



# Mark Scheme (Results)

November 2021

Pearson Edexcel GCSE  
In Combined Science (1SC0) Paper 2PF

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## General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

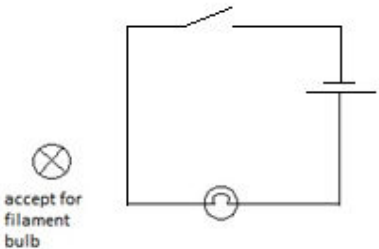
Mark schemes have been developed so that the rubrics of each mark scheme reflects the characteristics of the skills within the AO being targeted and the requirements of the command word. So for example the command word 'Explain' requires an identification of a point and then reasoning/justification of the point.

Explain questions can be asked across all AOs. The distinction comes whether the identification is via a judgment made to reach a conclusion, or, making a point through application of knowledge to reason/justify the point made through application of understanding. It is the combination and linkage of the marking points that is needed to gain full marks.

When marking questions with a 'describe' or 'explain' command word, the detailed marking guidance below should be consulted to ensure consistency of marking.

Assessment Objective		Command Word	
Strand	Element	Describe	Explain
AO1*		An answer that combines the marking points to provide a logical description	An explanation that links identification of a point with reasoning/justification(s) as required
AO2		An answer that combines the marking points to provide a logical description, showing application of knowledge and understanding	An explanation that links identification of a point (by applying knowledge) with reasoning/justification (application of understanding)
AO3	1a and 1b	An answer that combines points of interpretation/evaluation to provide a logical description	
AO3	2a and 2b		An explanation that combines identification via a judgment to reach a conclusion via justification/reasoning
AO3	3a	An answer that combines the marking points to provide a logical description of the plan/method/experiment	
AO3	3b		An explanation that combines identifying an improvement of the experimental procedure with a linked justification/reasoning

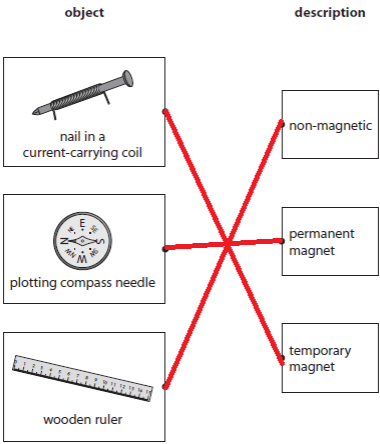
\*there will be situations where an AO1 question will include elements of recall of knowledge directly from the specification (up to a maximum of 15%). These will be identified by an asterisk in the mark scheme.

Question number	Answer	Additional guidance	Mark
1(a)	 <p>accept for filament bulb</p> <p>battery/cell symbol (1) lamp symbol (1) switch symbol (1)</p> <p>then complete series circuit shown (1)</p>	ignore polarity of battery	(4) AO3

Question number	Answer	Additional guidance	Mark
1(b)	<p>substitution (1) <math>0.15 \times 40</math></p> <p>evaluation (1) <math>6(.0) \text{ (V)}</math></p>	award full marks for correct answer without working	(2) AO2

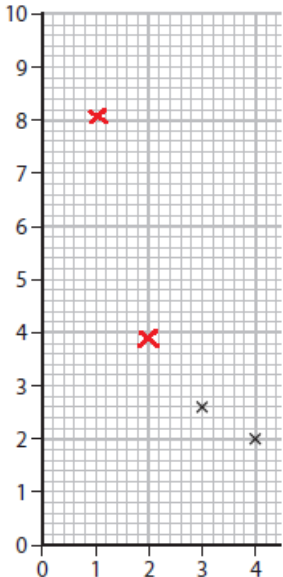
Question number	Answer	Mark
1(c)	1.4 (A)	(1) AO2

**Total for Question 1 =7 marks**

Question number	Answer	Additional guidance	Mark
2a	<p>object</p>  <p>description</p> <p>nail in a current-carrying coil</p> <p>plotting compass needle</p> <p>wooden ruler</p> <p>non-magnetic</p> <p>permanent magnet</p> <p>temporary magnet</p>	<p>three links correct (2)</p> <p>one link correct (1)</p>	(2) AO1

Question number	Answer	Additional guidance	Mark
2 (b) i	circle shown around wire (1)	allow tolerance for translation of 3D to 2D ignore any multiplicity of those circles	(1) AO1

Question number	Answer	Additional guidance	Mark
2 (b) ii	arrow indicating a clockwise direction (for magnetic field line drawn for i ) (1)		(1) AO1

Question number	Answer	Additional guidance	Mark
2(c) i	 <p>One mark for each point plotted correctly, to within <math>\pm 1</math> small square</p>		(2) AO2

Question number	Answer	Additional guidance	Mark
2(c)ii	smooth curve drawn fitting the plotted points (1)	judge by eye	(1) AO2

Question number	Answer	Additional guidance	Mark
2ciii	substitution using an attempt at calculation – any subtraction seen (1) e.g. $2(.0) - 1(.0)$  evaluation (1) (-) $1(.0)$ (mT)	accept any number that rounds to 1.0  award full marks for correct answer without working	(2) AO3

Question number	Answer	Mark
2 (c) iv	(size of) current	(1) AO1

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**(Total for Question 2 = 9 marks)**

Question number	Answer	Additional guidance	Mark
3 (a) i	substitution (1)  $I = \frac{P}{V} = \frac{1.9 \times 10^3}{230} \text{ (1)}$ evaluation (1)  8.3 (A)	8.3 / 8.26 (A)  award full marks for correct answer without working  award one mark for $8.26 \times 10^{-3} / 0.0083$	(2) AO2

Question number	Answer	Additional guidance	Mark
3 (a) ii	choice and substitution (1) $E = I \times V \times t$ $= 7.4 \times 230 \times 120$  evaluation (1)  200000 (J)	accept 204000 / 204240  award full marks for correct answer without working  award 1 mark for 3400 / 3404 (J) (using 2 minutes as time)	(2) AO2

Question number	Answer	Additional guidance	Mark
3 (b) i	Wire X .....earth.....(1)  Wire Y .....live..... (1)	accept 'life'	(2) AO1



Question number	Answer	Additional guidance	Mark
3 (b) ii	Component Z ....fuse..... (1)		(1) AO1

Question number	Answer	Additional guidance	Mark
3 (c)	<p>substitution (1)  <math>(I_p) \times 230 = 19 \times 2.37</math></p> <p>rearrangement (1)  <math>(I_p) = (19.0 \times 2.37) \div 230</math></p> <p>evaluation (1)  input current = 0.196 (A)</p>	<p>rearrangement and substitution in either order</p> <p>allow numerical values written above equation</p> <p><i>input voltage = (output voltage × output current) ÷ input voltage</i></p> <p>award full marks for any answer that rounds to 0.2(00) (A)</p> <p>award 1 mark for 5.1(07) (substitution with upside down rearrangement)</p> <p>award full marks for correct answer without working</p>	(3) AO2

**(Total for Question 3 = 10 marks)**

Question number	Answer	Additional guidance	Mark
4(a)i	substitution (1)  $(\Delta GPE) = 72 \times 10 \times 7.0$  evaluation (1) 5040 (J)	do not penalise any power of ten error (p.o.t.e.) at this stage do not accept an answer without value for g (10) being used)  award full marks for correct answer without working	(2) AO2

Question number	Answer	Additional guidance	Mark
4a ii	an explanation to include  (potential / kinetic) energy is transferred / dissipated (1)  to surroundings / water / air / slide (1)	accept lost / decreases  accept friction / air resistance acts  accept to <b>thermal</b> (store)	(2) AO3

Question number	Answer	Additional guidance	Mark
4b	Explanation linking <b>two</b> from:  choice of distance (1) 6.3 m  (calculations of work done need) the distance moved in the direction of the force (1)  (friction acts) along the slope / hypotenuse (1)	accept pushed up the slope	(2) AO3

Question number	Answer	Additional guidance	Mark
4 (c)	substitution (1)  $KE = \frac{1}{2} \times 58 (\times 10^{-3}) \times 28^2$  conversion (1) uses $58 \times 10^{-3}$ or 0.058  evaluation (1)  23 (J)	do not penalise p.o.t.e. at this stage       award full marks for any answer that rounds to 23 (e.g. 22.736) (J)  award max two marks for any answer that rounds to 2.3 to any other power of 10  consolation mark for not squaring 28 (8.1(2) to any p.o.t.) (maximum 1 mark)	(3)  <b>AO2</b>

**(Total for Question 4 = 9 marks)**

Question number	Answer	Mark
5(a)	D variable resistor  Options A, B and C are all wrong identifications with both the circuit components shown	(1) AO1

Question number	Answer	Mark
5(b)	C ammeter in series with component, voltmeter in parallel  Only option C is correct for both the ammeter and the voltmeter	(1) AO1

Question number	Answer	Additional guidance	Mark
5c(i)	A description including  as the potential difference (voltage) increases so does the current (1)  idea of gradient of graph decreasing as V increases (1)	positive correlation  at a decreasing rate non-linear not directly proportional	(2) AO3

Question number	Answer	Additional guidance	Mark									
5(c)(ii)	Award one mark for each row of the table <table border="1" data-bbox="400 1375 911 1608"> <thead> <tr> <th></th> <th>voltage V</th> <th>current in mA</th> </tr> </thead> <tbody> <tr> <td>point P</td> <td>1(.00)</td> <td>20</td> </tr> <tr> <td>point Q</td> <td>3.4 ±0.1</td> <td>43 ±1</td> </tr> </tbody> </table>		voltage V	current in mA	point P	1(.00)	20	point Q	3.4 ±0.1	43 ±1	ignore any units added in the boxes	(2) AO2
	voltage V	current in mA										
point P	1(.00)	20										
point Q	3.4 ±0.1	43 ±1										

Question number	Answer	Additional guidance	Mark
5(c)(iii)	substitution (1) $(R =) \frac{4.5}{51(\times 10^{-3})}$  evaluation (1) 88.(2) ( $\Omega$ )	0.088(2) or 8.8(2) or 0.88(2) or 0.09 seen scores 1 mark  0.088(2) k $\Omega$ or 0.09 k $\Omega$ scores 2 marks  award full marks for correct answer without working	(2)  <b>AO2</b>

Question number	Answer	Additional guidance	Mark
5(c)(iv)	an explanation linking any three of:  identification of resistance increasing (1)  heating (of the filament) (1)  because of more collisions (1)  of electrons (with ions / atoms / other electrons) (1)	temperature increases	(3) <b>AO1</b>

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**Question 5 =11 marks**

Question number	Answer	Additional guidance	Mark
6(a)	<p>descriptions to include any <b>two</b> of</p> <ul style="list-style-type: none"> <li>• particles / atoms in solid close(r) together (1)</li>   <li>• particles / atoms in solid (vibrate) in fixed positions but particles in liquid move (freely) (1)</li>   <li>• particles in a solid in regular arrangement but particles in liquid are randomly arranged (1)</li>   <li>• particles in a liquid have more (kinetic) energy (than in a solid) (1)</li> </ul>	<p>reverse argument</p> <p>difference asked for, so <b>must compare</b> for subsequent marking points</p>      <p>allow answers in terms of forces between particles</p>	(2) AO1

Question number	Answer	Additional guidance	Mark
6(b)	<p>volume substitution (1)  <math>1.5 \times 1.0 \times 0.2(0) (= 0.3)</math></p> <p>substitution in equation (1)  <math>\text{mass} = 2100 \times (0.3(0))</math></p> <p>evaluation (1)  <math>= 630 \text{ (kg)}</math></p>	<p>ecf from calculated value of volume for this mark only</p> <p>award 2 marks for 6.3 x any other power of 10</p> <p>5670 gains 1 mark from use of <math>1.5 + 1.0 + 0.2 = 2.7</math></p> <p>award full marks for correct answer without working</p>	(3) AO2

Question number	Answer	Additional guidance	Mark
6(c)	<p>statements to include any <b>two</b> from</p> <p>use cladding / (extra) insulation (1)</p> <p>use double thicknesses of the concrete (1)</p> <p>use silver / reflective / white (paint) (1)</p> <p>plant trees around (wind break) (1)</p> <p>use double glazed windows (1)</p> <p>(properly) close window(s)/door</p>	<p>create cavity</p> <p>draft exclusion</p>	(2) AO1

Question number	Indicative content	Mark
6 (d)*	<p>Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme.</p> <p>The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant.</p> <p style="text-align: center;"><b>AO1 (strand 2) (6 marks)</b></p> <p>Indicative content</p> <ul style="list-style-type: none"> <li>• measure the length and width of a strip with the ruler / a metre rule</li> <li>• measure the thickness of the strip with a more accurate device e.g. digital callipers OR place 5 (say) of the same strip on top of each other and measure their thickness with the ruler then <math>\div 5</math> to calculate a single thickness [plus air gap]</li> <li>• measure the mass of a strip with an electronic balance</li> <li>• measure the mass of (say) 5 strips then <math>\div 5</math> to calculate the mass of one of them</li> <li>• calculate the volume (= <math>l \times w \times t</math>) in <math>m^3</math> and the mass in kg</li> <li>• use displacement can/measuring cylinder to find the volume</li> <li>• mass / volume to get density</li> <li>• check if it's near one of the teacher's two values of density given</li> <li>• if it's close / not so far off it's safe to assume that strip is of the identified material</li> <li>• repeat for the other strip</li> <li>• other repeat measurements</li> </ul>	(6) AO1



## AO targeting: AO1.2

Level	Mark	Descriptor
	0	<ul style="list-style-type: none"><li>• No rewardable material.</li></ul>
Level 1	1-2	<ul style="list-style-type: none"><li>• Demonstrates elements of physics understanding, some of which is inaccurate. Understanding of scientific, enquiry, techniques and procedures lacks detail. (AO1)</li><li>• Presents a description which is not logically ordered and with significant gaps. (AO1)</li></ul>
Level 2	3-4	<ul style="list-style-type: none"><li>• Demonstrates physics understanding, which is mostly relevant but may include some inaccuracies. Understanding of scientific ideas, enquiry, techniques and procedures is not fully detailed and/or developed. (AO1)</li><li>• Presents a description of the procedure that has a structure which is mostly clear, coherent and logical with minor steps missing. (AO1)</li></ul>
Level 3	5-6	<ul style="list-style-type: none"><li>• Demonstrates accurate and relevant physics understanding throughout. Understanding of the scientific ideas, enquiry, techniques and procedures is detailed and fully developed. (AO1)</li><li>• Presents a description that has a well-developed structure which is clear, coherent and logical. (AO1)</li></ul>

**Summary for guidance**

<b>Level</b>	<b>Mark</b>	<b>Additional Guidance</b>	<b>General additional guidance – the decision within levels</b> e.g. - At each level, as well as content, the scientific coherency of what is stated will help place the answer at the top, or the bottom, of that level.
	0	No rewardable material.	
Level 1	1–2	<u>Additional guidance</u>  Partially complete description of a suitable procedure with at least two measurements  OR one measurement and another procedural point	<u>Possible candidate responses</u>  measure the length measure the width of a strip measure the mass/weight of a strip  e.g. repeat measurements
Level 2	3–4	<u>Additional guidance</u>  Mostly complete description of a suitable procedure with at least three measurements and some description of processing the results.	<u>Possible candidate responses</u>  As above with measure the thickness of the strip  calculate the volume (= l x w x t) OR immerse in liquid to get volume
Level 3	5–6	<u>Additional guidance</u>  Detailed description of a suitable procedure with all necessary measurements and a clear description of processing the results.	<u>Possible candidate responses</u>  As above with extra detail e.g. measure the mass of (say) 5 strips then ÷ 5 to calculate the mass of one of them detail of obtaining volume by immersion use density = mass / volume  check if density value obtained is near one of the teacher's two values

**Question 6 =13 marks**