



**F**

**GCSE (9–1)**

**Combined Science A (Gateway Science)**

**J250/05: Paper 5 (Foundation Tier)**

General Certificate of Secondary Education

**Mark Scheme for June 2019**



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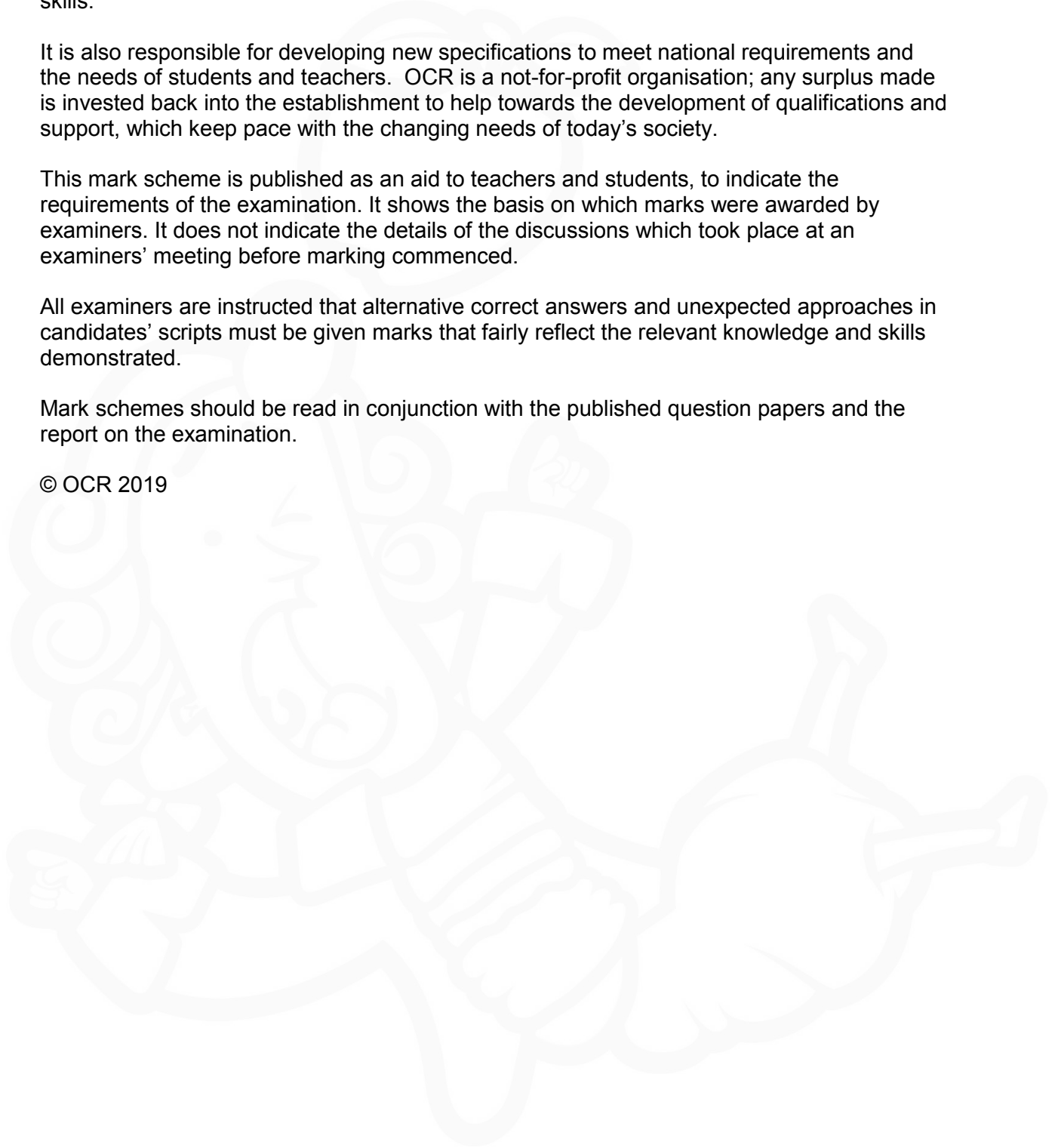
It is also responsible for developing new specifications to meet national requirements and the needs of students and teachers. OCR is a not-for-profit organisation; any surplus made is invested back into the establishment to help towards the development of qualifications and support, which keep pace with the changing needs of today's society.

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).

| <b>Annotation</b>   | <b>Meaning</b>  |
|---------------------|---|
| /                   | alternative and acceptable answers for the same marking point |
| ✓                   | Separates marking points                                      |
| <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   |

**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 Combined Science A:

|              | Assessment Objective  |
|--------------|---|
| <b>AO1</b>   | <b>Demonstrate knowledge and understanding of scientific ideas and scientific techniques and procedures.</b>  |
| AO1.1        | Demonstrate knowledge and understanding of scientific ideas.  |
| AO1.2        | 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>                                       |
| AO2.1        | Apply knowledge and understanding of scientific ideas.  |
| AO2.2        | 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.  |
| AO3.1a       | Analyse information and ideas to interpret.   |
| AO3.1b       | Analyse information and ideas to evaluate.  |
| <b>AO3.2</b> | 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.  |
| <b>AO3.3</b> | 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.   |

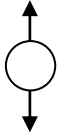
For answers to section A if an answer box is blank ALLOW correct indication of answer e.g. circled or underlined.

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

| Question |     |      | Answer   | Marks | AO element | Guidance                                   |
|----------|-----|------|--|-------|------------|--|
| 11       | (a) | (i)  | Measure one edge of the cube ✓<br>Value of edge cubed / $l \times w \times h$ / AW ✓   | 2     | 2×1.2      | ALLOW measure side/width/length/height/ AW |
|          |     | (ii) | <b>FIRST CHECK THE ANSWER ON ANSWER LINE</b><br><b>If answer = 6.8 (g/cm<sup>3</sup>) award 2 marks</b><br><br>850 / 125 ✓<br>= 6.8 (g/cm <sup>3</sup> ) ✓ | 2     | 2×2.1      | ALLOW answer = 7 (g/cm <sup>3</sup> ) ✓✓   |
|          | (b) | (i)  | Scales / (electronic) balance ✓  | 1     | 1.2        | ALLOW top-pan balance                      |
|          |     | (ii) | Measuring cylinder <b>or</b> eureka can <b>or</b> displacement can ✓   | 1     | 1.2        | ALLOW overflow can                         |



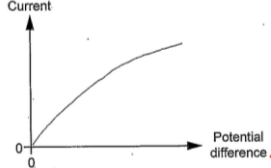
| Question |     |      | Answer   | Marks      | AO element       | Guidance  |
|----------|-----|------|--|------------|------------------|---|
| 12       | (a) | (i)  | Horizontal (by eye) arrow to right next to X ✓   | 1          | 1.1              | <b>ALLOW</b> correct clockwise arrow on any of the 5 field lines above the magnet.<br><b>IGNORE</b> any extra arrows drawn if they are in the correct direction   |
|          |     | (ii) | Near / around / at poles   | 1          | 1.1              | <b>ALLOW</b> at ends (of magnet) / one named pole<br><b>ALLOW</b> mark for correctly annotated diagram<br><b>ALLOW</b> where the (field) lines are closest (together)   |
|          | (b) |      | Earth has a magnetic field/core/force / AW ✓   | 1          | 1.1              | <b>ALLOW</b> Earth is (like) a magnet / compass lines up with the Earth's magnetic field (lines) / AW   |
|          | (c) | (i)  | Pass current through wire / add a cell/ battery/power supply to the wire ✓   | 1          | 1.2              | <b>IGNORE</b> pass electricity through coil   |
|          |     | (ii) | The more pins picked up, (the stronger the magnetic field)✓<br><br><b>AND</b><br><br><b>Any one from:</b><br>(The number of pins increases) as the number of turns increases ✓<br><br>The magnetic field gets stronger up to 15 ✓<br><br>Between 15 and 20 it (number of pins / magnetic field) remains the same ✓ | 1<br><br>1 | 3.1b<br><br>3.2a | <b>ALLOW</b> correct examples from the table e.g. at 5 (turns) it is zero (pins) and at 20 (turns) it is 2 (pins)<br><br><b>ALLOW</b> it is true up to 15 (turns)<br><br><b>ALLOW</b> the magnetic field does not increase after 15 (turns)<br><br><b>IGNORE</b> the more turns, the magnetic field increases (in stem of question) |

| Question |     | Answer  | Marks | AO element | Guidance   |
|----------|-----|---|-------|------------|--|
| 13       | (a) | <p><b>FIRST CHECK THE ANSWER ON ANSWER LINE</b><br/> <b>If answer = 1.5 (N) award 2 marks</b></p> <p><math>25 \times 0.06 \checkmark</math><br/> <math>= 1.5 \text{ (N)} \checkmark</math></p>  | 2     | 2x2.1      |  |
|          | (b) | (i) <div style="display: flex; align-items: center; justify-content: center;"> <div style="text-align: center; margin-right: 10px;">  </div> <div> <p>pull of spring / tension / AW <math>\checkmark</math></p> <p>(pull of) gravity / pull of earth / weight / AW <math>\checkmark</math></p> </div> </div> | 2     | 2x1.1      | <p><b>ALLOW</b> force of spring</p> <p><b>ALLOW</b> gravitational (force) / force of gravity / force due to gravity</p>  |
|          |     | (ii) <p>there is a resultant force / weight <math>\checkmark</math></p> <p>So the object accelerates (down) <math>\checkmark</math></p>   | 2     | 2x1.1      | <p><b>ALLOW</b> (there is a downwards force but) no upwards force / downwards force &gt; upwards force</p> <p><b>ALLOW</b> correct idea of unbalanced forces</p> |
|          | (c) | <p>Force of mass on bench / AW <math>\checkmark</math></p> <p>Contact force <math>\checkmark</math></p>   | 2     | 2x2.1      |  |

| Question |   | Answer   | Marks | AO element              | Guidance  |
|----------|---|--|-------|-------------------------|---|
| 14       | * | <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><br/>Describes and explains in detail the similarities <b>AND</b> differences using ideas about current and resistance.</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><br/>Describes and explains the similarities <b>OR</b> differences using ideas about current or resistance.</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><br/>Describes basic similarities <b>OR</b> differences between circuits.</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> <p><b>0 marks</b><br/><i>No response or no response worthy of credit.</i></p> | 6     | 3×2.2<br>3.1a<br>2×3.2b | <p><b>AO2.2 Applies knowledge and understanding of circuits</b></p> <ul style="list-style-type: none"> <li>• <b>A</b> has lower current than <b>B</b></li> <li>• <b>A</b> series and <b>B</b> parallel</li> <li>• resistance of circuit <b>A</b> higher than <b>B</b> / ORA</li> <li>• because current in <b>B</b> is larger / ORA</li> <li>• p.d. is shared between each resistor in series</li> <li>• full p.d. across each resistor in parallel</li> <li>• current before and after resistors in both circuits is the same</li> <li>• circuit <b>A</b> or <b>B</b> current is same in each resistor</li> <li>• current splits (between resistors) in <b>B</b> and current doesn't split (between resistors) in <b>A</b></li> </ul> <p><b>AO3 Analyses information and ideas to interpret and draw conclusions about the two circuits</b></p> <ul style="list-style-type: none"> <li>• <b>A</b> has resistors in a row / <b>B</b> has resistors in different loops / branches / AW</li> <li>• resistance of circuit <b>A</b> = 4 × resistance of circuit <b>B</b></li> <li>• the current in <b>A</b> is a quarter of the current in <b>B</b></li> <li>• total current in circuit <b>B</b> is double that for each resistor</li> </ul> |

| Question |     |      | Answer  | Marks | AO element        | Guidance   |
|----------|-----|------|---|-------|-------------------|--|
| 15       | (a) | (i)  | Force due to gravity / AW   | 1     | 1.1               | <b>ALLOW</b> the force/pull of gravity on an object<br><b>ALLOW</b> $W = m \times g$ or $W = m \times a$ or in words   |
|          |     | (ii) | Recall $W = m \times g$ ✓<br>$100g = 0.1\text{kg}$ ✓<br>$W (= 0.1 \times 10) = 1\text{N}$ ✓   | 3     | 1.2<br>1.2<br>2.1 | <b>ALLOW</b> $F=ma$<br><b>ALLOW</b> use of $g = 9.8$ to give 0.98 (N)  |
|          | (b) |      | Lubricate (wheels/surface) ✓  | 1     | 3.3b              | <b>ALLOW</b> incline surface<br><b>ALLOW</b> make surface/wheels smooth(er)<br><b>ALLOW</b> use an air track<br><b>ALLOW</b> decrease mass / weight of trolley |
|          | (c) | (i)  | <b>FIRST CHECK THE ANSWER ON ANSWER LINE</b><br><b>If answer = 3.75 (m/s<sup>2</sup>) award 3 marks</b><br><br>correct rearrangement of letters/words <b>OR</b><br>$1^2 - 0.5^2 = 2 \times a \times 0.1$ <b>OR</b> $1^2 - 0.5^2 = 0.75$ ✓<br><br>Rearrangement: $a = 1^2 - 0.5^2 / 2 \times 0.1$ <b>OR</b> $1^2 - 0.5^2 / 0.2$<br><b>OR</b> $0.75 / 0.2$ ✓<br><br>$a = 3.75 \text{ (m/s}^2\text{)}$ ✓ | 3     | 3 x 2.1           | <b>ALLOW</b> U and V transposed for -3.75 m./s <sup>2</sup>  |
|          |     | (ii) | <b>FIRST CHECK THE ANSWER ON ANSWER LINE</b><br><b>If answer = 0.72 (J) award 3 marks</b><br><br>Recall (KE =) $\frac{1}{2} \times m \times v^2$ ✓<br>$\frac{1}{2} \times 1 \times (1.2)^2$ ✓<br>(KE =) 0.72 (J) ✓  | 3     | 1.2<br>2x2.1      |  |
|          | (d) |      | (No) because line of best fit does not pass through origin / (0,0) (AW)   | 1     | 3.2b              | <b>ALLOW</b> quantitative description of direct proportionality using data from the graph  |

| Question |     | Answer   | Marks | AO element | Guidance  |
|----------|-----|--|-------|------------|---|
| 16       | (a) | <p>Connect one terminal of cell/battery to <b>A</b> / AW ✓<br/><b>BUT</b><br/>Lamp only lights if <b>A</b> is connected to positive (terminal) ✓✓</p> <p>Connect other terminal of cell/battery to <b>B</b> / AW ✓</p> | 3     | 3×3.3a     | <p><b>IGNORE</b> lamps does not light if <b>B</b> is connected to positive (terminal)</p> <p><b>ALLOW</b> idea of putting cell/battery between <b>A</b> and <b>B</b> in words or drawn on the diagram ✓✓</p> <p><b>ALLOW</b> add a cell/battery (to the series circuit) if no other mark awarded</p>  |
|          | (b) | (i)  | 2     | 2×1.1      | <p>p.d. and voltage are interchangeable throughout this question but ignore references to resistance</p> <p><b>ALLOW</b> gradient changes / gradient not constant<br/><b>ALLOW</b> graph does <b>not</b> obey Ohm's Law<br/><b>ALLOW</b> the graph is a curve<br/><b>ALLOW</b> (p.d and current) <b>not</b> proportional</p> <p><b>BUT</b> (p.d and current) <b>not</b> directly proportional ✓✓</p> <p><b>ALLOW</b> the current only flows in one/positive direction</p> <p><b>ALLOW</b> the current increases after 0.5 (V)<br/><b>IGNORE</b> just 'it' begins at 0.5 (V)</p> |

|  |  |                 |  |   |
|--|--|-----------------|--|---|
|  | <p><b>(ii) FIRST CHECK THE ANSWER ON ANSWER LINE</b><br/> <b>If answer = 40 (<math>\Omega</math>) award 4 marks</b></p> <p>(R =) p.d <math>\div</math> Current ✓<br/>         From graph, (I =) 0.02 (A) ✓</p> <p>0.8 / 0.02 ✓<br/>         = 40 (<math>\Omega</math>) ✓</p> | <p><b>4</b></p> | <p><b>1.2</b><br/><b>2.2</b><br/><b>2.1</b><br/><b>2.1</b></p> | <p><b>ALLOW</b> 0.8 <math>\div</math> current</p> <p><b>ALLOW</b> answer from graph in region 0.017 (A) to 0.023 (A)</p> <p><b>ALLOW</b> ecf from candidate's reading for current from graph</p> <p>If reading of current from 0.017 (A) to 0.023 (A) then allow answer from 34.78 (<math>\Omega</math>) to 47.06 (<math>\Omega</math>) for 4 marks<br/>         e.g. a current of 0.018 gives the answer of 44.4 (<math>\Omega</math>)</p> |
|  | <p><b>(c) Any two from:</b></p> <p>Current becomes (too) large/increases (too much) ✓</p> <p>Resistance of diode decreases (rapidly) ✓</p> <p>Diode can be damaged/blow/break ✓</p>  | <p><b>2</b></p> | <p><b>2x3.2b</b></p>   | <p><b>ALLOW</b> any answer that implies the current has increased e.g. current would be too high/too much<br/> <b>IGNORE</b> too strong</p> <p><b>ALLOW</b> the diode can explode / overheat / AW<br/> <b>IGNORE</b> it would be dangerous / heat up / blows the circuit / damages the circuit / just diode stops / short circuit / breaks the circuit / blows the fuse</p>   |
|  | <p><b>(d)</b> Graph starting at 0 with positive and decreasing slope ✓</p>   | <p><b>1</b></p> | <p><b>1.2</b></p>  |  <p><b>IGNORE</b> initial straight line / leveling off / any part of the graph outside the axes</p>  |

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