GCSE
COMBINED SCIENCE: TRILOGY

8464/P/1H - PHYSICS PAPER 1 HIGHER TIER

Mark scheme

8464

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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 Assessment Writer.

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 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	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	electron atom nucleus orbit		1 1 1 1	AO1 6.4.1.3 5.1.1.3
01.2	positive charge is provided by protons (every atom of the same element contain the) same number of protons	 do **not** accept same number of protons and neutrons ignore reference to electrons	1 1	AO1 6.4.1.2 6.4.1.3
01.3	 $v = 300\ 00\ 000 \times \left(\frac{7}{100}\right)$ v = 21 000 000 (m/s)	an answer of 21 000 000 scores **2** marks allow any correct method of determining 7% of 300 000 000 allow 2.1×10^7 (m/s)	 1 1	AO2 6.4.1.3
01.4	 $r = 6 \times 2.5 \times 10^{-11}$ $r = 1.5 \times 10^{-10}$ (m)	an answer in the range 1.4×10^{-10} to 1.6×10^{-10} scores **2** marks allow a ratio in the range of 5.7–6.3 or measurements that would give this range, correctly substituted allow 1.4×10^{-10} to 1.6×10^{-10} their ratio $\times 2.5 \times 10^{-11}$ correctly calculated scores **1** mark	 1 1	AO2 6.4.1.1
Total			**10**	

Question	Answers	Mark	AO / Spec. Ref.
02.1	**Level 3:** The method would lead to the production of a valid outcome. All key steps are identified and logically sequenced.	5–6	AO1 6.3.1.1
	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 • use a top pan balance or scales • part fill a measuring cylinder with water • measure initial volume • place object in water • measure final volume • volume of object = final volume − initial volume • fill a displacement / eureka can with water • water level with spout • place object in water • collect displaced water • measuring cylinder used to determine volume of displaced water • use of: $\text{density} = \frac{\text{mass}}{\text{volume}}$		

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.2	all *y*-axis values correct (minimum of 3)	allow **1** mark for two correct values	2	AO2 6.3.1.1
	all bars drawn to the correct height	allow **1** mark for two correct bars allow ± ½ small square	2	
02.3		an answer of 80 scores **2** marks		AO3 6.3.1.1
	$\frac{(1120 - 960)}{2}$	ignore + and / or − signs	1	
	= 80 (kg/m^3)	an answer of 160 scores **1** mark	1	
Total			**12**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	they move in random directions they move with a range of different speeds		1 1	AO1 6.3.3.1
03.2	the (mean) speed of the particles would increase	allow kinetic energy increases	1	AO1 6.3.3.1
03.3	(if the temperature increases) the pressure increases so it could explode	allow an explanation in terms of large pressure difference	1 1	AO1 6.3.3.1 AO2 6.3.3.1
03.4	p = 0.1 (MPa)		1	AO2 6.3.3.1
03.5	$p = 2.25 \times \left(\frac{25}{100}\right)$ p = 0.56 t = 27 (minutes)	an answer of 27 scores **3** marks allow any correct method of determining 25% of 2.25 allow use of 2.2–2.3 allow 0.55–0.575 allow 26–28 minutes allow correct value of t using their calculated value of p	 1 1 1	AO3 6.3.3.1
03.6	(the volume of the air) increases		1	AO1 6.3.3.1
Total			**10**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	2 charged particles and 2 neutral particles		1	AO1 6.4.2.1
04.2	it is the type of radiation with a negative charge		1	AO1 6.4.2.1
04.3	it has a very long range in air		1	AO1 6.4.2.1
04.4	risk / activity associated with iodine-131 has decreased by a large amount		1	AO3 6.4.2.3
	because of short half-life	allow many half-lives have passed allow half-life is only 8 days 2nd marking point dependent on 1st marking point	1	
	risk / activity associated with caesium-137 will not have decreased by much	allow activity has halved	1	
	because of long half-life	allow only one half-life has passed 4th marking point dependent on 3rd marking point	1	
04.5		an answer of 2136 scores **3** marks		AO2 6.4.2.3
	5 half-lives	allow any correct method eg ½ × ½ × ½ × ½ × ½ = 1/32	1	
	5 × 30 = 150		1	
	1986 + 150 = 2136	any calculation using a value of 137 scores zero	1	
Total			**10**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	the wall has two / three layers	allow the wall is thick	1	AO1 6.1.2.1
	cavity wall insulation / brick / block has a low thermal conductivity		1	
	so less energy is transferred by conduction	allow rate of energy transfer is lower ignore any reference to convection and / or radiation	1	
05.2	$T = 17.4 + \left(\frac{(20.8 - 17.4)}{2}\right)$ **or** $T = 20.8 + \left(\frac{(20.8 - 17.4)}{2}\right)$	an answer in the range 18.5–19.1 scores **2** marks	1	AO3 6.1.2.1
	T = 19.1 (°C)		1	
05.3	chemical energy store of the fuel decreases		1	AO1 6.1.2.1
	thermal energy store of the water increases	allow kinetic energy store of the water particles increases	1	
	thermal energy store of the air / atmosphere increases	allow kinetic energy store of the air particles increases	1	
05.4	E = 15 000 000 (J)	an answer of 25 000 scores **4** marks	1	AO2 6.1.1.4
	t = 600 (s)		1	
	$p = \frac{15\ 000\ 000}{600}$	allow a correct substitution of incorrectly / not converted values of E and / or t	1	
	P = 25 000 (W)	allow a correct calculation using incorrectly / not converted values of E and / or t	1	
Total			**12**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	a curve in the first and third quadrants only, passing through origin decreasing gradient		1 1	AO1 6.2.1.4
06.2	any **two** from: • $I_1 = I_2 + I_3$ • $I_2 = I_3$ • $I_1 = 2I_2$ • $I_1 = 2I_3$	allow **1** mark for each correct description given in words	2	AO2 6.2.2
06.3	$3 = I^2 \times 12$ $I = \sqrt{\left(\frac{3}{12}\right)}$ $I = 0.5$ (A) $Q = 0.5 \times 60 = 30$ $Q_{total} = 60$ **or** $3 = I^2 \times 12$ (1) $I = \sqrt{\left(\frac{3}{12}\right)}$ (1) $I = 0.5$ (A) (1) $I_{total} = 1.0$ (A) (1) $Q = 1.0 \times 60 = 60$ (1) coulombs **or** C	an answer of 60 scores **5** calculation marks allow Q = their calculated I × 60 allow an answer that is consistent with their calculated value of I allow I_{total} = their I × 2 allow an answer that is consistent with their calculated value of I	1 1 1 1 1 1	AO2 6.2.4.1 6.2.4.2

Question	Answers	Mark	AO / Spec. Ref.
06.4	**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 logically linking. The resulting account is not fully clear.	3–4	AO2
	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 • resistance of LDR changes when light intensity changes • when light intensity increase resistance of LDR decreases • overall resistance of circuit decreases • potential difference across total resistance remains unchanged • current in ammeter increases • potential difference across fixed resistor increases • potential difference across LDR decreases • reading on the voltmeter decreases • potential difference is shared between the components in series • the lower the resistance of the LDR the smaller the share of the potential difference • reading on the voltmeter decreases		6.2.1.1 6.2.1.4
Total		**16**	