)	allow 2.7 to 2.8 allow an answer consistent with a correct pair of values for activity allow **1** mark for a horizontal line drawn from 11	2	AO2 6.4.2.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	activity = 6.0 (kBq)	subsequent marks may be awarded if an activity of 7.0 (kBq) is used	1	AO3
	$\frac{22-6.0}{22}\times 100$		1	AO2
	72.7…(%)		1	AO2
	73 (%)	allow a percentage calculated using data from the graph given to two significant figures	1	AO2 6.4.2.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.5	Any **two** from: • beta only has a short range (in tissue) • increases the chance of killing the cancer cells • decreases the risk to healthy cells		2	AO3 6.4.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.6	the risk of removing the sample is greater than the risk of leaving the sample in the patient **or** the activity will reduce to a safe level in a short time	allow the risk of leaving the sample in the patient is very small	1	AO3 6.4.2.1 6.4.2.4

Total Question 4	**14**

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	230 (V) 50 (Hz)	allow about 230 (V)	1 1	AO1 6.2.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2	live – brown neutral – blue		1 1	AO1 6.2.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3	alternating (potential difference) continuously changes direction direct (potential difference) is always in the same direction		1 1	AO1 6.2.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.4	energy / power is transferred by the laptop (when being used) (so) the power delivered to the battery is reduced	 allow (so) the rate at which energy is transferred to the battery is lower	1 1	AO2 AO3 6.1.1.4 6.1.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.5	$P = 15 \times 4.8$		1	AO2 6.2.4.1
	$P = 72$ (W)		1	6.2.4.2 6.1.1.4
	$\Delta P = 97 - 72 = 25$ (W)		1	
	$25 = \frac{225\,000}{t}$	subsequent marks may be awarded if an incorrect / not converted value of E is used.	1	
	$t = 9000$ (s)		1	
	$t = 2.5$ (hours)		1	

Total Question 5	**14**

Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	V (= 5 × 5 × 5) = 125 (m^3)	do **not** allow subsequent marks unless volume is used subsequent marks may be awarded if volume is incorrectly calculated	1	AO2 6.3.1.1
	$4200 = \frac{m}{125}$		1	
	m = 4200 × 125		1	
	m = 525 000 (kg)		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.2	(the greater the density) the greater the mass (for a given volume)		1	AO1
	(so) a greater amount of energy can be stored		1	AO3
	OR			6.1.1.2
	(the greater the density) the smaller the volume (for a given mass) (1)			
	(so) the same amount of energy can be stored (for a smaller volume) (1)			

Question	Answers		Mark	AO / Spec. Ref.
06.3	measure the energy input from the National Grid **and** measure the energy output to the National Grid	allow measure the energy input to the motor **and** measure the energy output from the generator	1	AO3
	(then) use the equation: $\text{efficiency} = \frac{\text{energy output}}{\text{energy input}}$	MP2 dependent on MP1	1	AO1 6.1.2.2
	if no other mark awarded, allow **1** mark for: $\text{efficiency} = \frac{\text{energy released when lowering the block}}{\text{energy stored when raising block}}$			

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.4	use a motor with a greater power	allow increase the power of the motor	1	AO1 6.1.1.4
	(so) the cube / weight / mass is lifted more quickly	MP2 dependent on MP1	1	

Total Question 6	**10**