OCR
Oxford Cambridge and RSA

GCSE

Physics A

Unit **A181/02:** Unit 1 – Modules P1, P2, P3 (Higher 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.

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 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
	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.	Put ticks (✓) in the two correct boxes.	Put ticks (✓) in the two correct boxes.
☐	☐	☒
☐	☐	☒
☒	☑	☑
☒	☒	☑
☐	☐	☐
This would be worth 1 mark.	This would be worth 0 marks.	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: overlap with A181/01 shown by shading in column 3

Question			Answer	Mark	Guidance
1			**(Level 3)** Partial but essentially correct description of formation of sedimentary rocks **and** identifies the presence on the diagram of many layers /different types of rock, linked to formation over a long time. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **(Level 2)** **Either** a partial but essentially correct description of formation of sedimentary rocks **or** identifies the presence on the diagram of many layers /different types of rock, linked to formation over a long time. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **(Level 1)** **Either** a superficial description of structure of sedimentary rocks e.g. layers **or** describes one relevant feature of the diagram, possibly without consideration of time taken. 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:** **formation of sedimentary rocks** • rock formed in layers of sediment/mud/rock • new layers on top of older ones • weathering/erosion of rocks • layers of sediment in seas/lakes • pressure from above compacts layers into a rock **how the diagram supports Hutton's theory** • layers on top of layers • laid down over a long time • red sandstone more recent than grey sandstone • red sandstone in horizontal layers (as laid down) • grey sandstone layers almost vertical • red sandstone layers are more regular (undisturbed) • top of grey sandstone shows weathering • grey sandstone layers very distorted / rotated / bent (by movements in the Earth) • difference in colouration of stone is evidence of changes with time **Use the L1, L2, L3 annotations in Assessor; do not use ticks.**
			Total	**6**	

Question			Answer	Mark	Guidance
2	a	i	Speed = 8 (km/s)	1	
		ii	Time is 12.5s + 12.5s = 25s (1); Speed = 100 km / 25s = 4 (km/s) (1)	2	4 km/s without working = 2 marks 8 km/s = 1 mark
	b	i	All places 100 km from A are on this circle (1); Trace/equipment doesn't tell you the direction waves came from (1)	2	e.g. Because the 'quake happened 100 km away/trace tells you how far away the 'quake was (1) e.g. could have come from any direction/waves travel in all directions Must have idea of direction for m.p.2
	b	ii	X equidistant from B and A (1); on dotted circle (1)	2	Assessor overlay. Candidates who correctly choose both possible locations would get both marks.
			Total	7	
3	a		(0.74" is a very) small angle (1); so 'to scale' drawing would have to extend a long way to the right/ too thin to draw as a triangle/ *R* would be extremely tiny (1)	2	Accept 'R is much less than 4.4 light years ORA'.
	b	i	8.8 (light years)	1	
	b	ii	(22 l.y. = 22/4.4 =) 5 times further away than α Cen / k = 3.256 (1) parallax angle is 5× smaller = 0.74"/5 = 0.148 / 0.15 (seconds of arc) (1)	2	**Accept** use of $d = k/\theta$ where $k = 3.256$ Attempts to use a valid approach to solve inverse proportion, i.e. • Equating angle to (constant)/ distance • Finding ratio of distances and realising ratio of angle is the same (inverted) but makes error (1) Correct evaluation gets (2) even if working absent/confused/ contradictory
	c		Long way away (so cannot send a probe) /long time to get there (1) need to get all information from light from planet (1) very little light reaches us from a faint planet /telescopes not powerful enough (1) overwhelmed by light from star itself (1)	2	Any two e.g 'not visible enough through a telescope'
			Total	7	
4	a		1st & 3rd boxes (absorbs IR, Earth emits..)	2	
	b		SR, not, SR, not, not	3	all correct = 3; 4 correct = 2; 3 correct = 1
			Total	5	

Question			Answer	Mark	Guidance
5			**(Level 3)** Explains why illumination must not be too low. Correctly explains the decrease of light intensity with distance. Correctly calculates power of lamp. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **(Level 2)** Two of: explains why illumination must not be too low. Correctly explains the decrease of light intensity with distance. Correctly calculates power of lamp. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **(Level 1)** One of: explains why illumination must not be too low. Correctly explains the decrease of light intensity with distance. Correctly calculates power of lamp. 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 A*** **Indicative scientific points related to official regulations may include:** • low light levels could cause eyestrain • low light levels could result in errors • low light levels could result in accidents to staff • Allow, at L1 only, an interpretation of 'require a minimum' as meaning 'intensity should be as low as possible'. **Indicative scientific points related to variation of intensity with distance may include:** • light spreads out as it travels • area illuminated increases with distance /inverse square law • intensity is power (photons) per unit area • absorption of light by air **Indicative scientific points related to calculation may include:** • rearranges equation • substitutes correct values for intensity (150 lux) and distance (6.4m) • correct answer = 307.2 W = 310 W • accept using 2-D diagram $\Rightarrow d = 5$ m & $P = 190$ W • Allow, at L1 & L2, partial credit in this area for a calculation with one error only; e.g. 48 W (not squaring 6.4 m) or 180 W (using 3mx8m instead of $6.4m^2$) **Use the L1, L2, L3 annotations in Assessor; do not use ticks.**
			Total	**6**	

Question			Answer	Mark	Guidance
6	a		boxes 1(short $\lambda \Rightarrow$ high f) and 3 ($E \propto f$)	2	one mark each
	b		they are ionising radiations/can cause ionisation (1); (ionisation) removes electrons (from atoms/molecules) (1); (ionisation) results in chemical reactions /damage DNA/ cause mutations (1)	3	Ignore 'gives you cancer'
			Total	5	
7			Digital, Both, Both, Digital, Analogue	4	all correct = 4, four correct = 3, three correct = 2, two correct =1 (i.e. each error loses one mark)
			Total	4	
8	a		230 V x 2.5 A (1); = 575 (W)(1)	2	575 with no working gets both marks
	b		600 W × (5 × 60 s) (1); = 180 000 (J) (1)	2	3000 J = 1 mark 180 000 / 180 k / 0.18 M with no working gets both marks
	c		0.6 kW x (5/60) h (1); = 0.05 (kWh) (1)	2	Accept for 1 mark answer with just 1 error in conversion W $\Rightarrow$ kW or min $\Rightarrow$h for 1 mark, e.g. 3, 5 or 50 3000 kWh gets no marks accept intermediate rounding 5/60 = 0.083 h $\Rightarrow$ 0.048 (kWh) 0.05 with no working gets both marks
			Total	6	
9	a		C, A, B	2	all correct = 2, two correct = 1
	b		C, B, A	2	all correct = 2, one correct = 1 unless same answer given to all which =0 may write words, i.e. Uranium Gas Coal
			Total	4	
10	a		irradiation only (1); both (1)	2	
	b		irradiation means no physical contact with source/ contamination means physical contact with source(1); so exposed for less time with irradiation (1); irradiation can be screened off/can move away from source (1)	2	Any two **accept** examples e.g. lead screens ORA for mp2 & mp3
			Total	4	

Question			Answer	Mark	Guidance
11			**(Level 3)** Discussion of both sustainability and environmental effects. The answer should also address the consequences of population change marked (P) in the guidance column. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **(Level 2)** Both sustainability and environmental effects discussed or a discussion of one area with treatment of population (P) issues. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **(Level 1)** Either sustainability or environmental effects discussed. 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)		**This question is targeted at grades up to A*** **Indicative scientific points related to sustainability may include:** • more fossil fuels (and uranium) are used • primary fuels are running out • fuel may need transporting large distances • alternative energy sources cannot supply enough energy • alternative energy sources reduce demand from conventional power stations • (P) increased population ⇒ **greater rate** of depletion/use of resources • (P) more power stations needed • (P) the pattern of distribution of energy within countries will change • (P) population movement will change energy demand in cities **Indicative scientific points related to environmental effects may include:** • fossil fuels produce CO_2/ greenhouse gas • consequences of resulting climate change/global warming • nuclear power station produce radioactive waste • wind farms/solar farms/biofuel plants are often considered unsightly or displace other land use • (P) (greatly) increased energy use will **accelerate** climate change/global warming • (P) movement to cities will involve greater transportation of primary fuels / electrical distribution **Use the L1, L2, L3 annotations in Assessor; do not use ticks.**
			Total	**6**	

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

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