



GCSE (9-1)

Combined Science A (Gateway)

Unit **J250/05**: Physics

General Certificate of Secondary Education

Mark Scheme for June 2018

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




This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

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Annotations available in RM Assessor

| Annotation | Meaning |
|---|--|
|  | Correct response |
|  | Incorrect response |
|  | Omission mark |
|  | Benefit of doubt given |
|  | Contradiction |
|  | Rounding error |
|  | Error in number of significant figures |
|  | Error carried forward |
|  | Level 1 |
|  | Level 2 |
|  | Level 3 |
|  | Benefit of doubt not given |
|  | Noted but no credit given |
|  | Ignore |

Abbreviations, annotations and conventions used in the detailed Mark Scheme (to include abbreviations and subject-specific conventions).

| Annotation | Meaning |
|---------------------|---|
| / | alternative and acceptable answers for the same marking point |
| ✓ | Separates marking points |
| DO NOT ALLOW | Answers which are not worthy of credit |
| IGNORE | Statements which are irrelevant |
| ALLOW | Answers that can be accepted |
| () | Words which are not essential to gain credit |
| — | Underlined words must be present in answer to score a mark |
| ECF | Error carried forward |
| AW | Alternative wording |
| ORA | Or reverse argument |

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.


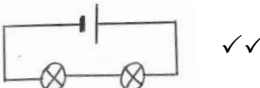
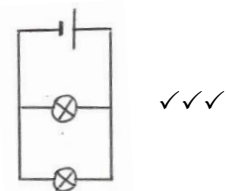
The breakdown of Assessment Objectives:

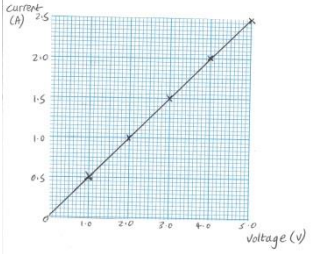
| | Assessment Objective |
|--------------|---|
| AO1 | Demonstrate knowledge and understanding of scientific ideas and scientific techniques and procedures. |
| AO1.1 | Demonstrate knowledge and understanding of scientific ideas. |
| AO1.2 | Demonstrate knowledge and understanding of scientific techniques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

For answers to Section A if an answer box is blank ALLOW correct indication of answer e.g. circled or underlined.

| Question | | | Answer | Marks | AO element | Guidance |
|----------|--|--|--------|-------|------------|----------|
| 1 | | | A ✓ | 1 | 2.2 | |
| 2 | | | B ✓ | 1 | 1.2 | |
| 3 | | | C ✓ | 1 | 1.1 | |
| 4 | | | B ✓ | 1 | 1.1 | |
| 5 | | | C ✓ | 1 | 1.2 | |
| 6 | | | B ✓ | 1 | 2.1 | |
| 7 | | | B ✓ | 1 | 1.1 | |
| 8 | | | A ✓ | 1 | 2.1 | |
| 9 | | | B ✓ | 1 | 2.1 | |
| 10 | | | C ✓ | 1 | 2.1 | |

BLANK PAGES MUST BE ANNOTATED TO SHOW THEY HAD BEEN SEEN

| Question | | Answer | Marks | AO element | Guidance |
|----------|-----|---|-------|----------------------------------|---|
| 11 | (a) | <p>Correct symbols used for cell and lamps ✓</p> <p>Complete working circuit with two lamps and one cell ✓</p> <p>Lamps are in parallel ✓</p> | 3 | <p>1.2</p> <p>2.2</p> <p>2.2</p> | <p>ALLOW </p> <p>ALLOW switches, voltmeters and ammeters if connected correctly. ALLOW very small gaps in the circuit</p> <p>ALLOW For example:</p> <div style="text-align: center;">  </div> <div style="text-align: center;">  </div> |

| Question | Answer | Marks | AO element | Guidance |
|----------|--|----------|----------------|---|
| (b) (i) | 2 or 3 points correctly plotted ✓ OR 4 points correctly plotted ✓✓ Appropriate single line of best fit drawn through all of their points ✓ | 3 | 3 x 2.2 | <p>IGNORE any extrapolation ALLOW a good freehand straight line through all of their points DO NOT ALLOW feathered lines</p> <p>For example:</p>  |
| | (ii) As voltage increases current increases / constant resistance / V and I (directly) proportional ✓ | 1 | 3.1b | IGNORE positive correlation / linear relationship / constant gradient / stronger current |
| | (iii) FIRST CHECK THE ANSWER ON THE ANSWER LINE If answer = 2 (ohms) award 2 marks. $1 \div 0.5$ OR $2 \div 1$ OR $3 \div 1.5$ OR $4 \div 2$ OR $5 \div 2.5$ ✓ $= 2$ (ohms) ✓ | 2 | 2.2 2.2 | ALLOW ECF from incorrect straight line of best fit |

| Question | | | Answer | Marks | AO element | Guidance |
|----------|-----|------|---|-------|--|--|
| 12 | (a) | (i) | Distance: ruler / tape measure / metre stick ✓ Time: stopclock / stopwatch / phone timer / light gates ✓ | 2 | 1.2 1.2 | IGNORE just datalogger IGNORE just timer |
| | | (ii) | (average speed) = distance ÷ time / divide the distance by the time / AW ✓ | 1 | 1.2 | ALLOW correct symbol equation $s \div t$ or $d \div t$ |
| | (b) | (i) | FIRST CHECK THE ANSWER ON THE ANSWER LINE If answer = 0.60 (m/s) award 3 marks (speed) = distance ÷ time or $1.2 \div 2.0$ ✓ = 0.6 (m/s) ✓ = 0.60 (m/s) (to 2 sig figs) ✓ | 3 | 1.2 2.1 2.1 | If there is no answer on the answer line, check the table ALLOW correct symbol equation $s \div t$ or $d \div t$ IGNORE triangle style equations |
| | | (ii) | Yes - because the 30°/biggest angle has the fastest speed OR the 30°/biggest angle has a faster speed than 10° or 20° ORA ✓ OR No - because the 20°/middle angle has the slowest speed OR the 10°/smallest angle does not have the lowest speed OR the 20°/middle angle has a slower speed than the 10° ORA ✓ | 1 | 3.2a | Judgement must be linked to correct explanation using data IGNORE just bigger angle has faster speed ORA IGNORE just as angle increases the speed increases ORA |
| | (c) | | No repeats (have been taken) ✓ Take more readings (for each angle) ✓ Calculate average ✓ OR Only three angles (of ramp) have been used ✓ (Do the experiment with) extra angle(s) ✓ Less than 90° ✓ OR It is difficult to measure the time (accurately) ✓ Use light gates (and data logging equipment) ✓ At start and end of the ramp / to start and stop the timer ✓ OR It is difficult to measure the time (accurately) ✓ | 3 | 3.3a 3.3b 3.3b 3.3a 3.3b 3.3b 3.3a 3.3b 3.3b 3.3a | ALLOW idea that no averages have been calculated ALLOW example(s) of extra angle(s) less than 90° ALLOW ideas about human error in timing / reaction time ALLOW ideas about human error in timing / |

| Question | | | Answer | Marks | AO element | Guidance |
|----------|--|--|--|-------|--|---------------|
| | | | Make a video of the experiment ✓ With a stopwatch visible ✓ OR Distance is not long enough ✓ Use a longer distance ✓ Measure the time (over the longer distance) ✓ | | 3.3b 3.3b 3.3a 3.3b 3.3b | reaction time |

| Question | Answer | Marks | AO element | Guidance |
|-----------|--|-------|----------------------------|---|
| 13 (*) | <p>Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question.</p> <p>Level 3 (5–6 marks)</p> <p>Detailed description AND explanation of the graph including the change of state and EITHER the rate of temperature decrease at different points OR conclusion drawn about the material's properties.</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>Level 2 (3–4 marks)</p> <p>Description AND explanation of the graph which may include EITHER change of state OR rate of temperature decrease at different points OR conclusion drawn about the material's properties.</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>Level 1 (1–2 marks)</p> <p>Simple description OR explanation of the graph which may include change of state OR the temperature change for two sections of the graph OR some conclusion drawn about the material's properties.</p> <p><i>There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.</i></p> | 6 | 1x3.1a 4x3.2a 1x3.2b | <p>PLEASE CHECK GRAPH AS STATEMENTS ON THE GRAPH NEED TO BE CONSIDERED AS PART OF THE MARKING</p> <p>AO3.1a Analyse information to interpret the graph</p> <ul style="list-style-type: none"> Graph is horizontal / levels out at 42°C +/- 2°C Temperature decreases (rapidly) at first and at the end The rate of temperature decrease falls prior to the change of state / after the change of state <p>AO3.2a Analyse information to make judgements about what the graph shows</p> <ul style="list-style-type: none"> Graph shows two states of matter Material could be changing from liquid to solid Material could be changing from gas to liquid The temperature is constant when energy is being used to change the state of the material Material gives out energy as it cools Material does not release energy when it changes state (or higher level answers in terms of latent heat) Material cools more rapidly when there is a greater temperature difference between it and the surroundings <p>AO3.2b Analyse information from the graph to draw conclusions about the material's properties.</p> <ul style="list-style-type: none"> the melting / boiling / freezing / condensing point is 42°C Material is not water |

| Question | | | Answer | Marks | AO element | Guidance |
|----------|--|--|---|-------|------------|----------|
| | | | 0 marks <i>No response or no response worthy of credit.</i> | | | |

| Question | | | Answer | Marks | AO element | Guidance |
|----------|-----|-------|--|-------|---------------------------|---|
| 14 | (a) | | Calculate the volume / measure the three dimensions of the cube / find the volume by displacement / use a Eureka can ✓ Find its mass / use a balance ✓ Density = mass ÷ volume ✓ | 3 | 1.2 1.1 1.2 | IGNORE references to weighing |
| | (b) | | In solids the atoms/molecules are close together/in a lattice structure ✓ In liquids atoms/molecules are closer than in a gas BUT more spread out than in a solid ✓ In gases the atoms/molecules are spread out ✓ solids are denser than liquids AND liquids are denser than gases / ORA ✓ | 4 | 1.1 1.1 1.1 | ALLOW correct particle model drawing of a solid ALLOW correct particle model drawing of a liquid ALLOW correct particle model drawing of a gas ALLOW correct ideas of particles moving closer together or further apart when changing state ALLOW correct higher level ideas about kinetic energy of particles or forces of attraction between particles |
| 15 | (a) | (i) | (upwards force) thrust / engine force / AW ✓ (downwards force) weight / drag / air resistance ✓ | 2 | 1.2 1.2 | DO NOT ALLOW upthrust / engine power ALLOW gravity / gravitational force IGNORE mass |
| | | (ii) | 2000(N) | 1 | 2.1 | |
| | | (iii) | FIRST CHECK THE ANSWER ON THE ANSWER LINE If answer = 2.5 (m/s²) award 3 marks (acceleration) = force ÷ mass ✓ = 2000 ÷ 800 ✓ = 2.5 (m/s ²) ✓ | 3 | 1.2 2.1 2.1 | ALLOW ECF from 15a(ii) ALLOW correct symbol equation e.g (a =) F ÷ m IGNORE triangle style equations |

| Question | | | Answer | Marks | AO element | Guidance |
|----------|-----|------|--|-------|--------------------------|---|
| 16 | (a) | (i) | FIRST CHECK THE ANSWER ON THE ANSWER LINE If answer = 0.05 (J) award 3 marks (work done) = force x distance ✓ $0.05 \times 1(.0)$ ✓ $= 0.05 \text{ (J)}$ ✓ | 3 | 1.2 2.1 2.1 | ALLOW correct symbol equation e.g. $(w) = fxd$ IGNORE triangle style equations |
| | | (ii) | FIRST CHECK THE ANSWER ON THE ANSWER LINE If answer = 0.01 W award 4 marks (power) = work done ÷ time ✓ $0.05 \div 5$ ✓ $= 0.01$ ✓ W / watts ✓ | 4 | 1.2 2.1 2.1 1.1 | ALLOW ECF from 16ai e.g. 1 W if answer to 16ai is 5 (J) ✓✓✓✓ 4 W if answer to 16ai is 20 (J) ✓✓✓✓ ALLOW correct symbol equation e.g. $(p) = w/t$ IGNORE triangle style equations ALLOW 0.01 with no units or incorrect units ✓✓✓ Unit mark is independent ALLOW J/s |
| | (b) | (i) | 3 (V) | 1 | 2.1 | |
| | | (ii) | FIRST CHECK THE ANSWER ON THE ANSWER LINE If answer = 0.5 (A) award 3 marks (current) = potential difference ÷ resistance ✓ $3 \div 6.0$ ✓ $= 0.5 \text{ (A)}$ ✓ | 3 | 1.2 2.1 2.1 | ALLOW ECF from 16bi ALLOW correct symbol equation e.g. $(I) = V/R$ IGNORE triangle style equations |
| | (c) | | Any one from remove one of the cells ✓ | 1 | 3.3a | IGNORE references about how to increase the speed rather than the time taken IGNORE just reduce p.d. / reduce power |

| Question | | | Answer | Marks | AO element | Guidance |
|----------|--|--|--|-------|------------|---|
| | | | add mass (to the toy car) ✓ add a resistor (to the electrical circuit to reduce current)✓ | | | ALLOW add weight (to the toy car) IGNORE just reduce current ALLOW specific changes to the motor e.g. use a lower current motor / use less powerful motor IGNORE just reduce voltage to motor / increase the resistance of the motor |

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