

Physics A

General Certificate of Secondary Education

Unit **A183/01**: Unit 3 – Module P7 (Foundation Tier)

Mark Scheme for June 2013

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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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1. Annotations

Used in the detailed Mark Scheme:

Annotation	Meaning
/	alternative and acceptable answers for the same marking point
(1)	separates marking points
not/reject	answers which are not worthy of credit
ignore	statements which are irrelevant - applies to neutral answers
allow/accept	answers that can be accepted
(words)	words which are not essential to gain credit
<u>words</u>	underlined words must be present in answer to score a mark
ecf	error carried forward
AW/owtte	credit alternative wording / or words to that effect
ORA	or reverse argument

Available in scoris to annotate scripts:

	correct response
	incorrect response
BOD	benefit of doubt
NBOD	no benefit of doubt
ECF	error carried forward
0 , L1 , L2 , L3	indicate level awarded for a question marked by level of response
A	information omitted
CON	contradiction
R	reject

	indicate uncertainty or ambiguity
	draw attention to particular part of candidate's response

2. **ADDITIONAL OBJECTS:** You **must** assess and annotate the additional objects for each script you mark. Where credit is awarded, appropriate annotation must be used. If no credit is to be awarded for the additional object, please use annotation as agreed at the SSU.

3. **Subject-specific Marking Instructions**

- Accept any clear, unambiguous response (including mis-spellings of scientific terms if they are *phonetically* correct, but always check the guidance column for exclusions).
- Crossed out answers should be considered only if no other response has been made. When marking crossed out responses, accept correct answers which are clear and unambiguous.

e.g. for a one-mark question where ticks in the third and fourth boxes are required for the mark:




*This would be worth
1 mark.*

✓


*This would be worth
0 marks.*



✓
✓

*This would be worth
1 mark.*

- The list principle:
If a list of responses greater than the number requested is given, work through the list from the beginning. Award one mark for each correct response, ignore any neutral response, and deduct one mark for any incorrect response, e.g. one which has an error of science. If the number of incorrect responses is equal to or greater than the number of correct responses, no marks are awarded. A neutral response is correct but irrelevant to the question.

d. Marking method for tick-box questions:

If there is a set of boxes, some of which should be ticked and others left empty, then judge the entire set of boxes.

If there is at least one tick, ignore crosses and other markings. If there are no ticks, accept clear, unambiguous indications, e.g. shading or crosses. Credit should be given according to the instructions given in the guidance column for the question. If more boxes are ticked than there are correct answers, then deduct one mark for each additional tick. Candidates cannot score less than zero marks.

e.g. if a question requires candidates to identify cities in England:

Edinburgh	☐
Manchester	☐
Paris	☐
Southampton	☐

the second and fourth boxes should have ticks (or other clear indication of choice) and the first and third should be blank (or have indication of choice crossed out).

Edinburgh			✓			✓	✓	✓	✓	
Manchester	✓	x	✓	✓	✓				✓	
Paris				✓	✓		✓	✓	✓	
Southampton	✓	x		✓		✓	✓		✓	
Score:	2	2	1	1	1	1	0	0	0	NR

e. For answers marked by levels of response:

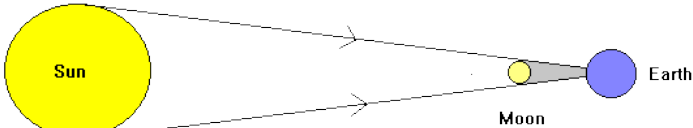
- Read through the whole answer from start to finish**
- Decide the level that best fits** the answer – match the quality of the answer to the closest level descriptor
- To determine the mark within the level**, consider the following:

Descriptor	Award mark
A good match to the level descriptor	The higher mark in the level
Just matches the level descriptor	The lower mark in the level

- Use the **L1**, **L2**, **L3** annotations in Scoris to show your decision; do not use ticks.

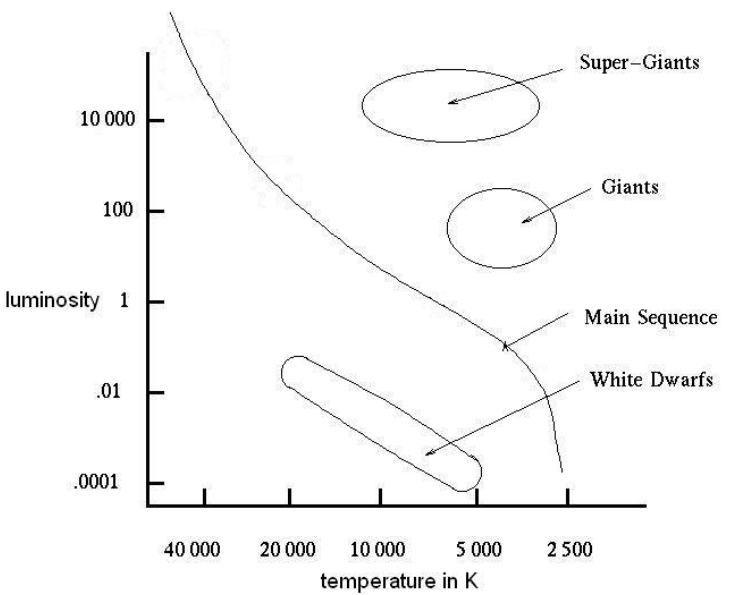
Quality of Written Communication skills assessed in 6-mark extended writing questions include:

- appropriate use of correct scientific terms
- spelling, punctuation and grammar
- developing a structured, persuasive argument
- selecting and using evidence to support an argument
- considering different sides of a debate in a balanced way
- logical sequencing.

Question	Answer	Marks	Guidance
1	<p>Level 3 (5–6 marks) A complete diagram in all details OR A detailed diagram AND an explanation with at least two features of the eclipse OR A detailed explanation AND a simple diagram Quality of written communication does not impede communication of the science at this level.</p> <p>Level 2 (3–4 marks) A more detailed diagram OR an explanation with at least two features of the eclipse OR a simple diagram AND a simple explanation that describes a feature of the eclipse Quality of written communication partly impedes communication of the science at this level.</p> <p>Level 1 (1–2 marks) a simple diagram showing relative position of Sun Moon and Earth OR a simple explanation that describes a feature of the eclipse Quality of written communication impedes communication of the science at this level.</p> <p>Level 0 (0 marks) Insufficient or irrelevant science. Answer not worthy of credit.</p>	6	<p>This question is targeted at grades up to E</p> <p>Indicative scientific points may include:</p> <ul style="list-style-type: none"> • Moon orbits the Earth / much closer to Earth • Moon orbits at an angle • sometimes Moon between Sun and the Earth • alignment is rare • Moon blocks/moves in front of Sun / light • shadow reaches (only small parts of) Earth / last for a short time • Moon is the same apparent size as the Sun / particular size and distance • total/full eclipse seen within shadow region • partial eclipse seen just outside main shadow zone (penumbra).  <p>Details of diagram</p> <ul style="list-style-type: none"> • relative size of Sun, Earth and Moon • relative distances of Sun, Earth and Moon • indication of orbital paths • light rays / shadow zone / umbra / penumbra <p>allow up to Level 2 for diagrams and/or explanations where the Sun is orbiting the Earth, or the Earth is eclipsing the Moon (lunar eclipse)</p> <p>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</p>
	Total	6	

Question			Answer	Marks	Guidance
2	(a)	(i)	parallel rays into lens (1) rays converge to a focus (1)	2	Arrows not needed but do not accept if the direction is incorrect ignore star labels allow - - - - for rays
		(ii)	refraction	1	allow any unambiguous indication e.g. refraction circled or underlined
		(iii)	<div> The image becomes clearer. The light waves turn upside down. All the light is reflected by the lens. The speed of the light wave changes. The direction of the light wave changes. </div> <div> ☐ ☐ ☐ ☒ ☒ </div>	2	
	(b)	(i)	D	1	
		(ii)	1 / 0.5 (1) 2 (1)	2	correct numerical answer scores both marks
	(c)		Eyepiece: X (1) the most powerful / magnifies the most (1) Objective: Y (1) the largest (diameter/area) / collects most light (1)	4	allow 1 mark for correct property of Y If Y is chosen allow 1 mark for correct property of X If X is chosen not just 'thickest' ignore irrelevant justifications e.g Y has the weakest magnification but is the largest lens = 2 marks but do not accept contradictions
			Total	12	

Question	Answer	Marks	Guidance
3	<p>Level 3 (5–6 marks) Lists at least one general advantage of computer control with detail AND at least one HST specific advantage with detail Quality of written communication does not impede communication of the science at this level.</p> <p>Level 2 (3–4 marks) Lists two general advantages of computer control with detail OR two HST specific advantages of computer control with detail Quality of written communication partly impedes communication of the science at this level.</p> <p>Level 1 (1–2 marks) Gives one advantage of computer control with detail OR two advantages without detail Quality of written communication impedes communication of the science at this level.</p> <p>Level 0 (0 marks) Insufficient or irrelevant science. Answer not worthy of credit.</p>	6	<p>This question is targeted at grades up to E</p> <p>Indicative scientific points may include:</p> <p>General Advantages of computer control ...with detail:</p> <ul style="list-style-type: none"> • being able to work remotely ...<i>convenience (of time, cost etc)</i> • continuously track ...<i>objects</i> • pointing of telescope ... <i>with precision / automatic / remotely / with speed / with ease</i> • computer recording ...<i>of data / images</i> • computer processing ...<i>of data / images</i> • data recording / processing ... <i>with speed / precision / volume</i> <p>HST Specific Advantages of computer control ...with detail:</p> <ul style="list-style-type: none"> • astronomers in space<i>not needed / difficult / costly</i> • ground control... <i>less risk / safer</i> • controlling the telescope wearing a space suit...<i>difficult</i> • continuously tracking impossible... <i>without people being there</i> • images recorded on film ... <i>returned to Earth for analysis.</i> • HST images ...<i>higher quality / no light or atmospheric pollution</i> <p>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</p>
	Total	6	

Question	Answer	Marks	Guidance
4 (a)	 <p>A Hertzsprung-Russell diagram with luminosity on the vertical axis (log scale from 0.0001 to 10,000) and temperature in K on the horizontal axis (log scale from 40,000 to 2,500). The Main Sequence is a diagonal line. Super-Giants are at high luminosity and low temperature. Giants are below them. White Dwarfs are at low luminosity and low temperature.</p>	4	<p>accept red/blue supergiants</p> <p>accept red giants</p>
(b)	X on main sequence in a horizontal line with 1 on the vertical axis	1	<p>By eye</p> <p>accept any unambiguous symbol</p>
(c)	<p>arrow points below horizontal (1)</p> <p>arrow points to the right (1)</p>	2	<p>arrow should relate to the star</p>
	Total	7	

Question			Answer	Marks	Guidance
5	(a)	(i)	Ann Byron Frances	2	any order all three correct = 2 marks any two correct = 1 mark
		(ii)	Edward	1	
		(iii)	Chris (1) Danni (1)	2	any order
	(b)		<div> astronauts hospital workers politicians scientists teachers </div> <div> ☐ ☐ ☒ ☒ ☐ </div>	2	
	(c)		any two from: idea of cost ; better spent on other things / named example ; plus any one explanation from: idea of environmental damage ; idea of disruption while building	3	allow named example e.g. spoils the view / affects habitats / affects wildlife allow named example e.g. pollution / noise pollution / access roads
			Total	10	

Question	Answer	Marks	Guidance
6	<p>Level 3 (5–6 marks) Describes the Curtis-Shapley debate AND describes the changing data which showed Curtis to have the correct interpretation Quality of written communication does not impede communication of the science at this level.</p> <p>Level 2 (3–4 marks) Describes the debate AND gives an example of data they used OR Describes debate AND gives an example of their interpretations OR Gives an example of their interpretations AND gives and example of the data the used Quality of written communication partly impedes communication of the science at this level.</p> <p>Level 1 (1–2 marks) Attempts to describe the Curtis-Shapley debate OR gives an example of either Curtis and/or Shapley's interpretation OR gives an example of the data that was used in the debate Quality of written communication impedes communication of the science at this level.</p> <p>Level 0 (0 marks) Insufficient or irrelevant science. Answer not worthy of credit.</p>	6	<p>This question is targeted at grades up to C</p> <p>Indicative scientific points may include:</p> <p>The debate</p> <ul style="list-style-type: none"> Disagreement about (spiral) nebulae / fuzzy objects in the sky Shapley – gas clouds Curtis – systems of stars <p>ignore If Shapley and Curtis are reversed or not named. If response indicates debate between 'Curtis-Shapley' and Hubble, limit to Level 1.</p> <p>Allow Position of Sun in galaxy / Curtis has Sun at centre of galaxy / Shapley has Sun at edge</p> <p>The data</p> <ul style="list-style-type: none"> Both agreed distance to nebulae (<i>Andromeda</i>) was very large / greater than any other star Hubble provided new distance measurement / evidence from Cepheid variables Curtis – (Hubble's method showed) distance to nebulae much too large to be inside the galaxy <p>The interpretations</p> <ul style="list-style-type: none"> Shapley – the nebulae are inside the Milky Way / The Universe is one big galaxy Curtis – the systems of stars are outside the Milky Way / Universe has more than one galaxy <p>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</p>
	Total	6	

Question			Answer	Marks	Guidance
7	(a)		gravity	1	
	(b)	(i)	pressure/temperature = constant (1) volume/temperature = constant (1)	2	allow temperature is proportional to pressure allow temperature is proportional to volume
		(ii)	(in the) core	1	
		(iii)	<div> <div>combustion</div> <div>conduction</div> <div>convection</div> <div>radiation</div> <div>reflection</div> </div> <div> ☐ ☐ ☒ ☒ ☐ </div>	2	
	(c)	(i)	5800 – 273 (1) 5527 (1)	2	allow 1 mark for 6073 (ie adds 273) correct numerical answer = 2 marks
		(ii)	(temperature) lower than the Sun / 5800K / 5527°C	1	allow lower than ecf from (c)(i) allow 'it is lower'
	(d)		any two from: (Sun fuses) hydrogen ; Hydrogen less positive OR Helium more positive ; Hydrogen less energy needed/easier to bring together OR Helium more energy needed/harder to bring together ; Higher energy linked to higher temperature needed for fusion OR A	2	

Question		Answer	Marks	Guidance
7	(e)	<p>By comparing its brightness with a star of similar luminosity / temperature (1)</p> <p>the brighter (the star) the closer (1) ORA</p> <p>OR</p> <p>if two stars look the same brightness then the hotter/more luminous one must be further away (2) ORA</p> <p>OR</p> <p>if two stars have the same luminosity/temperature the dimmer one is further away (2) ORA</p>	2	<p>allow compare brightness with the Sun / with a similar star</p> <p>do not credit the more luminous / hotter the closer the star ORA</p> <p>do not credit the less luminosity the further away</p>
		Total	13	

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