OCR
RECOGNISING ACHIEVEMENT

GCSE

Physics A

General Certificate of Secondary Education

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

Mark Scheme for January 2013

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	credit alternative wording / or words to that effect
ORA	or reverse argument

Available in scoris to annotate scripts:

	indicate uncertainty or ambiguity
BOD	benefit of doubt
CON	contradiction
	incorrect response
ECF	error carried forward
	draw attention to particular part of candidate's response
NBOD	no benefit of doubt
R	reject
	correct response

L1 , L2 , L3	indicate level awarded for a question marked by level of 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 <u>and</u> 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 <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**

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

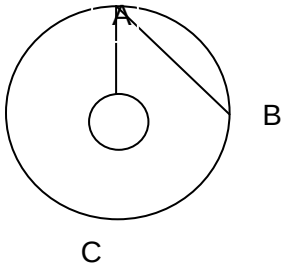
   iv. Use the **L1**, **L2**, **L3** annotations in Scoris to show your decision; do not use ticks.

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	Marks	Guidance
1			**[Level 3]** Considers both sides of the argument, gives 2 or more examples of Wegener's evidence and 2 or more reasons against accepting. Links this is to a conclusion. **Must** have a conclusion. No errors. Quality of written communication does not impede communication of the science at this level. . (5–6 marks) **[Level 2]** Considers both sides of the argument, gives at least one example of Wegener's evidence and a reason against accepting. There is a conclusion. May have some errors. Quality of written communication partly impedes communication of the science at this level. (3–4 marks) **[Level 1]** Only presents one side of the argument, with 2 examples. 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** **Relevant points include:** **Note:** candidates may say that Wegener's idea should have been accepted, should not have been accepted or that they cannot say, as long as their conclusion matches the data presented **Evidence for** • geometric fit of continents • matching fossils on different continents • matching rocks on different continents • provided an explanation for mountain formation. **Reasons for rejection** • movement of continents not detectable • too big an idea from limited evidence • simpler explanations for the same evidence e.g. land bridges • Wegener an outsider to the community of geologists / not a geologist / was a meterologist. • no mechanism to explain movement was known. **example errors** • movement in mantle provides mechanism for continental movement • Wegener had no evidence • Any reference to tectonic plates in wrong context. • any reference to sea floor spreading in wrong context **ignore** Wegner was not a <u>scientist</u> **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**
			Total	**6**	

Question			Answer	Marks	Guidance
2	(a)	(i)	redshift	1	
		(ii)	Bootes = 0.131 (1) Hydra = 61200 (1)	2	
	(b)	(i)	990 million (years) (1)	1	
		(ii)	Idea that it takes time for the light to reach us (1)	1	
		(iii)	speed = 0.051 light years / year **and** time = 990 million years (1) distance = 0.051 lty/y x 990 My = 50.5 (Mly) (1) new distance = 990 Mly + 50.5 Mly = 1040 (.5) (Mly) (1)	3	correct selection of values **allow** 2 marks for 50.5 (Mly) correct numerical answer gains 3 marks **allow** 3 marks for correct answer in km, 9.8×10^{15} km higher level answers taking into account the expansion of the universe should gain full credit SSU
		(iv)	*any two from:* space is expanding (1) as the galaxy moves away its speed is greater / accelerate (1) answer assumes galaxy was moving at constant speed / does not take account of change in speed (1)	2	 **accept** universe / galaxies expanding **ignore** other galaxies are moving away
			Total	**10**	

Question			Answer	Marks	Guidance
3	(a)	(i)	line from surface near A to surface near B **and** line starting near A going towards C, but stopping at the edge of the core near A.  	1	Both lines needed for the mark **accept** wavy lines **ignore** correct additional lines
		(ii)	<table><tr><td>P-waves cannot be detected at C.</td><td></td></tr><tr><td>The distance from A to B can be calculated just using P waves.</td><td></td></tr><tr><td>At B,P-waves are detected before S waves.</td><td>✓</td></tr><tr><td>P-waves transfer energy and transmit matter from A to B.</td><td></td></tr><tr><td>P-wave vibrations are perpendicular to their direction of motion.</td><td></td></tr><tr><td>P-wave frequencies are inversely proportional to their wavelength .</td><td>✓</td></tr></table>	2	
	(b)		plates (causes rocks to) move/rub against each other / release of stress in/between plates (1) Shows awareness of the longitudinal motion (of a P-wave) e.g. involve compression/forwards and backwards movement/ pressure wave (1)	2	Must be an interaction between plates
			Total	**5**	

Question			Answer	Marks	Guidance
4			**[Level 3]** More detailed description of the nature of digital signals (e.g frequencies/voltages) **and** a description of the reduction of transmission interference **and** processing/storage by computer **and** a correct explanation of one. Quality of written communication does not impede communication of the science at this level. (5–6 marks) **[Level 2]** Describes the nature of digital signals (e.g.0/1) **and** a description of the reduction of transmission interference **and** processing/storage by computer **and** attempts an explanation of one these. Quality of written communication partly impedes communication of the science at this level. (3–4 marks) **[Level 1]** Refers to two of reducing transmission interference, processing/storage by computer or nature of digital signals (e.g.0/1). 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*** **Relevant points might include** **Nature of digital signals** • digital signals as 0s and 1s/off and on • 0/1s are different voltages/ frequencies / pulses **Reduction of transmission interference** • digital signals decoded to give original image or sound • all signals pick up noise/interference during transmission • in a digital signal the noise is usually less than the difference between 0 and 1 • this allows the original digital signal to be recovered despite the interference **Processing/storage by computer** • encoding of images or sounds as digital signals • digital information can be stored by computers/memory • digital information can be processed by computers. **accept** arguments based on greater transmission rates available (due to compression/bandwidth/multiplexing) eg, more channels possible.
			Total	**6**	

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>5</td><td>(a)</td><td></td><td>graph shows (rapid) increase in CO_2 (1);

human activity increased (around this time) / industrial revolution/more factories / population increase /(1);

hence <u>correlation</u> (1);

Use of fossil fuels /deforestation (produces CO_2) (1);</td><td>4</td><td>do not accept increase before 1750

ignore named examples of human/industrial activity e.g. more cars / more technology

must have described graph AND history of human activity for this mark

ignore breathing out CO_2</td></tr>
<tr><td></td><td>(b)</td><td></td><td><table><tr><td>A cause for the melting icecaps.</td><td></td></tr><tr><td>A correlation between global temperatures and atmospheric carbon dioxide levels.</td><td>✓</td></tr><tr><td>A correlation between global temperatures and sea levels.</td><td></td></tr><tr><td>A mechanism linking atmospheric carbon dioxide and global warming.</td><td>✓</td></tr><tr><td>A mechanism linking plant growth and carbon dioxide.</td><td></td></tr></table></td><td>2</td><td></td></tr>
<tr><td></td><td>(c)</td><td></td><td>any two from:

idea that risk far in future / individual will not be affected; (1)

idea of keeping current lifestyle / idea of benefits outweighing risk (in the short term); (1)

belief that risk is not high; (1)

idea that they can make no difference/very small effect; (1)

somebody else's job eg, the government; (1)</td><td>2</td><td>accept examples of modern conveniences e.g. cars</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>8</td><td></td></tr>
</table>

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>6</td><td>(a)</td><td></td><td>emitted by source/heater

e.m. radiation transmitted by atmosphere/between source and water/beaker

absorbed by water/beaker</td><td>2</td><td>3 correct = 2 marks
2 correct = 1 mark
0 or 1 correct = 0 marks
accept photons for em radiation
accept transmitted through beaker

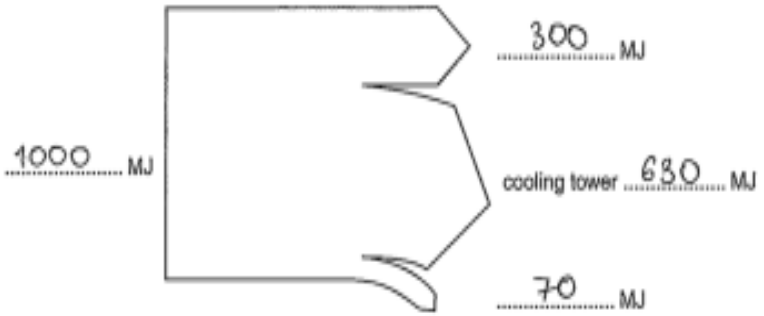
do not accept absorbed by temperature sensor</td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td><table><tr><td>Increase the energy of the photons.</td><td>✓</td></tr><tr><td>Decrease the frequency of radiation.</td><td></td></tr><tr><td>Increase the temperature of the water.</td><td></td></tr><tr><td>Decrease the number of photons in the radiation.</td><td></td></tr><tr><td>Decrease the wavelength of the radiation.</td><td>✓</td></tr></table></td><td>2</td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td>any two from:

increasing distance decrease intensity/radiation / decreasing distance increases intensity/radiation (1)

idea of radiation/photons spreading out over larger area (1)

some radiation/photons absorbed (by air) (1)</td><td>2</td><td>

ignore absorbed by other objects/things</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>6</td><td></td></tr>
</table>

Question			Answer	Marks	Guidance
7	(a)	(i)	 cooling tower – 630 as second label down on right (1) **max** 2 marks (coal) 1000 (MJ) (electricity) 300 (MJ) (wasted in friction) 70 (MJ)	1 2	3 correct = 2 marks 2 correct = 1 mark 0 or 1 correct = 0 marks
		(ii)	30	1	**do not accept** 0.3
	(b)		<table><tr><td>Biofuel</td><td></td></tr><tr><td>Nuclear</td><td></td></tr><tr><td>Oil</td><td></td></tr><tr><td>Solar</td><td></td></tr><tr><td>Wind</td><td>✓</td></tr><tr><td>Wave</td><td>✓</td></tr></table>	1	requires both ticks for one mark

Question	Answer	Marks	Guidance
(c)		2	

Contamination results in a long period of exposure to radiation.	✓
Contamination causes cancer, irradiation just damages cells.	
Ionising radiation causes contamination.	
Exposure to radiation from an external sources is Irradiation.	✓
Protective clothing mainly protects from irradiation.	

			Total	**7**	

Question			Answer	Marks	Guidance
8	(a)		3 (s)	1	
	(b)	(i)	**C**	1	
		(ii)	(**A** or **C** has) the highest power / the fastest energy transfer (1) **A** only has a capacity of 0.5 litres, so would have to be filled which would add extra <u>time</u> so more time than **C** (1)	2	No mark if answer to bi is **B** or **D**
	(c)		1500 / 230 6.5 (A)	2	**ignore** extra sig figs correct numerical answer gains both marks **allow** 1 mark for 1.5 / 230 or 0.0065
			Total	**6**	

Question			Answer	Marks	Guidance
9			**[Level 3]** Considers a wide range of factors [at least 4] with 2 examples. **Must include** an idea of comparing/balancing these factors. Quality of written communication does not impede communication of the science at this level. (5–6 marks) **[Level 2]** list some factors [at least 3], include an example or gives context. Quality of written communication partly impedes communication of the science at this level. (3–4 marks) **[Level 1]** Lists simple factors [at least 3], little or no context. 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*** **Relevant points include:** **Indicative of L3** • ever increasing demand • long term economics/budgeting/decommissioning • managing waste/balance of costs • role of government in setting regulations • need for a mix of sources **Indicative of L2** • alternatives to building new supplies eg, reducing demand • building costs • waste defined • role of government in setting policy • to ensure security of supply • carbon dioxide emissions **Indicative of L1** • environmental impact • cost • waste unqualified • pollution unqualified • use renewable resources **do not accept** government building power station/supplies **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**
			Total	**9**	

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