

# **Mark Scheme for January 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.

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**Annotations**

Used in the detailed Mark Scheme:

<b>Annotation</b>	<b>Meaning</b>
/	alternative and acceptable answers for the same marking point
(1)	separates marking points
<b>not/reject</b>	answers which are not worthy of credit
<b>ignore</b>	statements which are irrelevant - applies to neutral answers
<b>allow/accept</b>	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

L1 , L2 , L3	allocate level of response
▲	information omitted

### Subject-specific Marking Instructions

- Accept any clear, unambiguous response (including mis-spellings of scientific terms if they are *phonetically* correct, but always check the guidance column for exclusions).
- If a candidate alters his/her response, examiners should accept the alteration.
- 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:

<input type="checkbox"/>
<input type="checkbox"/>
<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>
<input type="checkbox"/>

*This would be worth  
1 mark.*

<input type="checkbox"/>
<input type="checkbox"/>
<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>
<input type="checkbox"/>

*This would be worth  
0 marks.*

<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>
<input type="checkbox"/>

*This would be worth  
1 mark.*

- 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.

## e. 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	<input type="checkbox"/>
Manchester	<input type="checkbox"/>
Paris	<input type="checkbox"/>
Southampton	<input type="checkbox"/>

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		✓		✓	✓		✓	
<b>Score:</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>NR</b>

## f. 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

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	(a)	<p>as far as very distant galaxies <input type="checkbox"/></p> <p>outside the Milky Way, but not as far as... <input type="checkbox"/></p> <p>outside the solar system but inside the... <input checked="" type="checkbox"/></p> <p>outside the solar system but closer than... <input type="checkbox"/></p> <p>in the solar system <input type="checkbox"/></p>	1	
	(b)	<p><b>any four from:</b>  red shift / increased wavelength;  of spectral lines / in spectrum;  greater red shift means greater speed / red shift shows speed (away from Earth);  further away a galaxy the faster it is moving away / the greater the red shift;  if space is expanding then all distances expand;  the further away the greater the distance expands (therefore greater speed)</p>	4	do <b>not</b> allow 'redder' for more red-shift

Question			Answer	Marks	Guidance
1	(c)	(i)	<b>any one from:</b> creative thought involved in developing explanations; scientists may be influenced by their experience / background interests; wasn't enough data / evidence to choose between the two explanations; data fits both conclusions/ can be interpreted in different ways;	1	<b>ignore</b> 'different opinions'  'lack of evidence' is insufficient
		(ii)	use additional / further evidence (1)  the idea of testing a prediction / the theory (1)	2	<b>allow</b> example of evidence eg microwave background radiation / no galaxies with all young stars nearby.
			<b>Total</b>	<b>8</b>	



Question	Answer	Marks	Guidance
2	<p><b>Level 3:</b> Describes the behaviour of P and S-waves. Describes the conclusions about the structure of the Earth. Explains how the conclusion is linked to the evidence. Quality of written communication does not impede communication of the science at this level. <b>(5 – 6 marks)</b></p> <p><b>Level 2:</b> Describes the behaviour of P and/or S-waves. Describes a conclusion about the structure of the Earth. Explanations are incomplete or muddled. Quality of written communication partly impedes communication of the science at this level. <b>(3 – 4 marks)</b></p> <p><b>Level 1:</b> Incomplete description of behaviour of P and/or S-waves and about the structure of the Earth. Quality of written communication impedes communication of the science at this level. <b>(1 – 2 marks)</b></p> <p><b>Level 0:</b> Insufficient or irrelevant science. Answer not worthy of credit. <b>(0 marks)</b></p>	6	<p><b>This question is targeted at grades up to A/A*</b></p> <p><b>Indicative scientific points may include:</b> Points may be made on the diagram</p> <p><b>Relevant points include:</b></p> <p>S- waves only travel through solids P-waves travel through both liquid and solids S- waves are transverse waves P-waves are longitudinal</p> <p>Earthquake waves can tell us: Size of core / mantle / crust; Core is liquid because no S waves travel through it; Mantle is solid because S waves do travel through it.</p> <p><b>allow</b> refraction of p-waves indicates presence of a solid inner core</p> <p><b>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</b></p>
	<b>Total</b>	<b>6</b>	

Question			Answer	Marks	Guidance
3	(a)	(i)	6÷12s 0.5 (Hz)	2	correct numerical answer gains both marks
		(ii)	10m÷4 2.5 (m)	2	correct numerical answer gains both marks
	(b)	(i)	0.5 x 2.5 1.25 (m/s)	2	ecf from a(i) x a(ii) correct numerical answer gains both marks <b>accept</b> 1.3
		(ii)	(No)  <b>any two from</b> the ball will only move up and down water waves are transverse particles will only move up and down only energy is transferred by a wave (not matter) idea that matter is not transferred by wave (only energy)	2	<b>accept</b> idea of vertical motion not horizontal movement  <b>accept</b> 'cannot move matter'
			<b>Total</b>	<b>8</b>	

Question	Answer	Marks	Guidance
4	<p><b>Level 3:</b> Considers balance of risk and benefit. Identifies a risk and identifies a benefit and considers methods of modifying risk. Gives explanations of at least two of risk, benefit or modifying risk. May give a perceived risk argument. Quality of written communication does not impede communication of the science at this level. <b>(5 – 6 marks)</b></p> <p><b>Level 2:</b> A comparison between risks and benefits is at least implied. Identifies a risk and a benefit. Gives an explanation of at least one. Quality of written communication partly impedes communication of the science at this level. <b>(3 – 4 marks)</b></p> <p><b>Level 1:</b> Identifies a risk and a benefit OR identifies either a risk or a benefit and gives some explanation. Quality of written communication impedes communication of the science at this level. <b>(1 – 2 marks)</b></p> <p><b>Level 0:</b> Insufficient or irrelevant science. Answer not worthy of credit. <b>(0 marks)</b></p>	6	<p><b>This question is targeted at grades up to C</b></p> <p><b>Indicative scientific points may include:</b></p> <p><b>Risks e.g.</b> exposure to UV - result in cancer or sunburn sunburn or sun stroke or cancer – bad effect on health damage to skin – less attractive affects eyesight – cataracts</p> <p><b>Benefits e.g.</b> tan - social benefits e.g. more attractive / feel better relaxing – reduces stress reduction in other cancers – health benefit. <b>accept</b> vitamin D production – health benefits <b>accept</b> SAD – reducing depression</p> <p><b>Factors affecting the risk/ benefit decision e.g.</b> exposure does not always lead to harm / cancer sunscreen blocks UV short exposures less likely to lead to skin cancer skin type may reduce risk the benefits are immediate, the risks may show up much later the sunbather does not know the risks</p> <p><b>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</b></p>
	<b>Total</b>	6	

Question			Answer	Marks	Guidance
5	(a)	(i)	identifies carbon dioxide as the important gas (1)  venus atmosphere has more / large amounts / 96% carbon dioxide (1)  (greater) greenhouse effect (1)	3	<b>accept</b> CO <sub>2</sub> <b>do not allow</b> CO <sup>2</sup> etc (for first marking point)  ora  <b>allow</b> description of the greenhouse effect e.g traps heat / CO <sub>2</sub> is a greenhouse gas <b>ignore</b> any reference to the distance from the Sun
		(ii)	<p>The diagram consists of five rectangular boxes. On the left, there are two boxes: 'no green plants' (top) and 'no ozone layer' (bottom). On the right, there are three boxes: 'nitrogen 3.5%' (top), 'oxygen less than 0.05%' (middle), and 'carbon dioxide 96%' (bottom). At the very bottom right is a fourth box: 'Neon less than 0.002%'. Dashed lines connect 'no green plants' to 'oxygen less than 0.05%' and 'carbon dioxide 96%'. A solid line connects 'no ozone layer' to 'carbon dioxide 96%'.</p>	2	one mark for line(s) from green plant one mark for line from no ozone layer  <b>allow</b> line from green plants to oxygen, or carbon dioxide, or both.  <b>reject</b> one correct and one incorrect line from green plants this loses the green plant mark

Question			Answer	Marks	Guidance	
5	(b)	(i)	The photons have more energy when they get to Venus		1	
			More photons hit Venus than Earth	✓		
			A day on Venus is about 240 times as long as on Earth			
			The Earth takes longer to orbit the Sun than Venus			
		(ii)	increases (1)                      distance (1) energy (1) decreases (1)	4		
		(iii)	$1/(0.7)^2$	1		
		(iv)	absorption / refraction / scattering / reflection (by particles / dust)	1	<b>allow</b> absorbed by atmosphere <b>ignore</b> absorption etc by large bodies e.g. asteroids, comets, planets	
			<b>Total</b>	<b>12</b>		

Question	Answer	Marks	Guidance
6	<p><b>Level 3</b> Identifies a group affected in favour and suggests an appropriate argument and identifies a group against and suggests an appropriate argument. Answer should include reference to nuclear waste or ionising radiation. Quality of written communication does not impede communication of the science at this level. <b>(5 – 6 marks)</b></p> <p><b>Level 2</b> Identifies groups affected, both in favour and against, and for at least one group suggests an appropriate argument. Some arguments may be given without identifying groups. Answer may include reference to radioactive materials. Quality of written communication partly impedes communication of the science at this level. <b>(3 – 4 marks)</b></p> <p><b>Level 1</b> Suggests an appropriate argument for or against, may not have identified the group. Quality of written communication impedes communication of the science at this level. <b>(1 – 2 marks)</b></p> <p><b>Level 0</b> Insufficient or irrelevant science. Answer not worthy of credit. <b>(0 marks)</b></p>	6	<p><b>This question is targeted at grades up to B</b></p> <p><b>Indicative scientific points may include:</b></p> <p><b>Groups in favour may include:</b> eg any environmental group. because: replaces pollution producing coal less CO<sub>2</sub> produced eg local workers / businesses because provides work during building and after eg health services / doctors because provides radioactive materials for diagnosis and treatment</p> <p><b>Groups against may include:</b> eg people living in area nearby because they are afraid of being contaminated / irradiated eg conservative groups because it's not natural / it's new eg any environmental group because produces harmful radioactive waste waste very difficult to dispose of risk of accidents when waste being transported eg security services because may provide radioactive materials to terrorists</p> <p><b>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</b></p>
	<b>Total</b>	<b>6</b>	

Question		Answer	Marks	Guidance																		
7	(a)	left box - boiler (1) middle box - turbine (1) right box - generator (1)	3	<b>allow</b> 1 mark if all names correct, but none in the correct box.																		
	(b)	<table border="1"> <thead> <tr> <th>Statement</th> <th>Type(s) of power station</th> <th></th> </tr> </thead> <tbody> <tr> <td>uses a non-renewable resource</td> <td><b>A C D</b></td> <td>(2)</td> </tr> <tr> <td>does <b>not</b> use a boiler to turn water into steam</td> <td><b>B E</b></td> <td>(2)</td> </tr> <tr> <td>produces carbon dioxide when generating power</td> <td><b>A D</b></td> <td>(1)</td> </tr> <tr> <td>generates a voltage by spinning a magnet near a coil</td> <td><b>AII / A B C D E</b></td> <td>(1)</td> </tr> <tr> <td>irradiation is a hazard</td> <td><b>C</b></td> <td>(1)</td> </tr> </tbody> </table>	Statement	Type(s) of power station		uses a non-renewable resource	<b>A C D</b>	(2)	does <b>not</b> use a boiler to turn water into steam	<b>B E</b>	(2)	produces carbon dioxide when generating power	<b>A D</b>	(1)	generates a voltage by spinning a magnet near a coil	<b>AII / A B C D E</b>	(1)	irradiation is a hazard	<b>C</b>	(1)	7	on each row lose 1 mark for each extra letter, minimum 0 marks per row  first row: 3 correct = 2 marks, 1 or 2 correct = 1 mark  second row: 1 mark for each, lose a mark for each extra letter more than two  third row: Both needed  <b>allow</b> names instead of letters
Statement	Type(s) of power station																					
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irradiation is a hazard	<b>C</b>	(1)																				

Question			Answer	Marks	Guidance
7	(c)	(i)	$420 \div 0.9$ or $420 \div 90\%$ or $420 \div 90$  467	2	if answer is between 466 and 467 inclusive (it does not have to be on the answer line) award 2 marks.  otherwise look to see if a correct calculation was written down for 1 mark
		(ii)	<u>energy</u> lost / wasted (to environment) (1)  example given (1)	2	eg heats kettle / air / produces sound / evaporates water / gives off steam <b>accept</b> light from indicator light
			<b>Total</b>	<b>14</b>	



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