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## Mark Scheme (Results)

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In Science (Single Award) (4SS0) Paper 1P

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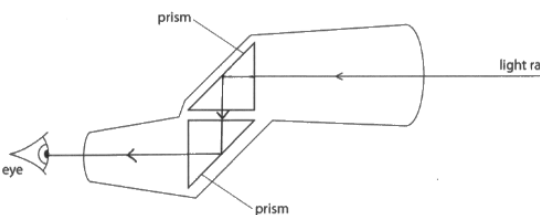
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## General Marking Guidance

- 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.

Question number	Answer	Notes	Marks
1 (a)	<div style="display: flex; align-items: center; justify-content: space-between;"> <div style="text-align: center;"> <p>earliest stage</p>  </div> <div style="border: 1px solid black; padding: 5px; width: 80%; margin: 0 auto;"> <p>nebula</p> <hr/> <p>main sequence</p> <hr/> <p>red giant</p> <hr/> <p>white dwarf</p> </div> </div> <p style="text-align: center; margin-top: 20px;">;;;</p> <p style="text-align: center;">latest stage</p>	<p>All correct: 3 marks</p> <p>Any two in correct box: 2 marks</p> <p>Only one correct box: 1 mark</p>	3
(b)	galaxy;	allow any correctly named galaxy eg Milky Way, Andromeda	(1)
(c)	(surface) temperature;	allow description of temperature eg how hot it is	(1)

Question number	Answer	Notes	Marks
2 (a)	<p>the angle of incidence (in the slower medium);</p> <p>above which gives total internal reflection OR gives an angle of refraction of <math>90^\circ</math>;</p>	<p>ALLOW ideas if clear from diagram</p> <p>ALLOW TIR for total internal reflection</p> <p>where light is refracted along the media boundary</p>	2
(b)	<p>TIR in both prisms;</p> <p>no refraction as ray enters and leaves prisms;</p> <p>emergent ray parallel to incident ray;</p> 		3

Question number	Answer	Notes	Marks
3 (a)	any THREE from: MP1 measure time; MP2 idea of measuring time at each mark; MP3 repeat and average (time measurement(s));  MP4 calculate speed  MP5 (average) speed = distance/time;  PLUS  MP6 suggestion of suitable graph e.g. speed or velocity against;  MP7 correct identification of how to obtain acceleration from the graph;	REJECT idea of final speed = total distance/time taken  No reference to a suitable graph limits score to a maximum of 3 marks	5
(b)	any one from: human reaction time would give wrong time interval;  ball may not travel in a straight line;  difficult to tell when ball crosses marking;		1

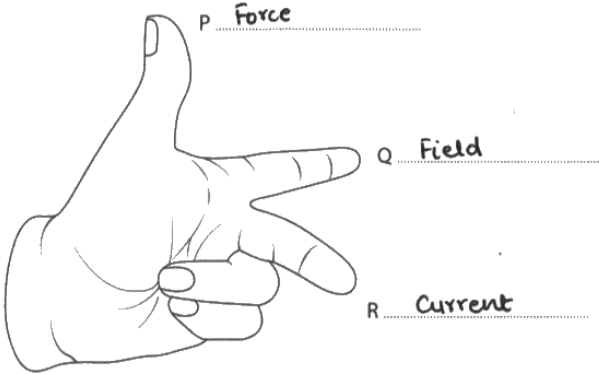
Question number	Answer	Notes	Marks
4 (a) (i)	voltage = current $\times$ resistance;	allow standard symbols and rearrangements e.g. $I = V / R$  CONDONE “i” for “I” REJECT “c” or “C” for current	1
4 (a) (ii)	rearrangement;  substitution; evaluation; correct answer: 0.084 A  e.g. current = voltage/resistance current = $1.6/19$ current = 0.084(2) (A)	ALLOW re-arrange and substitution in either order  ACCEPT 84 mA	3
4 (b) (i)	correct symbol for voltmeter in parallel with any component;  across resistor X;		2
(b) (ii)	evidence of idea that $V_x$ is difference between cell voltage and voltage across 16 ohm resistor; 0.69 (V);		2

Question number	Answer	Notes	Marks
5 (a) (i)	neutron;	accept symbol	1
(ii)	(when a) nucleus splits;		1
(iii)	kinetic energy/KE;	allow thermal	1
(b)	(gamma) radiation is a hazard / harmful shielding will absorb the (gamma) radiation;  (concrete needs to be thick as) gamma has the highest penetrating power/can penetrate through many centimetres of lead/absorbed by many centimetres of lead;	ALLOW specific hazard e.g. can cause cancer	3



Question number	Answer	Notes	Marks
6 (a)	substitution;  rearrangement;  evaluation; correct answer: 23 (m/s)  e.g. $3.2 \times 10^5 = \frac{1}{2} \times 1.25 \times 10^3 \times v^2$ $v = \sqrt{2 \times 3.2 \times 10^5 / 1.25 \times 10^3}$ $v = 22.6(3) \text{ m/s}$	ACCEPT substitution and re-arrangement in either order. ACCEPT correct rearrangement in symbols           ALLOW 512(.1) for 2 marks	3
(b)	(i) Evidence of “GPE = mass x g x height”; Substitution; Evaluation;  Correct answer: 560 000 (J) e.g. GPE = mgh GPE = $1.25 \times 10^3 \times 10 \times 45$ GPE = 562500 J  (ii) 560 000 J  (iii) mechanical(ly);	ACCEPT any number that is the same as (i)	3  1  1

Question number	Answer	Notes	Marks
6 (c) (i)	efficiency = useful output energy/total output energy (x 100%)	ALLOW a correct rearrangement	1
(ii)	<p>B - (the useful output energy transfer is 270 kJ, out of a total output energy transfer of 320 kJ);</p> <p>A is incorrect as 270 kJ is not the total output energy  C is incorrect as the mechanically transferred energy is not useful  D is incorrect as 320 kJ is the total output energy not the useful output energy</p>		1

Question number	Answer	Notes	Marks
7 (a)	<p>thumb: (magnetic) force;</p> <p>index finger: (magnetic) field;</p> <p>middle finger: current;</p> <p>e.g.</p> 	<p>CONDONE "motion"</p> <p>ALLOW correct symbols eg I for current</p>	3
(b)	<p>3 field lines with arrow from North to South;</p> <p>field lines parallel and evenly spaced;</p>	<p>IGNORE any lines drawn outside of the space between the poles</p>	2

Question number	Answer	Notes	Marks
7 (c) (i)	a.c. current changes direction frequently/continuously/repeatedly/50 Hz; d.c. current is in one direction only;		2
(ii)	(to / towards) right;	ALLOW in	1
(iii)	battery supplies constant current; idea of no vibration;	ALLOW idea that battery provides a direct current	2

Question number	Answer	Notes	Marks
8 (a) (i)	323 (K);		1
(ii)	check data point at (323,112);	ALLOW ECF from (i) plotted point should be within +/- half small square	1
(iii)	line of best fit draw;	1 <sup>st</sup> and 3 <sup>rd</sup> points above line, 2 <sup>nd</sup> and 4 <sup>th</sup> points below line;	1
(b)	2/two;	IGNORE any unit included in response	1

Question number	Answer	Notes	Marks
8 (c)	<p>gas molecules collide <b>with walls</b>;</p> <p>gas molecules exert a force on wall(s) (during collision);</p> <p>pressure = force/area;</p>	<p>IGNORE collisions between molecules</p> <p>ALLOW correct momentum references</p>	3
(d)	<p>Any THREE from:</p> <p>MP1 any reference to Boyle's Law (<math>pV = \text{constant}</math>);</p> <p>MP2 (volume decreases so) pressure increases;</p> <p>MP3 all pressure values will be higher;</p> <p>MP4 gradient steeper;</p> <p>MP5 (because) line still must pass through /extend back to absolute zero;</p>	<p>Credit idea that line would be higher up the grid for MP3</p>	3

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