

Science A

General Certificate of Secondary Education

Unit **A212/02**: Unit 2: Modules B2, C2, P2 (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.

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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
<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
	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. 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	<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		✓		✓	✓		✓	
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	(a)		12.5	1	accept any value within 12.3 – 12.7
	(b)		point does not fit pattern / does not fit into the graph or WTTE (1) repeat / discard / ignore (1)	2	accept idea of wrong measurement / recording of data ignore vague comments e.g. human error
			Total	3	

Question			Answer	Marks	Guidance										
2	(a)	(i)	<p>The environmental impact of extracting the raw materials and making the beakers is smaller for glass than plastic. <input type="checkbox"/> True <input checked="" type="checkbox"/> False</p> <p>The environmental impact of recycling the beakers is smaller for glass than for plastic. <input type="checkbox"/> True <input checked="" type="checkbox"/> False</p> <p>The environmental impact of the glass beakers is smaller than that of the plastic beakers over all four stages. <input type="checkbox"/> True <input checked="" type="checkbox"/> False</p>	2	all 3 correct = 2 marks 2 correct = 1 mark										
		(ii)	<p><i>any two from:</i></p> <p>saves on (non renewable) resources / (named) raw materials; (1)</p> <p>saves on energy in extracting raw materials ORA; (1)</p> <p>saves on pollution caused by extracting raw materials ORA; (1)</p> <p>uses less landfill space AW / landfills are an eyesore; (1)</p> <p>idea of non-biodegradable / will not rot; (1)</p>	2	<p>ignore ideas of damage to the environment / smell from landfill</p> <p>ignore "might run out of plastic"</p> <p>ignore "can use again"</p> <p>ignore financial arguments</p> <p>ignore gases produced by decomposition</p> <p>accept takes a long time to break down / disintegrate</p>										
	(b)		<table border="1"> <tr> <td>Methane made in landfill sites can be burned.</td> <td><input type="checkbox"/></td> </tr> <tr> <td>Less fossil fuel needs to be burned.</td> <td><input checked="" type="checkbox"/></td> </tr> <tr> <td>Much less space is used.</td> <td><input checked="" type="checkbox"/></td> </tr> <tr> <td>Land is needed for the incinerator.</td> <td><input type="checkbox"/></td> </tr> <tr> <td>Burning does not make harmful gases.</td> <td><input type="checkbox"/></td> </tr> </table>	Methane made in landfill sites can be burned.	<input type="checkbox"/>	Less fossil fuel needs to be burned.	<input checked="" type="checkbox"/>	Much less space is used.	<input checked="" type="checkbox"/>	Land is needed for the incinerator.	<input type="checkbox"/>	Burning does not make harmful gases.	<input type="checkbox"/>	2	
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Burning does not make harmful gases.	<input type="checkbox"/>														
Total				6											

Question		Answer	Marks	Guidance
3	(a)	polymerisation	1	accept phonetic spelling
	(b)	<div style="border: 1px solid black; padding: 2px; margin-bottom: 2px;">Increase the crystallinity of the polypropene. <input type="checkbox"/></div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 2px;">Decrease the length of the molecules of polypropene. <input type="checkbox"/></div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 2px;">Add a plasticiser to the polypropene. <input checked="" type="checkbox"/></div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 2px;">Decrease the strength of the bonds between molecules of polypropene. <input checked="" type="checkbox"/></div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 2px;">Increase the strength of the bonds between carbon atoms in each molecule of polypropene. <input type="checkbox"/></div>	2	1 mark for each correct answer 3 ticks deduct 1 mark 4 or 5 ticks = 0
	(c)	<div style="border: 1px solid black; padding: 2px; margin-bottom: 2px;">Sample A has smaller forces between its molecules. <input checked="" type="checkbox"/></div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 2px;">Sample A has larger forces between its molecules. <input type="checkbox"/></div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 2px;">Sample A has larger forces between carbon atoms in its molecules. <input type="checkbox"/></div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 2px;">Sample A has more cross-links. <input type="checkbox"/></div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 2px;">More energy is needed to break up the molecules. <input type="checkbox"/></div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 2px;">More energy is needed for the molecules to move from their positions in the solid structure. <input type="checkbox"/></div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 2px;">Less energy is needed for the molecules to move from their positions in the solid structure. <input checked="" type="checkbox"/></div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 2px;">Cross-linking reduces the energy needed to move polymer chains apart. <input type="checkbox"/></div>	2	1 mark for each correct answer 3 ticks deduct 1 mark 4 or 5 ticks = 0
Total			5	

Question			Answer	Marks	Guidance
4	(a)	(i)	250 ($\text{J m}^{-2} \text{s}^{-1}$)	1	
		(ii)	530 ($\text{J m}^{-2} \text{s}^{-1}$)	1	
	(b)	(i)	B (70) and E (490)	1	both needed in any order accept energies instead of letters
		(ii)	A (250) (1)	1	accept energy instead of letter
Total				4	

Question			Answer	Marks	Guidance
5	(a)		<i>any three from:</i> ultraviolet / UV damages cells; (1) (through) ionisation / chemical changes / mutation; (1) (benefit is) idea of feel-good factor / social acceptance AW / other benefit of associated activity e.g. ref. to Vitamin D; (1) people are prepared to take the risk / can minimise the risk (by taking preventative measures) / do not understand how their activity puts them at risk (mountain or water activities) AW; (1)	3	accept radiation accept UV causes (skin) cancer ignore ref to melanin / sunburn accept benefit outweighs the risk ignore detail of specific preventative measures
		(b)	any two of the following: use of sunblock covering up eg hat avoiding exposure during hottest time of day / reduce the time spent in sun not climbing high up		
Total				4	

Question	Answer	Marks	Guidance														
6	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="padding: 2px;">Infrared is an ionising radiation.</td> <td style="width: 30px; text-align: center;"><input type="checkbox"/></td> </tr> <tr> <td style="padding: 2px;">The frequency of the radiation is the number of photons emitted per second.</td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> <tr> <td style="padding: 2px;">Microwaves are reflected from metal surfaces.</td> <td style="text-align: center;"><input checked="" type="checkbox"/></td> </tr> <tr> <td style="padding: 2px;">X-ray photons have enough energy to remove electrons from atoms.</td> <td style="text-align: center;"><input checked="" type="checkbox"/></td> </tr> <tr> <td style="padding: 2px;">If a red light and a blue light emit the same energy, the red light emits more photons.</td> <td style="text-align: center;"><input checked="" type="checkbox"/></td> </tr> <tr> <td style="padding: 2px;">The energy of two ultraviolet photons is the same as the energy of one photon of visible light.</td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> <tr> <td style="padding: 2px;">Radio waves and microwaves of the same intensity will heat an absorber by the same amount per second.</td> <td style="text-align: center;"><input checked="" type="checkbox"/></td> </tr> </table>	Infrared is an ionising radiation.	<input type="checkbox"/>	The frequency of the radiation is the number of photons emitted per second.	<input type="checkbox"/>	Microwaves are reflected from metal surfaces.	<input checked="" type="checkbox"/>	X-ray photons have enough energy to remove electrons from atoms.	<input checked="" type="checkbox"/>	If a red light and a blue light emit the same energy, the red light emits more photons.	<input checked="" type="checkbox"/>	The energy of two ultraviolet photons is the same as the energy of one photon of visible light.	<input type="checkbox"/>	Radio waves and microwaves of the same intensity will heat an absorber by the same amount per second.	<input checked="" type="checkbox"/>	3	<p>4 correct = 3 3 correct = 2 2 correct = 1 1 correct = 0</p> <p>for each additional tick over 4 ticks deduct 1 mark</p>
Infrared is an ionising radiation.	<input type="checkbox"/>																
The frequency of the radiation is the number of photons emitted per second.	<input type="checkbox"/>																
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Question		Answer	Marks	Guidance										
7	(a)	<table border="1"> <tr> <td>Ozone is a greenhouse gas.</td> <td><input type="checkbox"/></td> </tr> <tr> <td>Ozone is produced by car engines.</td> <td><input type="checkbox"/></td> </tr> <tr> <td>Ozone forms a layer high in the atmosphere.</td> <td><input checked="" type="checkbox"/></td> </tr> <tr> <td>The ozone molecule consists of three oxygen atoms.</td> <td><input type="checkbox"/></td> </tr> <tr> <td>Ozone is converted into ordinary oxygen when it absorbs ultraviolet radiation</td> <td><input checked="" type="checkbox"/></td> </tr> </table>	Ozone is a greenhouse gas.	<input type="checkbox"/>	Ozone is produced by car engines.	<input type="checkbox"/>	Ozone forms a layer high in the atmosphere.	<input checked="" type="checkbox"/>	The ozone molecule consists of three oxygen atoms.	<input type="checkbox"/>	Ozone is converted into ordinary oxygen when it absorbs ultraviolet radiation	<input checked="" type="checkbox"/>	2	
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The ozone molecule consists of three oxygen atoms.	<input type="checkbox"/>													
Ozone is converted into ordinary oxygen when it absorbs ultraviolet radiation	<input checked="" type="checkbox"/>													
	(b)	methane / water (vapour)	1	accept NOx										
		Total	3											

Question		Answer	Marks	Guidance										
8	(a)	<table border="1"> <tr> <td>blind trial</td> <td><input type="checkbox"/></td> </tr> <tr> <td>placebo trial</td> <td><input type="checkbox"/></td> </tr> <tr> <td>double blind trial</td> <td><input checked="" type="checkbox"/></td> </tr> <tr> <td>double placebo trial</td> <td><input type="checkbox"/></td> </tr> <tr> <td>open trial</td> <td><input type="checkbox"/></td> </tr> </table>	blind trial	<input type="checkbox"/>	placebo trial	<input type="checkbox"/>	double blind trial	<input checked="" type="checkbox"/>	double placebo trial	<input type="checkbox"/>	open trial	<input type="checkbox"/>	1	
blind trial	<input type="checkbox"/>													
placebo trial	<input type="checkbox"/>													
double blind trial	<input checked="" type="checkbox"/>													
double placebo trial	<input type="checkbox"/>													
open trial	<input type="checkbox"/>													
	(b)	<p><i>any two from:</i></p> <p>placebo has no effect; (1)</p> <p>possibility of extending life outweighs the possible harmful effects; (1)</p> <p>unethical to withhold possible treatment / give a placebo; (1)</p>	2	<p>accept benefits outweigh the risks</p> <p>accept wrong for unethical</p>										
		Total	3											

Question		Answer	Marks	Guidance																		
9	(a)	glucose/sugar/protein/amino acids/fat/fatty acids/glycerol/oxygen/O ₂ ; carbon dioxide/CO ₂ ; fat (deposits)/plaque/cholesterol	2	3 correct =(2), 2 correct = (1) ignore food accept water ignore lactic acid ignore clot																		
	(b)	<table border="1"> <thead> <tr> <th>Lifestyle factor</th> <th>Increases risk</th> <th>Decreases risk</th> </tr> </thead> <tbody> <tr> <td>alcohol</td> <td>✓</td> <td></td> </tr> <tr> <td>exercise</td> <td></td> <td>✓</td> </tr> <tr> <td>saturated fat</td> <td>✓</td> <td></td> </tr> <tr> <td>smoking</td> <td>✓</td> <td></td> </tr> <tr> <td>stress</td> <td>✓</td> <td></td> </tr> </tbody> </table>	Lifestyle factor	Increases risk	Decreases risk	alcohol	✓		exercise		✓	saturated fat	✓		smoking	✓		stress	✓		1	5 correct for 1 marks
Lifestyle factor	Increases risk	Decreases risk																				
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exercise		✓																				
saturated fat	✓																					
smoking	✓																					
stress	✓																					
	(c)	F B D E H A	2	correct 6 letters (not C or G) =1 mark correct order = 1 mark use of any letter more than once = 0																		
	(d)	<table border="1"> <thead> <tr> <th>Statement</th> <th>Correlation</th> <th>Cause</th> </tr> </thead> <tbody> <tr> <td>.....their lungs are black.</td> <td>✓</td> <td></td> </tr> <tr> <td>More smokersdevelop lung cancer.</td> <td>✓</td> <td></td> </tr> <tr> <td>Chemicals in cigarette smoke damage cells....</td> <td></td> <td>✓</td> </tr> <tr> <td>.....air pollution from car exhausts.....</td> <td>✓</td> <td></td> </tr> </tbody> </table>	Statement	Correlation	Causetheir lungs are black.	✓		More smokersdevelop lung cancer.	✓		Chemicals in cigarette smoke damage cells....		✓air pollution from car exhausts.....	✓		1	4 correct for 1 mark			
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Total			6																			

Question		Answer	Marks	Guidance
10	(a)	<p><i>any one from:</i> antibodies not produced any longer; (1)</p> <p>immune system needs boosting; (1)</p> <p>reference to decreasing number of memory cells; (1)</p>	1	<p>accept microorganisms changing/mutate/ different strain</p> <p>accept vaccination/immunity wears off</p> <p>ignore tetanus is a virus</p> <p>ignore any reference to injury</p>
	(b)	Amrit	1	
Total			2	

Question		Answer	Marks	Guidance
11	(a)	antibodies and white blood cell;	1	both for 1 mark
	(b)	<p><i>any two from:</i> white blood cells (that make antibodies) or antibodies are already present (in blood)(from first infection) / idea that specific memory cells (from first infection) are still present; (1)</p> <p>rapid increase in number of white blood cells; (1)</p> <p>number of antibodies (in the blood) increases quickly; (1)</p>	2	ignore ref. to vaccination
Total			3	

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