RECOGNISING ACHIEVEMENT

GCSE

Physics A

General Certificate of Secondary Education

Unit **A331/02:** 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.

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

Any enquiries about publications should be addressed to:

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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
	draw attention to particular part of candidate's response
	draw attention to particular part of candidate's response
NBOD	no benefit of doubt
R	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 <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.

<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>8200 + 2012 - 185(1)
= 10027 (years)(1)</td><td>2</td><td>raw 10027 (years) gets 2</td></tr>
<tr><td></td><td></td><td>(ii)</td><td><table>
<tr><td>It allows other astronomers to try and repeat the finding.</td><td>✓</td></tr>
<tr><td>The astronomers ' friends will be able to see their results.</td><td></td></tr>
<tr><td>It shows the astronomers are scientists.</td><td></td></tr>
<tr><td>The findings can be evaluated by other astronomers.</td><td>✓</td></tr>
<tr><td>Only astronomers are allowed to write articles for the journal.</td><td></td></tr>
</table></td><td>2</td><td></td></tr>
<tr><td></td><td>(b)</td><td></td><td><table>
<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 the slowest.</td><td></td></tr>
<tr><td>What we know about galaxies comes from the radiation from them.</td><td>✓</td></tr>
</table></td><td>2</td><td></td></tr>
<tr><td></td><td>(c)</td><td></td><td>helium (1)

hydrogen (1)</td><td>2</td><td></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>Mark</th><th>Guidance</th></tr>
<tr><td>2</td><td>(a)</td><td></td><td>10 cm/year</td><td>1</td><td></td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td><table><tr><td>The shape of the magnetic field.</td><td></td></tr><tr><td>The direction of magnetic field.</td><td>✓</td></tr><tr><td>The strength of magnetic field.</td><td></td></tr><tr><td>The type of magnetic field.</td><td></td></tr></table></td><td>1</td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td>Earth's magnetic field reverses(1)

plus any 3 from:
molten rock/magma rises (1)
at junction of tectonic plates/as the oceanic plates move apart(1)
magnetic field in rock is fixed as it cools (1)
new rock formed as older rocks move sideways(1)
as magnetic field reverses the new rock will record an opposite polarity to neighbouring rock(1)</td><td>4</td><td>allow Earths polarity reverses
ignore just ‘changes’ but allow ‘changes polarity’

accept older rock pushed out</td></tr>
<tr><td></td><td></td><td>(iii)</td><td><table><tr><td>Magnetism pushes the continents apart.</td><td></td></tr><tr><td>The magnetic patterns suggest that the seafloor spreads apart.</td><td>✓</td></tr><tr><td>Pattern shows continents fit together.</td><td></td></tr><tr><td>There is a correlation between the magnetic patterns and the depth of the rock layer.</td><td></td></tr><tr><td>Provides part of a mechanism for continental drift.</td><td>✓</td></tr></table></td><td>2</td><td></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>Mark</th><th>Guidance</th></tr>
<tr><td>3</td><td>(a)</td><td></td><td>
<table>
<tr><td>Ozone absorbs some radiation in the Earth's atmosphere.</td><td></td></tr>
<tr><td>Carbon dioxide absorbs some radiation in the Earth's atmosphere.</td><td>✓</td></tr>
<tr><td>The atmosphere reflects radiation from the Sun.</td><td></td></tr>
<tr><td>The Earth emits radiation at a lower frequency than it absorbs.</td><td>✓</td></tr>
<tr><td>Ultraviolet radiation comes from the Sun.</td><td></td></tr>
<tr><td>Gamma rays have very high energy photons.</td><td></td></tr>
<tr><td>Radiation absorbed by the atmosphere may be radiated towards the Earth.</td><td>✓</td></tr>
</table>
</td><td>3</td><td></td></tr>
<tr><td></td><td>(b)</td><td></td><td>
<table>
<tr><td>The number of photons reaching the Earth’s surface is less than the number leaving the Sun.</td><td>✓</td></tr>
<tr><td>Ionising radiation from the Sun breaks up molecules in the ozone layer.</td><td></td></tr>
<tr><td>The average energy of photons reaching the Earth is less than the average energy of photons leaving the Sun.</td><td></td></tr>
<tr><td>Most of the energy from the Sun is visible light, but some is in the microwave region of the spectrum.</td><td></td></tr>
<tr><td>X-rays and gamma rays from the Sun pass straight through the Earth.</td><td></td></tr>
<tr><td>The radiation from the Sun spreads out as it travels towards the Earth.</td><td>✓</td></tr>
<tr><td>Some radiation from the Sun is reflected from the Earth.</td><td>✓</td></tr>
</table>
</td><td>3</td><td></td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>6</td><td></td></tr>
</table>

Question			Answer	Mark	Guidance
4			radiation/light source/from is the Sun (1) radiation/light travels / transmits through air/space (1) reflects from the Moon (1) eyes/retina are light detectors / light absorbed by eyes/retina (1)	4	if light travels from Earth to Moon then maximum 2 marks **ignore** anything about street lighting and the countryside **do not allow** air between Sun and Moon and Earth **ignore** 'Moon absorbs the light' not just 'light reaches our eyes'
			Total	**4**	

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Mark</th><th>Guidance</th></tr>
<tr><td>5</td><td>(a)</td><td></td><td>
<table>
<tr><td>Ionising radiation can damage body cells.</td><td></td></tr>
<tr><td>Metals reflect microwaves.</td><td>✓</td></tr>
<tr><td>Microwaves heat up water molecules in body cells.</td><td>✓</td></tr>
<tr><td>Microwaves are ionising radiation.</td><td></td></tr>
<tr><td>Microwaves are also used by mobile phones.</td><td></td></tr>
<tr><td>When microwaves reflect from metal they become ultraviolet radiation.</td><td></td></tr>
</table>
</td><td>2</td><td></td></tr>
<tr><td></td><td>(b)</td><td></td><td>
<table>
<tr><td>infrared</td><td>✓</td></tr>
<tr><td>microwaves</td><td>✓</td></tr>
<tr><td>ultraviolet</td><td>✓</td></tr>
<tr><td>visible light</td><td>✓</td></tr>
</table>
</td><td>1</td><td>all four boxes must be ticked</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>3</td><td></td></tr>
</table>

Question			Answer	Mark	Guidance
6	(a)		**Kevin**: total flights = 52 x 2 x 2 = 208 208 x 0.1 mSv = 20.8 mSv compares to Josie's 20 mSv/Kevin has slightly bigger risk / risk about the same	3	credit for correct calculation of dose based on incorrect number of flights (i.e. candidate missed the return flight x2) penalise 1 mark (10.4 = 1 mark) penalise 1 mark for not having 52 weeks in a year **allow** weekly rates to be calculated but penalise each error by 1 mark credit a comparison that is based on an incorrect calculation even if it leads to Josie having a larger risk
	(b)		Kevin perceives Josie is more at risk because she works directly with radiation	1	answer must refer to either Kevin or Josie or their occupations **and** to perceived **and** actual risk Josie knows she works with radiation Kevin doesn't realise he is exposed to radiation
			Total	**4**	

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Mark</th><th>Guidance</th></tr>
<tr><td>7</td><td>(a)</td><td></td><td>idea of not running out OR can be replaced within a lifetime/reasonably quickly</td><td>1</td><td>do not accept can be used again/re-used 0 marks
‘sustainable’ needs further explanation
allow ‘does not use finite resources’</td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td>8250 kJ and 750 kJ (1)

7500 kJ (1)</td><td>2</td><td>maximum of 1 mark if no units, unit must occur in at least one box</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>calculation 750/8250 (X100) (1)

evaluation 0.09 or 9(%) (1)</td><td>2</td><td>correct answer with no working scores 2
allow 9.1% or 0.091
0.09% 1 max, 1/11 (1 max)</td></tr>
<tr><td></td><td>(c)</td><td></td><td><table><tr><td>It can keep being developed.</td><td></td></tr><tr><td>It can be used without damaging the environment for the future.</td><td>✓</td></tr><tr><td>It is made from materials that are sustainable.</td><td></td></tr><tr><td>It will work in the developing world.</td><td></td></tr></table></td><td>1</td><td></td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>6</td><td></td></tr>
</table>

Question			Answer	Mark	Guidance
8	(a)		steam turbine	2	
	(b)		nuclear	1	**accept** uranium or plutonium or nuclear fission **not** radioactive material
			Total	**3**	

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