OCR
Oxford Cambridge and RSA

GCSE

Physics A

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

General Certificate of Secondary Education

Mark Scheme for June 2016

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

	indicate uncertainty or ambiguity
	benefit of doubt
	contradiction
	incorrect response
	error carried forward
	draw attention to particular part of candidate's response
	draw attention to particular part of candidate's response
	draw attention to particular part of candidate's response
	no benefit of doubt
	reject

	correct response
	draw attention to particular part of candidate's response
	information omitted

2. Subject-specific Marking Instructions

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

b. 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 boxes 3 and 4 are required for the mark:

Put ticks (✓) in the two correct boxes.

This would be worth 1 mark.

Put ticks (✓) in the two correct boxes.

This would be worth 0 marks.

Put ticks (✓) in the two correct boxes.

This would be worth 1 mark.

c. 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 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, e.g. 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.

E.g. 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 <u>should be blank</u> (or have indication of choice crossed out).

Edinburgh			✓			✓	✓	✓	✓	
Manchester	✓	×	✓	✓	✓				✓	
Paris				✓	✓		✓	✓	✓	
Southampton	✓	×		✓		✓	✓		✓	
Score:	**2**	**2**	**1**	**1**	**1**	**1**	**0**	**0**	**0**	**NR**

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Mark</th><th>Guidance</th></tr>
<tr><td>1</td><td>a</td><td>i</td><td><table><tr><td>Neptune</td><td>✓</td></tr><tr><td>the Moon</td><td></td></tr><tr><td>Saturn</td><td></td></tr><tr><td>stars</td><td></td></tr><tr><td>the Sun</td><td>✓</td></tr></table></td><td>2</td><td></td></tr>
<tr><td></td><td></td><td>ii</td><td>Direction is wrong (1)

Should be North / Because pole star / North star in centre (1)

Time is correct / it is 6 hours (1)

Because stars have moved about a quarter of the way around the sky(1)</td><td>4</td><td>Accept just ‘No’ if it is clearly about the direction
Ignore Sue is (partly) correct/incorrect

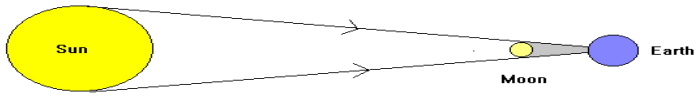
Accept just ‘Yes’ if it is clearly about the time/6hours

Accept quarter of a circle, 24 hours to travel complete circle</td></tr>
<tr><td></td><td></td><td>iii</td><td>Idea of Earth moving / Earth is on the other side of its orbit/the Sun

different stars (are seen) / looking at the stars in a different direction / stars (appear to be) in a different position/at different angles / original stars are blocked/behind the Sun</td><td>2</td><td>Ignore rotation of Earth on its axis
pole

Not stars have moved
Not just stars look different (stem)</td></tr>
<tr><td></td><td>b</td><td></td><td>Earth in centre of moons orbit

Sun to right hand side of the moons orbit</td><td>2</td><td>At least one of Earth or Sun must be labelled to gain any marks
Accept an arrow pointing off page to right and labelled Sun</td></tr>
<tr><td></td><td>c</td><td></td><td>angles</td><td>1</td><td></td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>11</td><td></td></tr>
</table>

Question			Answer	Mark	Guidance
2			**[Level 3]** Detailed explanation of eclipse **and** a detailed explanation of the importance of apparent size Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **[Level 2]** Detailed explanation of eclipse **OR** detailed explanation of the importance of apparent size **OR** Limited explanation of eclipse **and** limited explanation of the importance of apparent size Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **[Level 1]** Limited explanation of eclipse. Quality of written communication impedes communication of the science at this level. (1 – 2 marks) **[Level 0]** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	6	**This question is targeted at grades up to E.** **Indicative scientific points may include:** **Detailed explanation of eclipse** • Moon between Sun and the Earth casts shadow/causes darkness on Earth • example of diagram:  **Explanation of the importance of apparent size** **Detailed** • diagram showing Moon near enough to Earth to produce umbra • Moon is smaller but much closer / enough to block out all the light from the Sun • Sun is wider and much further away so Moon can block all light from the Sun **Limited** • Moon is smaller / Sun is bigger **Limited explanations of eclipse** • Moon orbits the Earth • Moon moves between Earth and Sun • Moon blocks Sun • Moon cast shadow on Earth • Total/full eclipse seen within umbra of shadow/ when all light blocked • Partial eclipse seen in penumbra of shadow **Ignore diagrams that do not produce an eclipse.** **Use the L1, L2, L3 annotations in RM Assessor; do not use ticks.**
			Total	**6**	

Question			Answer	Mark	Guidance
3	a		14,000 million years	1	
	b		70 x 300 21000 (km/s)	2	 correct numerical answer gains 2 marks
	c		uses 273 -270	2	**Allow** -276 / 276 / 270 / 273–3 / 273x3 etc. **Allow just** 273 correct numerical answer gains 2 marks
			Total	**5**	

Question			Answer	Mark	Guidance
4	a		Any correct average using 4 or 5 stars to any s.f. [1] correct average distance 170 [1] Star D is too far away/not in the group/an outlier OR distances A, B, C and E are similar	3	5 stars gives 186 (Others mean values for 4 of the stars are 191.25, 187.5, 192.5 and 188.75) 170 = 2 marks
	b	i	Hydrogen Helium	2	Any order **Accept** symbols H_2 / H / He
		ii	any 3 Gravity (pulls cloud inwards) temperature increases pressure (increases) (At high enough temperature) fusion starts Hydrogen fuses to helium	3	 **Accept** compresses **Ignore** fusion causing initial temperature and pressure increase / fusion causing further temperature increase **Ignore** changes in volume **allow** initial low temperature needed for atoms to be pulled in by gravity.
			Total	**8**	

Question			Answer	Mark	Guidance
5			**[Level 3]** The correct sequence of change **and** a nuclear reaction in a RG **or** WD **and** a correct change in a RG **or** WD Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **[Level 2]** Two of: part of the sequence of change / a nuclear reaction in a RG **or** WD / a correct change in a RG **or** WD Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **[Level 1]** One of: part of the sequence of change OR a nuclear reaction in a RG **or** WD OR a correct change in a RG **or** WD Quality of written communication impedes communication of the science at this level. (1 – 2 marks) **[Level 0]** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	6	**This question is targeted at grades up to E** **Indicative scientific points may include:** **Sequence of change** • (low mass star) → red giant → white dwarf (→ black/brown dwarf) **Description of what happens as a <u>Main Sequence changes</u> to Red Giant** • **core** gets hotter • expands/swells (to become a red giant) • (surface/photosphere) cools • hydrogen (in core) runs out • mass decreases **Description of what happens as a <u>Red Giant changes</u> to a White Dwarf** • loses outer layers • cools • fades • shrinks • helium runs out • mass decreases **Nuclear reactions:** • fusion of hydrogen **in MS/ the Sun** • fusion of heavier elements (e.g He → C) **in RG** • fusion stops in **WD/Black Dwarf/Brown Dwarf** Use the L1, L2, L3 annotations in RM Assessor; do not use ticks.
			Total	6	

Question			Answer	Mark	Guidance
6	a		0.2 1	2	If no response in table check the graph
	b		(Yes) it has the larg**est**/bigg**est** diameter [1] it will collect the most light [1]	2	No mark for Yes/No. But, if 'No' 1 mark max. **Accept** it is the bigg**est** (lens) / has the larg**est** aperture **Accept** correct comparative size e.g it is big compared to all the others / it is bigger **Accept** it collects a lot of light **Ignore** more wavelengths/frequencies
	c		speed wavelength not bent	3	
			Total	**7**	

Question			Answer	Mark	Guidance
7*	a	i	background/fixed stars [1] star (to be measured) [1] Earth / planet / satellite / observer / eye [1] Sun [1]	4	**Accept** distant stars **accep**t closer star **Not** Sun **Not** Moon **Ignore** star
		ii	Clear indication of half the angle subtended by the Earth's orbit	1	**accept** equivalent angles e.g. the angle between a vertical line through the Earth and the adjacent light ray.
	b		1÷0.71 1.4 Parsec / pc	3	 correct numerical answer gains 2 marks **ignore** megaparsec/Mpc
			Total	**8**	

Question			Answer	Mark	Guidance
8*	a		idea of spreading cost [1] idea of sharing expertise / more scientists [1]	2	**Accept** more/sharing resources for 1 mark, if no other mark scored **Ignore** expertise in analysing results
	b	i	idea of non-scientists e.g. politicians/bureaucrats/administrators/officials/Head of (ESA) /Governments/EU.	1	**Not just** engineers/ESA **Ignore** NASA

Question			Answer	Mark	Guidance
8*		ii	**[Level 3]** States 3 advantages and 3 disadvantages. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **[Level 2]** States 2 advantages and 2 disadvantages. 3 and 0 = 3 marks. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **[Level 1]** States an advantage and a disadvantage. Quality of written communication impedes communication of the science at this level. (1 – 2 marks) **[Level 0]** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	6	**This question is targeted at grades up to C** **Indicative scientific points may include:** **advantages** • no atmospheric pollution • no light pollution • avoids atmospheric refraction • avoids atmospheric absorption • all parts of em spectrum available • new discoveries • shows beauty of science • collect more accurate/detailed data • national prestige • international cooperation • encourage support for science • clearer image **disadvantages** • cost of setting up • cost of maintenance • cost of repair • money could be used for better purposes e.g. hospitals etc. • pollution during take off • risk of accident during take off • very hazardous for astronauts • difficult working conditions (to maintain/repair/upgrade) **Ignore** incorrect statements **Do not accept** space telescopes are closer to observed stars **Use the L1, L2, L3 annotations in RM Assessor; do not use ticks.**
			Total	**9**	

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