

Physics A

General Certificate of Secondary Education

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

Mark Scheme for June 2012

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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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Any enquiries about publications should be addressed to:

OCR Publications
PO Box 5050
Annesley
NOTTINGHAM
NG15 0DL

Telephone: 0870 770 6622
Facsimile: 01223 552610
E-mail: publications@ocr.org.uk

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:

	indicate uncertainty or ambiguity
	benefit of doubt
	contradiction
	incorrect response
	error carried forward
	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. Accept any clear, unambiguous response (including mis-spellings of scientific terms if they are *phonetically* correct, but always check the guidance column for exclusions).
- 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 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.*

- 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-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:
- i. **Read through the whole answer from start to finish**
 - ii. **Decide the level that best fits** the answer – match the quality of the answer to the closest level descriptor
 - iii. **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

- iv. 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	Mark	Guidance
1	(a)	10 cm/year	1	
	(b)	(i)	1	do not accept positive / negative but allow positive negative magnetic anomalies
		(ii)	4	accept 'poles change' 'Earth's poles move' is insufficient allow 'as it becomes rock'
		(iii)	2	
			Total	8

Question			Answer	Mark	Guidance
2	(a)	(i)	(C) given, no credit A or B (1) D (1) B (1) A (1) if previous letter was D allow F for one mark C (1)	5	in order
		(ii)	1010001010	1	
	(b)		B	1	
			Total	7	

Question		Answer	Mark	Guidance										
3	(a)	8200 + 2012 - 185 10027	2	correct numerical answer gains 2 marks allow 1 mark for 1827 presented as the answer										
	(b)	<table border="1"> <tr> <td>Distant galaxies are moving away from us.</td> <td>✓</td> </tr> <tr> <td>Galaxies contain a maximum of 100000 stars.</td> <td></td> </tr> <tr> <td>The distances to galaxies are known very accurately.</td> <td></td> </tr> <tr> <td>The most distant galaxies move away from the Earth at the slowest speed.</td> <td></td> </tr> <tr> <td>The movement of galaxies suggests the Universe is expanding.</td> <td>✓</td> </tr> </table>	Distant galaxies are moving away from us.	✓	Galaxies contain a maximum of 100000 stars.		The distances to galaxies are known very accurately.		The most distant galaxies move away from the Earth at the slowest speed.		The movement of galaxies suggests the Universe is expanding.	✓	2	
Distant galaxies are moving away from us.	✓													
Galaxies contain a maximum of 100000 stars.														
The distances to galaxies are known very accurately.														
The most distant galaxies move away from the Earth at the slowest speed.														
The movement of galaxies suggests the Universe is expanding.	✓													
	(c)	helium (1) hydrogen (1)	2											

Question	Answer	Mark	Guidance
3 (d)	<p>[Level 3] Quantitative evaluation of data. Conclusions are valid based on the information. Recognises limitations of current technology in suggesting solutions. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks)</p> <p>[Level 2] Some appropriate reference to quantitative data. Conclusions are based on the information. May not recognise limitations of current technology in suggested solutions. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks)</p> <p>[Level 1] Little evaluation of information. Suggestions have little basis in what is possible. May be limited to just one aspect. Quality of written communication impedes communication of the science at this level. (1 – 2 marks)</p> <p>[Level 0] Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)</p>	6	<p>This question is targeted at grades up to A/A*</p> <p>Indicative scientific points at Level 3 may include:</p> <ul style="list-style-type: none"> • very little we could do with current technology • quantifies warning time 1 year min- 3.3 years max • assess all the stars closer than 30 light years, and see if they will turn into supernova • no warning of gamma rays • suggest there is little the government can do to protect life on Earth, so there is no point in spending money on investigating such a small risk <p>Indicative scientific points at Level 2 may include:</p> <ul style="list-style-type: none"> • quantifies risk - 1 in 250 000 000 chance per year • consequence/hazard is very severe • time from gamma ray arrival to shock wave short • governments could spend money on research to find out methods to reduce harm or assess risk • any precautions will be very expensive <p>Indicative scientific points at Level 1 may include:</p> <ul style="list-style-type: none"> • probability is very low • hence risk is very low • gamma is recognised as a risk • build shields in space • build underground shelters • government should tell everybody about the risks <p>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</p>
	Total	12	

Question	Answer	Mark	Guidance
4	<p>[Level 3] Correct explanation using the photon model and correct explanation using the general model. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks)</p> <p>[Level 2] Relevant attempt to use photon model explanation, but may contain errors and relevant attempt to use general model explanation, but may contain errors OR may give a correct explanation using the photon model only or may give a correct explanation using the general model only. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks)</p> <p>[Level 1] Describes photon model and general model but does not explain the situation. Quality of written communication impedes communication of the science at this level. (1 – 2 marks)</p> <p>[Level 0] Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)</p>	6	<p>This question is targeted at grades up to A</p> <p>Indicative scientific points may include:</p> <ul style="list-style-type: none"> • emitted by radiator • travels through air • absorbed by hand • temperature detector in hand • infrared radiation • intensity decreases with distance <ul style="list-style-type: none"> • photons are packets of energy • energy per photon the same • fewer photons reach the hand • less energy means lower temperature • some absorbed by air <p>accept idea of photons spread out</p> <p>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</p>
	Total	6	

Question		Answer	Mark	Guidance	
5	(a)	Ozone absorbs some UV radiation in the Earth's atmosphere.		3	
		Carbon dioxide absorbs some radiation in the Earth's atmosphere.	✓		
		The atmosphere reflects radiation from the Sun.			
		The Earth emits radiation at a lower principal frequency than it absorbs.	✓		
		Ultraviolet radiation comes from the Sun.			
		The principal frequency of radiation emitted from the Earth decreases with its temperature.			
		Radiation absorbed by the atmosphere may be radiated towards the Earth.	✓		
	(b)	combustion of trees produces carbon dioxide (1) (less) trees means (less) photosynthesis (1) (photosynthesis) removes carbon dioxide from atmosphere (1)	3	accept no trees ORA	
		Total	6		

Question		Answer	Mark	Guidance
6	(a)	steam (1) turbine (1) voltage (1)	3	ignore water vapour allow volts / potential difference / p.d.
	(b)	nuclear (fuel) / plutonium / uranium	1	do not accept 'nuclear energy' , 'nuclear power' or 'nuclear reactor'
		Total	4	

Question		Answer	Mark	Guidance
7	(a)	idea of not running out OR can be replaced within a lifetime/reasonably quickly	1	do not accept can be used again/re-used/is infinite
	(b)	8 (m/s) (1) the generator will work (as the wave speed is lower than 10m/s) (1)	2	second mark is ecf to be consistent with numerical answer an explicit link to the numerical answer is required e.g. at a minimum 'so it works'
	(c) (i)	wave energy = 8250(kJ) AND electrical energy = 750(kJ); (1) wasted energy = 7500(kJ); (1)	2	
	(ii)	efficiency = useful energy output x100/energy input OR efficiency =750 x 100 ÷ 8250 9(.09...)	2	correct numerical answer gains 2 marks allow 1 mark for 0.09
	(d) (i)	idea of power x time e.g. 750 x 24 (1) OR 750,000 x 24 x 60 x 60 or 64,800,000,000 (1) 18,000 (1)	2	accept errors in units e.g. 750 x 24 x 60 x 60 correct numerical answer gains 2 marks allow correct unit match to numerical answer (18) MWhr / (18,000,000) Whr OR (64,800,000,000) J/(64,800) MJ/(64,800,000) kJ
	(ii)	(current = power÷voltage or 900 000 ÷ 11,000) (maximum power = 100 x 11000) 82 A OR 1100 kW; (1) these cables are suitable because the current (82A) is less than the maximum current (100A) / the maximum power (1100kW) is greater than the output (900kW); (1)	2	allow ecf from <u>calculation</u> of current or power an explicit link to the numerical answer is required e.g. at a minimum 'therefore the cables are suitable', when the calculation is clear
Total			11	

Question	Answer	Mark	Guidance
8	<p>[Level 3] At least 3 energy sources are considered. They are discussed in the context of the island situation with well justified appropriate suggestions. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks)</p> <p>[Level 2] At least 2 energy sources considered. At least one justification for the use of a source and one against the use of a source is suggested. Some suggestions are clearly in the context of the island. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks)</p> <p>[Level 1] At least 2 energy sources considered with generic justifications. Answer may be simplistic. Suggestions are not particularly related to island context. Quality of written communication impedes communication of the science at this level. (1 – 2 marks)</p> <p>[Level 0] Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)</p>	6	<p>This question is targeted at grades up to C allow other energy sources e.g. solar, geothermal note any justifications must be reasonable Indicative scientific points may include:</p> <ul style="list-style-type: none"> • hydro - no evidence to say whether possible or not • all oil is imported, this is expensive but system already in place • wind can be installed offshore - (option being developed by Falkland Islands) • waves/tidal should be possible on an island • nuclear possible <p>possible advantages</p> <ul style="list-style-type: none"> • oil - high energy density/already established • wind - little environmental cost/renewable • waves/tidal - little environmental cost/renewable • nuclear - well established technology/small amounts of fuel needed • comparison of running costs of renewable (cheap) and expensive for fuel-using methods <p>possible disadvantages</p> <ul style="list-style-type: none"> • oil - high cost/CO₂ pollution/environmental consequences • wind - high set up costs • waves/tidal - technology still undeveloped/high set up costs • nuclear - safety issues/disposal of radioactive waste - very high set up costs • peat is being used up quickly and should be reduced for a small island <p>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</p>
		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

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