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 2017

OCR (Oxford Cambridge and RSA) is a leading UK awarding body, providing a wide range of qualifications to meet the needs of candidates of all ages and abilities. OCR qualifications include AS/A Levels, Diplomas, GCSEs, Cambridge Nationals, Cambridge Technicals, Functional Skills, Key Skills, Entry Level qualifications, NVQs and vocational qualifications in areas such as IT, business, languages, teaching/training, administration and secretarial skills.

It is also responsible for developing new specifications to meet national requirements and the needs of students and teachers. OCR is a not-for-profit organisation; any surplus made is invested back into the establishment to help towards the development of qualifications and support, which keep pace with the changing needs of today's society.

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.

OCR will not enter into any discussion or correspondence in connection with this mark scheme.

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

Available in RM Assessor to annotate scripts

	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

R	reject
✓	correct response
≈	draw attention to particular part of candidate's response
^	information omitted

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**

MARK SCHEME:

Question			Answer	Mark	Guidance
1			**[Level 3]** Detailed diagram **and** states and explains reasons for using mirrors Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **[Level 2]** Simple diagram **AND either** states and explains one reason **or** states reasons for using mirrors **OR** detailed diagram **and** states a reason for using mirrors Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **[Level 1]** Simple diagram **or** explains one reason for using mirrors **or** states reasons for using mirrors **OR** attempts diagram e.g identifies a lens **and** states a reason 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 diagram of optical telescope** • two lenses • parallel rays refract through first lens and converge in front of second lens **Simple diagram of optical telescope** • one lens • parallel rays refract through lens **Reasons *and explanations* for using mirrors** are/can be made much larger - *to collect more light / clearer image* - *to see more distant/dimmer objects* - *as they have less weight* use concave mirrors - *reflect light to a focal point* mirror can be supported / mirror weighs less - *so can be made much larger* cheaper - *because easier to make/repair* better/clearer image - *they collect more light* - *can be highly polished* - *reflect all colours the same* - *glass absorbs some light / splits colours* **Use the L1, L2, L3 annotations in RM Assessor; do not use ticks.**

Question			Answer	Mark	Guidance
2	a		Sun (1) parallax angle (1)	**2**	
	b	i	decreases	**1**	
		ii	50 (1) parsecs/pc (1)	**2**	
	c	i	Planets move (against the fixed stars)	**1**	**allow** planets orbit / rotate around the sun **not just** planets rotate/rotated
		ii	(Too far away) the parallax angle is too small to measure	**1**	
	d		Any two from: Cepheid variables / standard candles (apparent) brightness/intensity and luminosity/actual brightness Hubble's law	**2**	**allow** other possible answers e.g. radar (for planets) **allow** two marks for idea of using apparent brightness and Cepheid variables **allow** 'relative brightness' **allow** red shift (of galaxies)
3	a	i	280 (kpc) (1) It is very different/much less than the other (values) (1)	**2**	**allow** it is outside the 750 to 810 range / e.g. it is more than 400 below/too far from next value / it doesn't fit in
		ii	excludes the outlier 280 (1) [810 + 750 +760 + 780 +800] / 5 (1) = 780 (kpc) (1)	**3**	**allow** all 3 marks for e.c.f using ai outlier correct numerical answer gains 3 marks. Allow 2 marks for 696 to 697 / 700 i.e. outlier not excluded
		iii	810 – 750 (1) 60 (kpc) (1)	**2**	correct numerical answer gains both marks **allow** for 1 mark (810 – 280 =) 530
3	b		**[Level 3]** Describes strands of the Curtis-Shapley debate **and**	**6**	**This question is targeted at grades up to E** **Indicative scientific points may include:**

Question			Answer	Mark	Guidance
			explains how scientists can draw different conclusions from data **and** states how Hubble's measurement was used Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **[Level 2]** Describes strands of the Curtis-Shapley debate **AND either** explains how scientists can draw different conclusions from data **or** states how Hubble's measurement was used Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **[Level 1]** Describes a strand of the Curtis-Shapley debate **or** explains how scientists can draw different conclusions from data **or** states how Hubble's measurement was used 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)		**Curtis-Shapley debate** • the debate was about the nature of the nebula / 'fuzzy objects' • nebula small vs large • nebula is inside our galaxy vs outside our galaxy • nebula is nearby vs very distant • nebula is a galaxy (C) vs nebula is a gas cloud (S) • universe is one galaxy (S) vs many galaxies (C) • location of the Sun (centre vs edge of our galaxy) **Different conclusions** • they tried to make the data fit their different theories • neither totally correct / both partially correct • incomplete evidence • used/influenced by other scientist's theories • different interpretations (of same data) **How Hubble's measurement was used** • used Cepheid variables • showed nebula was very large / too distant to be inside Milky Way • showed nebula (Andromeda) was a galaxy / outside the Milky Way • led to acceptance that there are many galaxies Ignore any mixing up of what was said by Curtis and Shapley **Use the L1, L2, L3 annotations in RM Assessor; do not use ticks.**
				6	
4	a	i	4	**1**	

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Mark</th><th>Guidance</th></tr>
<tr><td></td><td></td><td>ii</td><td>positron</td><td>1</td><td>allow anti-electron / positive electron</td></tr>
<tr><td></td><td></td><td>iii</td><td>gamma radiation</td><td>1</td><td></td></tr>
<tr><td></td><td></td><td>iv</td><td>convection (1) radiation (1)

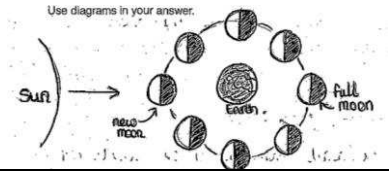
radiation (1)</td><td>3</td><td>Either order</td></tr>
<tr><td></td><td>b</td><td>i</td><td>Line or area from top left to bottom right</td><td>1</td><td></td></tr>
<tr><td></td><td></td><td>ii</td><td><table><tr><td>It will turn into a supernova and then a black hole.</td><td></td></tr><tr><td>It will turn into a red giant and then a white dwarf</td><td>✓</td></tr><tr><td>It will turn into a red giant and then a neutron star</td><td></td></tr><tr><td>It will turn into a supergiant star and then into a supernova</td><td></td></tr></table></td><td>1</td><td></td></tr>
<tr><td></td><td></td><td>iii</td><td>any 2 from
Carbon / C
Nitrogen / N
Oxygen / O</td><td>2</td><td></td></tr>
<tr><td>5</td><td>a</td><td></td><td>(Yes there is a correlation because…)
pressure increases as temperature increases / positive (correlation) / proportional (1)

(constant =) 4 (1)

States that they are equal / they are 4 (1)</td><td>3</td><td>

check the table of results for calculations (mp2 and 3 may be gained here
allow 0.25
ignore units
allow ‘they are all 4’ / ’they are all 0.25’ gains mp2 also</td></tr>
</table>

Question			Answer	Mark	Guidance
	b		310 – 273 37 (^{o}C)	**2**	 Correct numerical answer gains 2 marks **allow** for 1 mark: 583 or -37 or 273 seen
6*			**[Level 3]** Correctly calculates cost of space telescope and compares to land based telescope **and** discusses infra-red absorption in atmosphere **and** considers another factor. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **[Level 2]** Uses an incomplete calculation, or quotes a number to compare costs of space and mountain telescopes **AND either** discusses infra-red absorption in atmosphere **or** considers another factor. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **[Level 1]** Compares costs of space and mountain telescopes **or** discusses infra-red absorption in atmosphere **or** considers another factor. 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:** **cost** space telescope: • launch = 80 x 6.5 = 520 million • Add costs = 3500 + 4000 + 520 million = 8020 million ~8000 million land based telescope: • = 1100 million • land based is 6920m cheaper **infra-red absorption** • No absorption in space • Dry conditions on mountain minimises absorption **other factor** • Quality of image/data • refraction of atmosphere • no atmospheric pollution or light pollution • cost of maintenance and repairing • uncertainties of space programme • environmental impact • working conditions for employees **Use the L1, L2, L3 annotations in RM Assessor; do not use ticks.**

Question			Answer	Mark	Guidance
7*	a		angles	1	
	b		Arcs of circle for stars (1) Attempts to show centered on pole star (1) Pole star no line (provide at least one line drawn elsewhere) (1) Arc is 90 degrees (1)	4	
	c		Planets (1) Backwards (1) stars (1)	3	
	d		Describes relative position for Sun, Moon and Earth for at least two phases (1) Identifies illuminated part of Moon is due to (reflected) sunlight / part of Moon away from Sun is in shadow/dark (1) Identifies cycle based on Moon's orbit (of Earth**)** / Moon orbits Earth (1)	3	 **allow** e.g ..... as observed **ignore** other phases around the Earth **allow** e.g 'sun lights up the parts we see' All three marking points may be obtained from a diagram **e.g** 

* Overlap

OCR (Oxford Cambridge and RSA Examinations)
1 Hills Road
Cambridge
CB1 2EU

OCR Customer Contact Centre

Education and Learning
Telephone: 01223 553998
Facsimile: 01223 552627
Email: general.qualifications@ocr.org.uk

www.ocr.org.uk

For staff training purposes and as part of our quality assurance programme your call may be recorded or monitored

Oxford Cambridge and RSA Examinations
is a Company Limited by Guarantee
Registered in England
Registered Office; 1 Hills Road, Cambridge, CB1 2EU
Registered Company Number: 3484466
OCR is an exempt Charity

OCR (Oxford Cambridge and RSA Examinations)
Head office
Telephone: 01223 552552
Facsimile: 01223 552553