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...day June 20XX – Morning/Afternoon  
GCSE (9–1) Physics A (Gateway Science)  
J249/02 Paper 2 (Foundation Tier)

**SAMPLE MARK SCHEME**

**Duration:** 1 hour 45 minutes

**MAXIMUM MARK            90**

**DRAFT**

**This document consists of 20 pages**

SPECIMEN

**MARKING INSTRUCTIONS****PREPARATION FOR MARKING****SCORIS**

1. Make sure that you have accessed and completed the relevant training packages for on-screen marking: *scoris assessor Online Training*; *OCR Essential Guide to Marking*.
2. Make sure that you have read and understood the mark scheme and the question paper for this unit. These are posted on the RM Cambridge Assessment Support Portal <http://www.rm.com/support/ca>
3. Log-in to scoris and mark the **required number** of practice responses (“scripts”) and the **required number** of standardisation responses.

YOU MUST MARK 10 PRACTICE AND 10 STANDARDISATION RESPONSES BEFORE YOU CAN BE APPROVED TO MARK LIVE SCRIPTS.

**MARKING**

1. Mark strictly to the mark scheme.
2. Marks awarded must relate directly to the marking criteria.
3. The schedule of dates is very important. It is essential that you meet the scoris 50% and 100% (traditional 50% Batch 1 and 100% Batch 2) deadlines. If you experience problems, you must contact your Team Leader (Supervisor) without delay.
4. If you are in any doubt about applying the mark scheme, consult your Team Leader by telephone, email or via the scoris messaging system.

5. Work crossed out:
- where a candidate crosses out an answer and provides an alternative response, the crossed out response is not marked and gains no marks
  - if a candidate crosses out an answer to a whole question and makes no second attempt, and if the inclusion of the answer does not cause a rubric infringement, the assessor should attempt to mark the crossed out answer and award marks appropriately.
6. Always check the pages (and additional objects if present) at the end of the response in case any answers have been continued there. If the candidate has continued an answer there then add a tick to confirm that the work has been seen.
7. There is a NR (No Response) option. Award NR (No Response)
- if there is nothing written at all in the answer space
  - OR if there is a comment which does not in any way relate to the question (e.g. 'can't do', 'don't know')
  - OR if there is a mark (e.g. a dash, a question mark) which isn't an attempt at the question.
- Note: Award 0 marks – for an attempt that earns no credit (including copying out the question).
8. The scoris **comments box** is used by your Team Leader to explain the marking of the practice responses. Please refer to these comments when checking your practice responses. **Do not use the comments box for any other reason.**  
If you have any questions or comments for your Team Leader, use the phone, the scoris messaging system, or email.
9. Assistant Examiners will send a brief report on the performance of candidates to their Team Leader (Supervisor) via email by the end of the marking period. The report should contain notes on particular strengths displayed as well as common errors or weaknesses. Constructive criticism of the question paper/mark scheme is also appreciated.

10. For answers marked by levels of response:

Read through the whole answer from start to finish, concentrating on features that make it a stronger or weaker answer using the indicative scientific content as guidance. The indicative scientific content indicates the expected parameters for candidates' answers, but be prepared to recognise and credit unexpected approaches where they show relevance.

Using a 'best-fit' approach based on the science content of the answer, first decide which set of level descriptors, Level 1, Level 2 or Level 3, best describes the overall quality of the answer using the guidelines described in the level descriptors in the mark scheme.

Once the level is located, award the higher or lower mark.

**The higher mark** should be awarded where the level descriptor has been evidenced and all aspects of the communication statement (in italics) have been met.

**The lower mark** should be awarded where the level descriptor has been evidenced but aspects of the communication statement (in italics) are missing.

**In summary:**

**The science content determines the level.**

**The communication statement determines the mark within a level.**

## 11. Annotations

| <b>Annotation</b>   | <b>Meaning</b>   |
|---------------------|--|
| <b>DO NOT ALLOW</b> | Answers which are not worthy of credit                     |
| <b>IGNORE</b>       | Statements which are irrelevant                            |
| <b>ALLOW</b>        | Answers that can be accepted                               |
| ( )                 | Words which are not essential to gain credit               |
| —                   | Underlined words must be present in answer to score a mark |
| <b>ECF</b>          | Error carried forward                                      |
| <b>AW</b>           | Alternative wording  |
| <b>ORA</b>          | Or reverse argument  |

## 12. Subject-specific Marking Instructions

### INTRODUCTION

Your first task as an Examiner is to become thoroughly familiar with the material on which the examination depends. This material includes:

- the specification, especially the assessment objectives
- the question paper
- the mark scheme.

You should ensure that you have copies of these materials.

You should ensure also that you are familiar with the administrative procedures related to the marking process. These are set out in the OCR booklet **Instructions for Examiners**. If you are examining for the first time, please read carefully **Appendix 5 Introduction to Script Marking: Notes for New Examiners**.

Please ask for help or guidance whenever you need it. Your first point of contact is your Team Leader.

The breakdown of Assessment Objectives for GCSE (9–1) in Physics A:

|               | <b>Assessment Objective</b>   |
|---------------|---|
| <b>AO1</b>    | <b>Demonstrate knowledge and understanding of scientific ideas and scientific techniques and procedures.</b>  |
| <b>AO1.1</b>  | Demonstrate knowledge and understanding of scientific ideas.  |
| <b>AO1.2</b>  | Demonstrate knowledge and understanding of scientific techniques and procedures.  |
| <b>AO2</b>    | <b>Apply knowledge and understanding of scientific ideas and scientific enquiry, techniques and procedures.</b>                                       |
| <b>AO2.1</b>  | Apply knowledge and understanding of scientific ideas.  |
| <b>AO2.2</b>  | Apply knowledge and understanding of scientific enquiry, techniques and procedures.   |
| <b>AO3</b>    | <b>Analyse information and ideas to interpret and evaluate, make judgements and draw conclusions and develop and improve experimental procedures.</b> |
| <b>AO3.1</b>  | Analyse information and ideas to interpret and evaluate.  |
| <b>AO3.1a</b> | Analyse information and ideas to interpret.   |
| <b>AO3.1b</b> | Analyse information and ideas to evaluate.  |
| <b>AO3.2</b>  | Analyse information and ideas to make judgements and draw conclusions.  |
| <b>AO3.2a</b> | Analyse information and ideas to make judgements.   |
| <b>AO3.2b</b> | Analyse information and ideas to draw conclusions.  |
| <b>AO3.3</b>  | Analyse information and ideas to develop and improve experimental procedures.   |
| <b>AO3.3a</b> | Analyse information and ideas to develop experimental procedures.   |
| <b>AO3.3b</b> | Analyse information and ideas to improve experimental procedures.   |

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## SECTION A

| Question | Answer | Marks | AO element | Guidance |
|----------|--------|-------|------------|----------|
| 1        | B      | 1     | 1.1        |          |
| 2        | A      | 1     | 1.1        |          |
| 3        | B      | 1     | 1.1        |          |
| 4        | D      | 1     | 1.2        |          |
| 5        | B      | 1     | 1.1        |          |
| 6        | C      | 1     | 1.1        |          |
| 7        | C      | 1     | 1.2        |          |
| 8        | C      | 1     | 1.1        |          |
| 9        | A      | 1     | 1.1        |          |
| 10       | C      | 1     | 2.1        |          |
| 11       | D      | 1     | 1.1        |          |
| 12       | C      | 1     | 2.1        |          |
| 13       | C      | 1     | 1.1        |          |
| 14       | C      | 1     | 2.1        |          |
| 15       | B      | 1     | 2.1        |          |

SECTION B

| Question                 |                   | Answer   | Marks | AO element | Guidance |           |                          |           |      |               |      |                   |               |               |         |                   |   |         |   |
|--------------------------|-------------------|--|-------|------------|----------|-----------|--------------------------|-----------|------|---------------|------|-------------------|---------------|---------------|---------|-------------------|---|---------|---|
| 16                       | (a)               | more can be grown / <b>AW</b> (1)  | 1     | 1.1        |          |           |                          |           |      |               |      |                   |               |               |         |                   |   |         |   |
|                          | (b)               | <table border="1"> <thead> <tr> <th>Fuel</th> <th>Type</th> </tr> </thead> <tbody> <tr> <td>Wood</td> <td>renewable</td> </tr> <tr> <td>Plant and vegetable oils</td> <td>renewable</td> </tr> <tr> <td>Peat</td> <td>non-renewable</td> </tr> <tr> <td>Coal</td> <td>Renewable (x) (1)</td> </tr> <tr> <td>North Sea gas</td> <td>non-renewable</td> </tr> <tr> <td>Uranium</td> <td>renewable (x) (1)</td> </tr> </tbody> </table> | Fuel  | Type       | Wood     | renewable | Plant and vegetable oils | renewable | Peat | non-renewable | Coal | Renewable (x) (1) | North Sea gas | non-renewable | Uranium | renewable (x) (1) | 2 | 2 x 1.1 | <b>ALLOW</b> the answer to be checked on the fuel side. |
| Fuel                     | Type              |  |       |            |          |           |                          |           |      |               |      |                   |               |               |         |                   |   |         |   |
| Wood                     | renewable         |  |       |            |          |           |                          |           |      |               |      |                   |               |               |         |                   |   |         |   |
| Plant and vegetable oils | renewable         |  |       |            |          |           |                          |           |      |               |      |                   |               |               |         |                   |   |         |   |
| Peat                     | non-renewable     |  |       |            |          |           |                          |           |      |               |      |                   |               |               |         |                   |   |         |   |
| Coal                     | Renewable (x) (1) |  |       |            |          |           |                          |           |      |               |      |                   |               |               |         |                   |   |         |   |
| North Sea gas            | non-renewable     |  |       |            |          |           |                          |           |      |               |      |                   |               |               |         |                   |   |         |   |
| Uranium                  | renewable (x) (1) |  |       |            |          |           |                          |           |      |               |      |                   |               |               |         |                   |   |         |   |
|                          | (c)               | Increases output potential difference (1)  | 1     | 1.1        |          |           |                          |           |      |               |      |                   |               |               |         |                   |   |         |   |
|                          | (d)               | <p>Correct matching of wires to colours (1)<br/>Correct matching of colours to functions (1)</p>   | 4     | 4 x 1.1    |          |           |                          |           |      |               |      |                   |               |               |         |                   |   |         |   |

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| Question |     | Answer  | Marks | AO element                     | Guidance                             |
|----------|-----|---|-------|--------------------------------|--------------------------------------|
| 17       | (a) | Reading would be very high (1)  | 1     | 3.2a                           |                                      |
|          | (b) | (i) All points correctly plotted (within +/- half a square) (1)<br>Smooth single curve (1)  | 2     | 2 x 1.2                        |                                      |
|          |     | (ii) 140 (1)  | 1     | 3.1b                           | <b>ALLOW</b> a tolerance of + / - 25 |
|          | (c) | (i) Activity decreases (1)<br>by a factor of 4 (1)  | 2     | 2 x 3.1b                       |                                      |
|          |     | (ii) 4000 scores (1)  | 1     | 3.2a                           |                                      |
|          | (d) | For A / solid <ul style="list-style-type: none"> <li>irradiation decreases with distance (1)</li> <li>no contact with source so no contamination risk (1)</li> </ul> For B / gas <ul style="list-style-type: none"> <li>gas can move so can be near person (1)</li> <li>gas can be breathed in hence contamination (1)</li> </ul> | 4     | 3.1a<br>2.2<br><br>3.1a<br>2.2 |                                      |

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| Question |     | Answer   | Marks | AO element                   | Guidance   |
|----------|-----|--|-------|------------------------------|--|
| 18       | (a) | Gravitational / centripetal (force) (1)  | 1     | 1.1                          | <b>ALLOW</b> 'gravity (1) Ignore 'weight force'              |
|          | (b) | Moon (1)   | 1     | 1.1                          |  |
|          | (c) | Recall weight = mass x gravitational field strength (1)<br>Substitute: $185 \times 3.75$ (1)<br>694 to 3 sig.figs (2)<br>N (1) | 5     | 1.1<br>2.1<br>2 x 2.1<br>1.1 | <b>ALLOW</b> 693.75 (1) but no marks for significant figures |
|          | (d) | 'g' is greater on Earth than Mars/weight is bigger as 'g' is greater on Earth (1)  | 1     | 2.1                          |  |

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| Question |         | Answer  | Marks | AO element     | Guidance              |
|----------|---------|---|-------|----------------|-----------------------|
| 19       | (a)     | Oil will not freeze (as easily as water) / <b>ORA</b> (1)   | 1     | 3.2b           |                       |
|          | (b)     | Reduces risk of burns to people / children (1)  | 1     | 2.2            |                       |
|          | (c)     | Time conversion: $10 \times 60 = 600$ seconds (1)<br><br>$800 \times 600 / 480\,000$ (J) (1)  | 2     | 1.2<br><br>2.1 | <b>ALLOW</b> 480 (kJ) |
|          | (d) (i) | Substitute into formula for specific heat capacity /<br>$10 \times 40 \times 1\,700$ (1)<br><br>$680\,000$ (J) (1)  | 2     | 2 x 2.1        | <b>ALLOW</b> 680 (kJ) |
|          | (ii)    | Any two from:<br><br>Some energy used to heat the radiator case (rather than the oil) (1)<br><br>Energy passed from oil to air in room / oil undergoes cooling whilst heating up (1)<br><br>Energy is dissipated to surroundings (1)<br><br>It is not 100% efficient at transferring energy (1) | 2     | 2 x 2.2        |                       |

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| Question |         | Answer   | Marks | AO element                   | Guidance                                      |
|----------|---------|--|-------|------------------------------|---|
| 20       | (a)     | 59 (anomalous result should be left out of calculation) (1)  | 1     | 1.2                          |   |
|          | (b)     | 28 (1)   | 1     | 3.1b                         |   |
|          | (c)     | Green results unreliable / large variation / anomalous result (1)<br><br>Should have repeated 31 (green) reading/other results (red, blue, white, yellow) are reliable (1)<br><br>A sensible suggested improvement (1) | 3     | 3.1b<br><br>3.3a<br><br>3.3b | e.g. use camera to measure bounce heights (1) |
|          | (d) (i) | bounce height/ drop height x 100% = 85% useful, therefore 15% wasted. (1)<br><br>transferred to heat and sound (1)   | 2     | 2 x 2.1                      |   |
|          | (ii)    | If the bounce height was greater then the efficiency would be higher / <b>ORA</b> (1)  | 1     | 2.1                          |   |
|          | (e)     | Any 2 from:<br>(Moving) ball has KE (1)<br><br>Ball heats up (1)<br><br>Some energy lost as heat to surroundings/ moving air/particles in floor (1)  | 2     | 2 x 2.2                      |   |

| Question |      | Answer   | Marks | AO element                      | Guidance   |
|----------|------|--|-------|---------------------------------|--|
| 21       | (a)* | <p>Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question.</p> <p><b>Level 3 (5–6 marks)</b></p> <p><b>Mathematical comparisons made and an explanation provided suggesting why the thinking distance does not increase at the same rate as the braking distance.</b></p> <p><i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i></p> <p><b>Level 2 (3–4 marks)</b></p> <p><b>Both distances calculated AND a simple description of the patterns shown in the thinking or braking distance.</b></p> <p><i>There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.</i></p> <p><b>Level 1 (1–2 marks)</b></p> <p><b>Both distances calculated OR a simple description of the patterns shown in the thinking or braking distance.</b></p> <p><i>The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear.</i></p> | 6     | 2 x 3.2b<br>2 x 3.1b<br>2 x 2.1 | <p><b>AO3.2b: Mathematical comparisons made with suggestions of the difference in the rate of increase of thinking and braking distance</b></p> <ul style="list-style-type: none"> <li>Idea that the thinking distance and braking distance do not increase at the same rate</li> <li>Suggestion that the thinking distance is dependent on reaction time which is constant</li> <li>Braking distance is effected by speed of the car as it will have more KE (energy <math>\propto v^2</math>) and will require more energy to stop</li> </ul> <p><b>AO3.1b: Analysis of data in the completed table to describe the patterns shown</b></p> <ul style="list-style-type: none"> <li>When speed doubles thinking distance doubles</li> <li>When speed doubles braking distance quadruples</li> <li>Reference to how this effects the overall stopping distance</li> </ul> <p><b>AO2.1: Apply knowledge of braking distances</b></p> |

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| Question |      | Answer  | Marks | AO element                   | Guidance  |
|----------|------|---|-------|------------------------------|---|
|          |      |   |       |                              | <ul style="list-style-type: none"> <li>Total stopping distance at 16m/s = 36m</li> <li>Thinking distance at 32m/s = 24m</li> <li>Idea that as speed increases so does the thinking/braking/stopping distance</li> </ul> |
| (b)      | (i)  | Use of graph to calculate time / $t = 2.25 - 0.75$ / $t = 1.5$ (1)<br>Substitution into acceleration formula:<br>$8 / 1.5$ (1)<br>(-) 5.3 (1)<br>$\text{m/s}^2$ (1) | 4     | 2.2<br><br>2.1<br>2.1<br>1.1 |   |
|          | (ii) | $5\,000 \times 6$ (1)<br>30 000 (J)   | 2     | 2 x 2.1                      |   |
| (c)      |      | No effect (1)<br>Braking distance is not effected by the driver / braking distance is only based on the car and road conditions (1)                                 | 2     | 2 x 1.1                      |   |

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| Question |     | Answer  | Marks | AO element                         | Guidance   |
|----------|-----|---|-------|------------------------------------|--|
| 22       | (a) | Arms move at 90° to wave direction / <b>AW</b> (1)  | 1     | 2.1                                | e.g. arms move at right angles to the wave (1)   |
|          | (b) | (i) 2 waves pass the same point (1)<br>each second (1)  | 2     | 2 x 1.1                            |  |
|          |     | (ii) Use of velocity = frequency x wavelength / 2 x 2 (1)<br>4 m/s scores (1)<br>12/4 = 3 s scores (1)  | 3     | 1.2<br>2.1<br>2.1                  | <b>ALLOW</b> use of speed = distance/time to calculate final answer                                    |
|          | (c) | Either:<br><br>Reflections return at different times / <b>AW</b> (1)<br><br><b>OR</b><br><br>speed of ultrasound is known / <b>AW</b> (1)<br><br><b>AND</b><br><br>Times indicate depth (of tissue boundaries) / <b>AW</b> (1)<br><br>Depth can be calculated by speed x time (1) | 3     | 1.1<br><br><br><br><br><br>2 x 2.1 |  |
|          | (d) | 1 <sup>st</sup> column: shows up soft tissues / <b>AW</b> (1)<br><br>2 <sup>nd</sup> column: pregnancy scans / <b>AW</b> (1)<br><br>3 <sup>rd</sup> column: mutations / damage to DNA (1)   | 3     | 1.1<br><br>2.2<br><br>1.1          | <b>ALLOW</b> other uses of scans e.g. scanning tissues other than bones (1)<br><b>ALLOW</b> cancer (1) |

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| Question |     | Answer   | Marks | AO element                    | Guidance       |
|----------|-----|--|-------|-------------------------------|----------------|
| 23       | (a) | Re-arrange and substitute into $WD = F \times D$ :<br><br>217 000 / 6 500 (1)<br><br>33 (m) (1)  | 2     | 2 x 2.1<br><br>2.1<br><br>2.2 | ALLOW 33.4 (m) |
|          | (b) | Reduce the friction between the car and track/lubrication of wheel bearings (1)<br><br>Make the shape of the car more streamlined to reduce drag (1) | 2     | 2 x 3.3b                      |                |

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