OCR
RECOGNISING ACHIEVEMENT

SPECIMEN H

GENERAL CERTIFICATE OF SECONDARY EDUCATION

TWENTY FIRST CENTURY SCIENCE

PHYSICS A **A183/02**

Unit A183: Module P7 (Higher Tier)

MARK SCHEME

Duration: 1 hour

MAXIMUM MARK 60

This document consists of 16 pages

Guidance for Examiners

Additional guidance within any mark scheme takes precedence over the following guidance.

1. Mark strictly to the mark scheme.
2. Make no deductions for wrong work after an acceptable answer unless the mark scheme says otherwise.
3. Accept any clear, unambiguous response which is correct, eg mis-spellings if phonetically correct (but check additional guidance).
4. Abbreviations, annotations and conventions used in the detailed mark scheme:

/	=	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
words	=	underlined words must be present in answer to score a mark
ecf	=	error carried forward
AW/owtte	=	alternative wording
ORA	=	or reverse argument

Eg mark scheme shows 'work done in lifting / (change in) gravitational potential energy' (1)
work done = 0 marks
work done lifting = 1 mark
change in potential energy = 0 marks
gravitational potential energy = 1 mark

5. Annotations:
The following annotations are available on SCORIS.

✓	=	correct response
✗	=	incorrect response
bod	=	benefit of the doubt
nbod	=	benefit of the doubt **not** given
ECF	=	error carried forward
^	=	information omitted
I	=	ignore
R	=	reject

6. If a candidate alters his/her response, examiners should accept the alteration.

7. 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.

   Eg
   For a one mark question, where ticks in boxes 3 and 4 are required for the mark:

Put ticks (✓) in the two correct boxes.	Put ticks (✓) in the two correct boxes.	Put ticks (✓) in the two correct boxes.
		
This would be worth 0 marks.	This would be worth one mark.	This would be worth one mark

8. 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, eg 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.

9. Marking method for tick boxes:

   Always check the additional guidance.

   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. If there are no ticks, accept clear, unambiguous indications, eg shading or crosses.
   Credit should be given for each box correctly ticked. 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.

   Eg If a question requires candidates to identify a city in England, then in the boxes

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	✓	×	✓	✓	✓				✓	
Paris				✓	✓		✓	✓	✓	
Southampton	✓	×		✓		✓	✓		✓	
Score:	2	2	1	1	1	1	0	0	0	NR

10. Three questions in this paper are marked using a Level of Response (LoR) mark scheme with embedded assessment of the Quality of Written Communication (QWC). When marking with a Level of Response mark scheme:

- Read the question in the question paper, and then the list of relevant points in the 'Additional guidance' column of the mark scheme, to familiarise yourself with the expected science. The relevant points are not to be taken as marking points, but as a summary of the relevant science from the specification.
- Read the level descriptors in the 'Expected answers' column of the mark scheme, starting with Level 3 and working down, to familiarise yourself with the expected levels of response.
- *For a general correlation between quality of science and QWC*: determine the level based upon which level descriptor best describes the answer; you may award either the higher or lower mark within the level depending on the quality of the science and/or the QWC.
- *For high-level science but very poor QWC*: the candidate will be limited to Level 2 by the bad QWC no matter how good the science is; if the QWC is so bad that it prevents communication of the science the candidate cannot score above Level 1.
- *For very poor or totally irrelevant science but perfect QWC*: credit cannot be awarded for QWC alone, no matter how perfect it is; if the science is very poor the candidate will be limited to Level 1; if there is insufficient or no relevant science the answer will be Level 0.

Question			Expected answers	Marks	Additional guidance
1	(a)		pressure increases because: particles move faster/have more kinetic energy / more frequent/energetic collisions between particles / particles have increased momentum / increased forces during collisions between particles	[2]	**do not accept** 'moves more' or 'vibrates' or just 'more energy' **allow** collisions with 'edge' or 'boundary' **allow** 'more collisions'
	(b)	(i)	Hydrogen → Helium	[2]	per correct answer (1) **allow** H and He (symbols must be correct) **ignore** any balancing/additional numbers

Question			Expected answers	Marks	Additional guidance
1	(b)	(ii) ✎	**[Level 3]** Answer correctly describes the processes of energy release in the Sun (hydrogen to helium fusion must be mentioned) and transport and clearly sequences them in the correct order from core to photosphere (then space). All information in answer is relevant, clear, organised and presented in a structured and coherent format. Specialist terms are used appropriately. Few, if any, errors in grammar, punctuation and spelling. (5 – 6 marks) **[Level 2]** Answer may name some processes rather than describing them, and/or may not make the correct order clear. For the most part the information is relevant and presented in a structured and coherent format. Specialist terms are used for the most part appropriately. There are occasional errors in grammar, punctuation and spelling. (3 – 4 marks) **[Level 1]** An incomplete answer, naming some processes without describing them and omitting other processes. Answer may be simplistic. There may be limited use of specialist terms. Errors of grammar, punctuation and spelling prevent communication of the science. (1 – 2 marks) **[Level 0]** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	**[6]**	**relevant points include:** applies generic knowledge of stellar interiors to specific case of the Sun • energy produced by nuclear fusion, primarily of hydrogen nuclei into helium nuclei / by the fusion of other light elements into heavier elements, in the core of the star then • energy is transported from core to surface / photosphere, by photons of radiation in inner region • and by convection currents in outer region **accept** reference to radiative zone as inner region and convective zone as outer region then • photosphere – electromagnetic radiation / photons , emitted / radiated / travels , into space
			Total	**[10]**	

<table>
<tr><th colspan="3">Question</th><th>Expected answers</th><th>Marks</th><th>Additional guidance</th></tr>
<tr><td>2</td><td>(a)</td><td></td><td>
<table>
<tr><th>statement</th><th>Ryle</th><th>Hoyle</th><th>both</th><th>neither</th></tr>
<tr><td>In the past ...</td><td>✓</td><td></td><td></td><td></td></tr>
<tr><td>no pattern</td><td></td><td>✓</td><td></td><td></td></tr>
<tr><td>stop expanding</td><td></td><td></td><td></td><td>✓</td></tr>
</table>
</td><td>[3]</td><td>one mark per correct row

accept any clear and unambiguous response
more than one response in any row does not score that row</td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td>distance from earth is proportional to velocity away from earth</td><td>[1]</td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td>correctly reads 4 values from the graph
2 velocities
2 distances

calculates ratio: velocity/distance

answer = 70 ± 2</td><td>[4]</td><td>

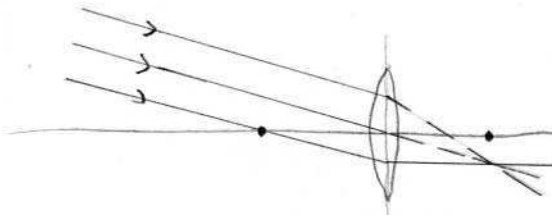
only 1 mark for only using a single pair of values, if 0,0 used this must be explicit eg (61200-0)/(870-0)</td></tr>
<tr><td></td><td></td><td>(iii)</td><td>distances get larger/increase
recognises idea of inverse relationship (from equation)</td><td>[2]</td><td></td></tr>
<tr><td colspan="3"></td><td>Total</td><td>[10]</td><td></td></tr>
</table>

Question			Expected answers	Marks	Additional guidance
3	(a)		In order left to right: gas cloud/nebula protostar *(Sun now)* red giant white dwarf	[4]	**accept** 'hydrogen cloud 'dust cloud', 'gases' and 'dust and gas' are insufficient **accept** brown/black dwarf
	(b)		In order left to right: (giant star now) red supergiant supernova neutron star/black hole	[3]	diagrams are not required **allow** 1 mark for any two not in correct sequence eg red giant(×), neutron star, supernova = 1 mark red supergiant(✓), neutron star, supernova = 2 marks **accept** super red giant
			Total	[7]	

Question			Expected answers	Marks	Additional guidance
4	(a)	(i)	Alpha Centauri C	[1]	
		(ii)	3.48 or 1/0.287	[1]	
		(iii)	Tau Ceti	[1]	
	(b)		**any two from:** avoids atmospheric refraction/turbulence; idea of an increased baseline; avoids light pollution can use additional parts of spectrum; atmosphere absorbs some radiation;	[2]	'no atmosphere' is insufficient
			Total	[5]	

Question			Expected answers	Marks	Additional guidance
5	✎		**[Level 3]** Provides a balanced valid conclusion fully based on correct explanations of the function of peer review journals and newspapers. All information in answer is relevant, clear, organised and presented in a structured and coherent format. Specialist terms are used appropriately. Few, if any, errors in grammar, punctuation and spelling. (5 – 6 marks) **[Level 2]** Draws a conclusion but may only correctly explain one of peer review or newspaper, may only link to an advantage or disadvantage. For the most part the information is relevant and presented in a structured and coherent format. Specialist terms are used for the most part appropriately. There are occasional errors in grammar, punctuation and spelling. (3 – 4 marks) **[Level 1]** May not draw a conclusion. Focuses on newspaper with little/incorrect explanation of peer review or replication. Answer may be simplistic. There may be limited use of specialist terms. Errors of grammar, punctuation and spelling prevent communication of the science. (1 – 2 marks) **[Level 0]** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	**[6]**	**relevant points include:** • both serve different functions, so both are of value **peer review** • other scientists / astronomers evaluate/review/check the claim • before publication • idea of identifying mistakes/errors in the original claim • other scientists can repeat the experiment/observations and get the same results • other scientists can get the same results using a different method **newspaper** • wide circulation • not always reliable • more interested in story than validity of results
			Total	**[6]**	

Question			Expected answers	Marks	Additional guidance
6	(a)		idea that the Earth rotates in the same direction as the Earth orbits the Sun therefore the Earth has to make more than one whole rotation for the Sun to move once across the whole sky	[2]	**allow** answers from diagrams
	(b)		**E** **D** **H**	[3]	three correct = 3 marks two correct = 2 marks one correct = 1 mark
	(c)		Moon must be between Earth and Sun / Moon blocks light from Sun (for eclipse) lunar orbit tilted (relative to Earths orbit) so (Moon) often above/below/not in line with Earth and Sun	[3]	points may be on a diagram 'Moon blocks Sun' is insufficient ora **accept** for 1 mark 'lunar shadow is very small/eclipse not visible everywhere' must be stated and not just shown on diagram
			Total	[8]	

Question			Expected answers	Marks	Additional guidance
7	(a)		ray through centre of lens continues straight to intersect bottom ray top ray bends in lens then continues as straight line to intercept of central and bottom ray image labelled at intercept of three rays eg 	[3]	no mark for a ray if it is continued in more than one direction
	(b)	(i)	re-arrangement: f=1÷P or f=1÷20 0.05	[2]	correct numerical answer (2)
		(ii)	correct substitution: m= 0.5÷0.01 50	[2]	correct numerical answer (2) If units given in answer maximum 1 mark
		(iii)	no (no mark) because magnification = 1 / no magnification	[1]	**ignore** comments about focus or blurring

Question			Expected answers	Marks	Additional guidance
7	(c)	✎	**[Level 3]** Comprehensive explanation of the reasons for telescopes being large, and application of knowledge of relative wavelengths of radio waves and light to diffraction effects. All information in answer is relevant, clear, organised and presented in a structured and coherent format. Specialist terms are used appropriately. Few, if any, errors in grammar, punctuation and spelling. (5 – 6 marks) **[Level 2]** May only use one reason for having large telescopes, but applies reason to both types. For the most part the information is relevant and presented in a structured and coherent format. Specialist terms are used for the most part appropriately. There are occasional errors in grammar, punctuation and spelling. (3 – 4 marks) **[Level 1]** Attempts to give a reason, but may be inappropriate eg, diffraction for optical telescopes. Answer may be simplistic. There may be limited use of specialist terms. Errors of grammar, punctuation and spelling prevent communication of the science. (1 – 2 marks) **[Level 0]** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	**[6]**	**relevant points include:** • Little electromagnetic energy/few photons received from faint and/or distant objects • The larger the telescope aperture, the more energy/photons collected • Larger apertures can detect fainter / more distant objects • Radiation is diffracted by the aperture of a telescope • Diffraction is significant when the aperture is comparable to the wavelength • Radio wavelengths are much longer than visible light wavelengths, so radio telescopes need much larger apertures • Less diffraction means a sharper/better focused image **ignore** better image/picture
			Total	**[14]**	