



GCSE
COMBINED SCIENCE: TRILOGY
8464/P/1H

Physics Paper 1H

Mark scheme

June 2020

Version: 1.0 Final Mark Scheme

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 **not** 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.

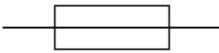
The exemplar materials used during standardisation will help. There will be an answer in the standardising materials which will correspond with each level of the mark scheme. This answer will have been awarded a mark by the Lead Examiner. You can compare the student's answer with the example to determine 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 | swap the blue wire and the green and yellow wire | allow connect the blue wire to the neutral pin and the yellow and green wire to the earth pin. allow swap the earth and neutral wires ignore the earth wire and neutral wire are wrongly connected | 1 | AO2 6.2.3.2 |
| 01.2 | 230 (V) 50 (Hz) | | 1 1 | AO1 6.2.3.1 6.2.3.2 |
| 01.3 | 0 (V) | | 1 | AO1 6.2.3.2 |
| 01.4 |  | | 1 | AO1 6.2.1.1 |
| 01.5 | the person could get an electric shock because there is a current in the person | allow so the person could be electrocuted allow because the person provides a connection (from the washing machine) to earth allow because there is a potential difference across the person | 1 1 | AO3 6.2.3.2 |

| | | | | |
|--------------|---|--|----------|----------------|
| 01.6 | the charge flows through the earth wire (instead of the person) | | 1 | AO3 6.2.3.2 |
| | because the resistance of the earth wire is much less than that of a person | allow so the case does not become live allow so the fuse will break / melt / blow | 1 | |
| Total | | | 9 | |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|----------|-----------------------|-------------------------------|--------|-----------------|
| 02.1 | A = 206 | | 1 | AO2 6.4.2.2 |
| 02.2 | Z = 82 | | 1 | AO2 6.4.2.2 |
| 02.3 | 89 39 | numbers must be in this order | 1 1 | AO2 6.4.2.2 |
| 02.4 | electromagnetic waves | | 1 | AO1 6.4.2.1 |

| Question | Answers | Mark | AO / Spec. Ref. |
|--------------|---|-----------|--------------------------------------|
| 02.5 | Level 3: Relevant points (reasons/causes) are identified, given in detail and logically linked to form a clear account. | 5–6 | AO1 6.4.1.2 6.4.2.1 6.4.2.2 |
| | Level 2: Relevant points (reasons/causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear. | 3–4 | |
| | Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking. | 1–2 | |
| | No relevant content | 0 | |
| | Indicative content <u>alpha radiation</u> <ul style="list-style-type: none"> • an alpha particle is the same as a helium nucleus • alpha is the least penetrating • alpha is stopped by paper or skin • alpha has the shortest range in air • alpha will travel a few cm in air • because alpha is most ionising • because alpha has a charge of +2 <u>beta radiation</u> <ul style="list-style-type: none"> • a beta particle is an electron (emitted from the nucleus) • beta penetrates less than gamma and more than alpha • beta is stopped by a thin sheet of aluminium • beta has a shorter range than gamma • beta will travel up to 1m in air • because beta is more ionising than gamma and less ionising than alpha • because beta has a charge of -1 <u>gamma radiation</u> <ul style="list-style-type: none"> • gamma radiation is an electromagnetic wave • gamma is the most penetrating • gamma is reduced/stopped by several cm of lead or thick concrete • gamma has the largest range in air • gamma will travel very large distances in air • because gamma is least ionising • because is uncharged <p>to access level 3 the answer should compare alpha, beta and gamma radiation and provide some explanation of their properties</p> | | |
| Total | | 11 | |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|-------------|---|---|------|-------------------------------------|
| 03.1 | (the variable resistor) changes the resistance of the circuit | | 1 | AO1 6.2.1.3 6.2.1.4 RPA 15 |
| | to keep the current the same | | 1 | |
| | so the temperature of the wire is kept constant | allow to control the temperature of the wire | 1 | |
| 03.2 | $0.17 = \frac{X+0.18+0.15}{3}$ | allow $X = 3 \times 0.17 - 0.18 - 0.15$ | 1 | AO2 6.2.1.3 RPA 15 |
| | $X = 0.18 \text{ (V)}$ | | 1 | |
| 03.3 | resistance is directly proportional to length | allow length is directly proportional to resistance allow as length increases resistance increases for 1 mark allow positive correlation for 1 mark | 2 | AO1 6.2.1.3 RPA 15 |
| 03.4 | resistance = 7.5 (Ω) | allow a range from 7.4 to 7.6 | 1 | AO3 6.2.1.3 |
| | $0.90 = I \times 7.5$ | allow their value of R read from the graph correctly substituted | 1 | |
| | $I = \frac{0.90}{7.5}$ | allow a correct re-arrangement using their value of R read from the graph | 1 | |
| | $I = 0.12 \text{ (A)}$ | allow a value consistent with their value of R read from the graph | 1 | |

| | | | | |
|--------------|--|---|------------------------------------|----------------|
| 03.5 | the length/width/volume (of the blood sample) affects the resistance of the blood sample so only glucose concentration affects resistance | allow length/width/volume (of the blood sample) should be a control variable allow shape/size of the tube should be a control variable ignore amount of blood | 1 1 | AO3 6.2.1.3 |
| Total | | | 13 | |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|--------------|---|--|---------------------|-----------------|
| 04.1 | a renewable biofuel | | 1 | AO1 6.1.3 |
| 04.2 | any two from <ul style="list-style-type: none"> • burning wood causes air pollution • burning wood may lead to deforestation • destruction of habitats • burning wood is carbon-neutral | allow creates smoke ignore cutting down trees allow does not contribute to global warming or the greenhouse effect or climate change | 2 | AO1 6.1.3 |
| 04.3 | the chemical store of energy of the wood decreases the internal/thermal store of energy of the pipe increases the internal/thermal store of energy of the water increases | both the store of energy and what happens to the store are required | 1 1 1 | AO1 6.1.1.1 |
| 04.4 | energy is dissipated (to the surroundings) at the same rate that energy is transferred to the water | allow energy is transferred/lost to the surroundings | 1 1 | AO2 6.1.2.1 |
| Total | | | 8 | |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|----------|--|---|------------------------------|-----------------|
| 05.1 | they vibrate about fixed positions. | | 1 | AO1 6.3.1.1 |
| 05.2 | kinetic energy decreases potential energy decreases | | 1 | AO1 6.3.2.1 |
| 05.3 | metal: has a high thermal conductivity which increases the rate of energy transfer from the mixture plastic: has a low thermal conductivity which reduces the rate of energy transfer from the surroundings (to the liquid coolant at -20°C) | allow ice cream for mixture ignore references to insulation throughout | 1 1 1 1 | AO2 6.1.2.1 |
| 05.4 | a high specific heat capacity so it can absorb a large amount of energy with only a small temperature change | | 1 1 | AO2 6.3.2.2 |

| | | | | |
|--------------|---|--|-----------|-------------------------------|
| 05.5 | 165 kJ = 165000 J | | 1 | AO2 |
| | $\Delta E = m \times 3500 \times 21.5$ and $\Delta E = m \times 255000$ | | 1 | 6.3.2.2 6.3.2.3 6.1.1.3 |
| | 165000 = 75250 m + 255000 m or 165000 = 330250 m | this mark may be awarded if E is incorrectly/not converted | 1 | |
| | $m = \frac{165000}{75250 + 255000}$ or $m = \frac{165000}{330250}$ | this mark may be awarded if E is incorrectly/not converted | 1 | |
| | m = 0.499621 (kg) | allow an answer consistent with their value of E | 1 | |
| | m = 0.50 (kg) | this answer only | 1 | |
| | If no marks awarded other than the first marking point: either 165 000 = m × 3500 × 21.5 scores 1 mark m = 2.192... scores 1 mark m = 2.2 (kg) scores 1 mark. these marks may be awarded if E is incorrectly/not converted or 165 000 = m × 255 000 scores 1 mark m = 0.647 scores 1 mark m = 0.65kg scores 1 mark. these marks may be awarded if E is incorrectly/not converted | | | |
| Total | | | 14 | |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|--------------|--|---|----------------------------|-----------------|
| 06.1 | both are random processes | allow rolling dice is a random process allow radioactive decay is a random process | 1 | AO1 6.4.2.3 |
| 06.2 | 144 → 72 → 36 → 18 → 9 4 half lives $\frac{20}{4} = 5$ (rolls of the dice) | allow the probability of not getting a 6 is 5/6 allow $144 \times (5/6)^4 = 69$ allow 69 is closest to 72 so 4 (rolls of the dice) some credible working must be shown to gain this mark | 1 1 1 | AO2 6.4.2.3 |
| 06.3 | a dice with 8 sides will have a smaller chance of decay (in one roll) so dice with 8 sides have a greater half-life | allow answers in terms of the 6-sided dice or in terms of more or fewer sides. allow the 8 sided dice has a 1/8 chance of decay, whereas the 6 sided dice has a 1/6 chance of decay | 1 1 | AO1 6.4.2.3 |
| 06.4 | nuclei in source A are more stable than nuclei in source B | allow nuclei in source A are less likely to decay (in a given time period) | 1 | AO1 6.4.2.3 |
| Total | | | 7 | |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|--------------|---|--|----------|-----------------|
| 07.1 | the (maximum tendon) extension increases (as speed increases) | allow the tendons stretch more (as speed increases) | 1 | AO3 6.1.2.2 |
| | so the elastic potential energy increases | allow so the (elastic) force increases | 1 | |
| | which is transferred to gravitational potential energy | | 1 | |
| 07.2 | $E = 770 \times 0.14$ | allow $E = 107.8$ (J) | 1 | AO2 6.1.1.2 |
| | extension = 0.070m | | 1 | |
| | $107.8 = 0.5 \times k \times 0.070^2$ | this mark may be awarded if extension is incorrectly/not converted and/or if the efficiency equation has not been applied | 1 | |
| | $k = 2 \times \frac{107.8}{0.070^2}$ | this mark may be awarded if extension is incorrectly/not converted and/or if the efficiency equation has not been applied | 1 | |
| | $k = 44\,000$ (N/m) | this mark may be awarded if extension is incorrectly/not converted this mark may not be awarded if the efficiency equation has not been applied | 1 | |
| Total | | | 8 | |