

GCSE

Additional Science B

Unit **B722/02**: Modules B4, C4, P4 (Higher Tier)

General Certificate of Secondary Education

Mark Scheme for June 2014

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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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1. These are the annotations, (including abbreviations), including those used in scoris, which are used when marking

Annotation	Meaning
	Blank Page – this annotation must be used on all blank pages within an answer booklet (structured or unstructured) and on each page of an additional object where there is no candidate response.
	correct response
	incorrect response
	benefit of the doubt
	benefit of the doubt not given
	error carried forward
	information omitted
	ignore
	reject
	contradiction

2. Abbreviations, annotations and conventions used in the detailed Mark Scheme.

- / = alternative and acceptable answers for the same marking point
- (1)** = separates marking points
- allow** = answers that can be accepted
- not** = answers which are not worthy of credit
- reject** = answers which are not worthy of credit
- ignore** = statements which are irrelevant
- () = words which are not essential to gain credit
- = underlined words must be present in answer to score a mark (although not correctly spelt unless otherwise stated)
- ecf = error carried forward
- AW = alternative wording
- ora = or reverse argument

MARK SCHEME

Question	Answer	Marks	Guidance						
1 a	provides oxygen (for microbes) (1) for respiration (1)	2	allow aerobic respiration = 2 mention of anaerobic respiration max 1 mark						
b	(nitrogen is) needed for amino acids (1) for proteins / enzymes (1)	2	ignore code for proteins allow other named nitrogen containing compound eg DNA (1) for chromosome replication (1) chlorophyll (1) needed for photosynthesis (1)						
c i	decay in A was (at a) faster (rate) / ORA (1) idea that it finished quicker / ORA (1)	2	ignore references to temperature assume first reference is A if not stated ignore just A decays more allow less time to decompose (1)						
ii	<table border="1" data-bbox="504 882 864 1078"> <tr> <td>grass clippings</td> <td>A</td> </tr> <tr> <td>sawdust</td> <td>C</td> </tr> <tr> <td>straw</td> <td>B</td> </tr> </table> <p style="text-align: right;">(1)</p>	grass clippings	A	sawdust	C	straw	B	1	
grass clippings	A								
sawdust	C								
straw	B								
Total		7							

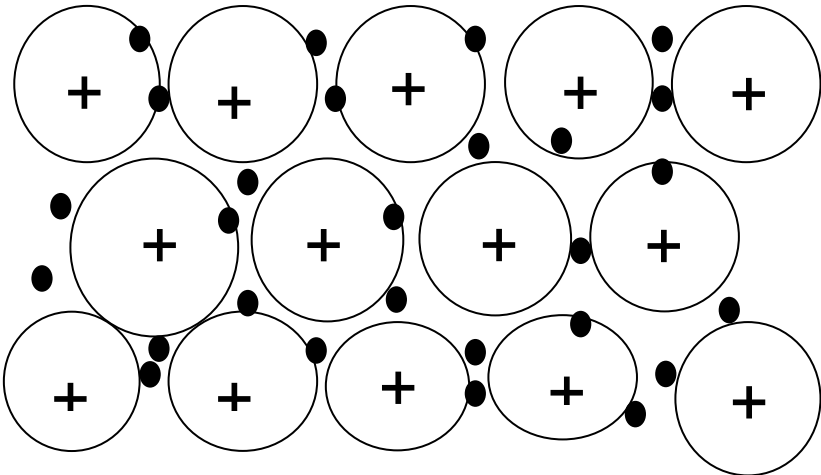
Question	Answer	Marks	Guidance
<p>2</p>	<p>[Level 3] Answer includes more than one conclusion on abundance or distribution of organisms. and explains one of these conclusions in detail. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks)</p> <p>[Level 2] Answer includes a conclusion referring to either the abundance or distribution of organism(s) and there is some attempt to explain the conclusion. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks)</p> <p>[Level 1] Answer includes a conclusion concerning either the abundance or distribution of organisms</p> <p>There may be limited use of specialist terms. 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>		<p>This question is targeted up to A</p> <p>Indicative scientific points about conclusions may include:</p> <ul style="list-style-type: none"> • Each organism is growing at a particular area of the shore / zonation is seen • Some organisms are more abundant than others • Some live over wider ranges • More species in the mid shore (ORA) <p>Allow references to individual species</p> <p>Indicative scientific points involving explanations may include</p> <ul style="list-style-type: none"> • Organisms further up the shore will be uncovered for longer periods of time (level 3) • Reference to photosynthetic organisms being too deep underwater and so limited light (level 3) • Reference to differential predation / food availability / competition at different parts of the shore (level 3) • Distribution is caused by the tide (level 2) • Some organisms adapted to drier conditions / wet conditions (level 2)
<p>Total</p>		<p>6</p>	

Question	Answer	Marks	Guidance
3 a	palisade (mesophyll) (1)	1	mark answer on line first allow correct answer indicated on list if answer line is blank
b	max two from: bacteria have moved to the lit side of the cell (1) bacteria have moved to where photosynthesis is occurring (1) bacteria have moved close to the chloroplasts (1) oxygen is produced by chloroplasts (1) and at least one from: blue /red light gives a higher rate of photosynthesis than green light / ORA (1) green light is not absorbed (well) / is reflected (by photosynthetic pigments) (1)	3	allow chlorophyll for chloroplasts allow bacteria move towards the light allow because there is light here allow because there is photosynthesis occurring here
Total		4	

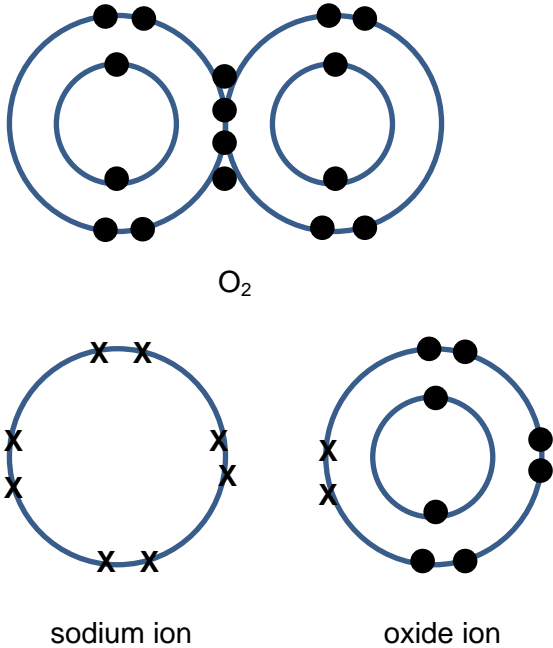
Question	Answer	Marks	Guidance
4 a	<p>any three from:</p> <p>thin, so short distance for diffusion (1)</p> <p>stoma(ta) which can open (and close) (1)</p> <p>air spaces (in the spongy mesophyll) allow diffusion (1)</p> <p>broad leaves / large surface area of leaves allow more carbon dioxide to enter (1)</p>	3	<p>allow gas(eous) exchange for diffusion throughout</p> <p>allow reference to speed / ease of diffusion</p> <p>ignore pores / holes</p>
b	<p>any two from:</p> <p>idea of competition from weeds (1)</p> <p>more water ORA (1)</p> <p>more minerals ORA(1)</p> <p>more light ORA(1)</p> <p>more space ORA(1)</p>	2	<p>ignore nutrients</p> <p>allow idea that weeds would take some of the water (1)</p> <p>allow idea that weeds would take some of the minerals (1)</p> <p>allow named mineral or essential elements eg nitrogen / nitrate, phosphorus / phosphate / sulfur / sulfate /potassium / magnesium (1)</p> <p>allow idea that weeds would take some of the light (1)</p> <p>allow idea that weeds would take some of the space (1)</p> <p>allow more carbon dioxide</p>
c	crop rotation (1)	1	more than one tick scores 0

Question	Answer	Marks	Guidance
d	<p>any two from:</p> <p>yield is more after growing barley (than after growing soya beans) / ORA (1)</p> <p>chemical used on barley / roneet does not seem to affect the yield (1)</p> <p>chemical used on soya beans / treflan reduces yield (1)</p> <p>but</p> <p>reduction in yield after growing soya beans is not just due to the chemical used = (2)</p>	2	<p>allow grows bigger / grows better / grows more as alternatives to more yield ORA</p> <p>allow roneet only has a very small effect on the yield</p>
Total		8	

Question	Answer	Marks	Guidance						
5 a	<table border="1" data-bbox="450 233 920 419"> <tr> <td data-bbox="450 233 824 292">Number of electrons in outer shell</td> <td data-bbox="824 233 920 292">7</td> </tr> <tr> <td data-bbox="450 292 824 351">Number of occupied shells</td> <td data-bbox="824 292 920 351">6</td> </tr> <tr> <td data-bbox="450 351 824 419">Mass number</td> <td data-bbox="824 351 920 419">210</td> </tr> </table>	Number of electrons in outer shell	7	Number of occupied shells	6	Mass number	210	3	
Number of electrons in outer shell	7								
Number of occupied shells	6								
Mass number	210								
b i	<p data-bbox="331 560 994 624">melting point any value or range of values between -240 and -160</p> <p data-bbox="331 660 387 692">and</p> <p data-bbox="331 729 987 793">boiling point any value or range of values between -200 and -80 (1)</p>	1	<p data-bbox="1182 493 1935 557">both needed for one mark but melting point must be lower than boiling point to score</p>						
ii	<p data-bbox="331 834 898 898">gas because the boiling point is below 20 °C (1)</p>	1	<p data-bbox="1182 834 2018 962">allow ecf from (b)(i) allow gas because the boiling point is below room temperature / below freezing / very low / minus (1) allow gas because it is above the boiling point</p>						
iii	<p data-bbox="331 971 595 1003">astatine / At₂ / At (1)</p>	1							
c	<p data-bbox="331 1054 703 1086">$Cl_2 + 2KAt \rightarrow 2KCl + At_2$</p> <p data-bbox="331 1123 591 1155">correct formulae (1)</p> <p data-bbox="331 1192 936 1224">balancing – dependent on correct formulae (1)</p>	2	<p data-bbox="1182 1054 1451 1086">allow = instead of \rightarrow</p> <p data-bbox="1182 1123 1509 1155">not and or & instead of +</p> <p data-bbox="1182 1192 2002 1287">allow one mark for correct balanced equation with minor errors of subscript, superscript or case e.g. $Cl_2 + 2KAT \rightarrow 2KCl + At_2$</p>						
Total		8							

Question	Answer	Marks	Guidance
6 a	<p>C because any two from is strong (1) does not corrode (easily) / corrodes (very) slowly (1) low density (1)</p>	2	<p>no marks for C on its own but if C is not chosen = no marks ignore references to melting points / conductivity</p> <p>ignore light allow lightweight</p>
6 b	<p>close (packed) positive ions / positive ions in a regular pattern (1)</p> <p>delocalised electrons / mobile electrons / free electrons / sea of electrons (1)</p> <p>strong attraction / bonds / forces (1)</p> <p>all marks could be shown on a labelled diagram (minimum number of 6 positive ions)</p>	3	<p>ignore atoms allow metal ions / cations</p> <p>not intermolecular forces / ionic bonds / covalent bonds ignore electromagnetic bonds allow lots of energy needed to break bonds / overcome attractions / forces</p>  <p>allow large circles with positive signs in for positive ions allow e as electrons but small circles or negative charges need to be labelled as electrons</p>
Total		5	

Question	Answer	Marks	Guidance
7 a	Na ₂ O / ONa ₂ (1)	1	<p>allow (Na⁺)₂O²⁻ allow answer on right hand side of equation (the equation does not need to be balanced)</p> <p>eg Na + O₂ -> Na₂O (1)</p>
b	<p>[Level 3] Use the dot and cross model to explain the covalent bonding in an oxygen molecule AND draw the electronic structures of the sodium ion and the oxide ion Quality of written communication does not impede communication of the science at this level (5 – 6 marks)</p> <p>[Level 2] Use the dot and cross model to explain the covalent bonding in an oxygen molecule OR Uses the dot and cross model to draw the electronic structures of the sodium ion and the oxide ion Quality of written communication partly impedes communication of the science at this level (3 – 4 marks)</p> <p>[Level 1] States or shows that O₂ is bonded covalently OR Na₂O by ionic bonding 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 at all levels 2 and 3 could include:</p> <ul style="list-style-type: none"> • Dot and cross diagram for oxygen • Electronic structure of sodium ion (no need to have charge but if shown must be correct) • Electronic structure of oxide ion (no need to have charge but if shown must be correct) • Idea that positive sodium ion attracts a negative oxide ion <p>allow Na⁺ or an empty shell for electronic structure of sodium ion ignore inner shells if drawn</p> <p>Indicative scientific points at level 1 could include:</p> <ul style="list-style-type: none"> • O₂ has covalent bonding • O₂ has shared pairs of electrons • Na₂O has ionic bonding • Na₂O bonding involves electron transfer • Na loses electron and O gains electrons <p>Use the L1, L2, L3 annotations in scoris. Do not use ticks.</p> <p>See next page for dot and cross diagrams.</p>

Question	Answer	Marks	Guidance
b			 <p style="text-align: center;">O_2</p> <p style="text-align: center;">sodium ion oxide ion</p> <p>At level 2 and 3, if dot and cross diagram shows the same electron on the sodium ion and the oxide ion then answer is limited to lower mark within level Credit word descriptions however for level 2 or 3 correct electron structures must be described eg $Na^+ 2.8$ $O^{2-} 2.8$</p>
	Total	7	

Question	Answer	Marks	Guidance
8 a	<p>filtration to remove large / insoluble substances or objects (1)</p> <p>sedimentation to let small particles / insoluble particles / suspended particles settle (1)</p> <p>chlorination to kill microbes (1)</p>	3	<p>allow example of large object eg leaves / sticks / rocks / debris</p> <p>ignore just dirt</p> <p>not remove molecules / remove small particles, however if answer refers to filtration by sand then allow removes small particles</p> <p>not large particles / molecules</p> <p>allow add chlorine to kill bacteria or microorganisms</p> <p>ignore reference to germs</p> <p>allow any order of the three processes</p>
b	nitrate is soluble in water / nitrate is dissolved in water (so not removed by filtration or sedimentation) (1)	1	
c	large amount of heat needed / large amount of energy needed (1)	1	ignore reference to cost unless qualified by reference to energy / heat
Total		5	

Question	Answer	Marks	Guidance
9 a i	5.2 (A) (2) but if incorrect or incomplete then: $\frac{1200}{230} = (1)$	2	Max (1) if answer not given to 2 sig figs eg 5.22 / 5.217 / 5.2173913 (1) allow 5.21 (1)
ii	10 (A) (1)	1	mark answer on line first allow answer ringed, underlined or ticked on diagram if no answer on the answer line allow ecf
b i	10 (Ω) (1)	1	
ii	resistance is 4(Ω) (1) so current will be (above) 5A for (less than) 40 cm wire / minimum resistance for 5A $R = \frac{20}{5} = 4(\Omega)$ (1)	2	
c	ideas that if earthed: metal parts/ TV cannot become charged / charge will be conducted to earth (1) insulating mats: prevent charge passing (to earth) through the person (1)	2	allow current / electrons as charge ignore electricity / shock
	Total	8	

Question	Answer	Marks	Guidance
10 a	<p>any two from:</p> <p>(very) high frequency <u>sound</u> (1)</p> <p>20000Hz / 20kHz or above (1)</p> <p>too high to be heard by humans (1)</p>	2	<p><u>sound</u> above 20 000Hz / 20kHz = (2)</p> <p>allow 20000 cycles/ waves per second</p> <p>allow <u>above</u> 20000Hz, so cannot be heard by humans = 2 frequency too high to be heard by humans = 2</p>
b	<p>(ultrasound) reflections (from different layers) (1)</p> <p>Idea that echoes (from different layers) take different times to return to the detector (1)</p> <p>BUT the idea of 'deeper' reflections take longer to return scores (2)</p>	2	<p>ignore bouncing / rebounding waves</p>
c	<p>breaking / treating kidney stones / AW (1)</p>	1	<p>allow cleaning instruments / repair of deep body injury / in cataract removal / teeth cleaning</p> <p>allow producing scan / image of named part of body eg pregnancy scan</p>
d	<p>this is the distance between two adjacent rarefactions / AW (1)</p>	1	<p>Eg they are two adjacent low pressure areas / they are one complete cycle (1)</p>
	Total	6	

Question	Answer	Marks	Guidance
11	<p>[Level 3] gives detailed description of the method and chooses tracer E giving correct justifications. Quality of written communication does not impede communication of the science at this level (5 – 6 marks)</p> <p>[Level 2] gives a simple or partial description of the method and chooses tracer D or E with a supporting reason. Quality of written communication partly impedes communication of the science at this level (3 – 4 marks)</p> <p>[Level 1] gives a simple or partial description of the method involved OR chooses tracer D or E with a supporting reason. 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 up to grade C</p> <p>Indicative scientific points at level 3 for choice of tracer is: gamma E emitter chosen for its appropriate (long enough to detect) half-life AND penetrates soil / pipe</p> <p>Indicative scientific points at level 2 / level 1 for choice of tracer is E emitter chosen for its appropriate (long enough to detect) half-life OR D/E emitter chosen for its appropriate (short enough not to cause harm) half-life OR D / E / gamma source chosen for soil penetration</p> <p>Description at all levels may include:</p> <ul style="list-style-type: none"> • uses a detector • measures radiation on surface along the pipe • blockage is where count rate changes / blockage shows a larger reading / blockage followed by a reduced reading <p>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</p>
Total		6	

Question	Answer	Marks	Guidance
12 a	36 (hrs) (1)	1	allow +/- 1 hour
b	216 (hours) (2) but evidence of repeated halving OR Indication that 31 counts per minute = 6 half lives (1)	2	allow 9 days (2) allow ecf ie 6 x answer from part a evidence of more than one halving may be shown on graph
Total		3	

Question	Answer	Marks	Guidance
13 a	3 He 2 both needed	1	
b	share costs / share expertise / share results / variety of approaches / variety of ideas / share technology (1)	1	ignore reference to speed or rate of work / discovery ignore idea of checking results
Total		2	

Question	Answer	Marks	Guidance
14 a	345 (2) but $\frac{11.5 \times 3000}{100}$ (1)	2	
b i	total radiation = 4120 (2)	2	allow one error in any figure or in addition for 1 mark correct values are (2410) + (260) + 50 + 900 + 400 + 100
ii	any two from: idea that he is receiving higher than the average dose / higher than 3000 (1) but he receives lower than the limit put on workers / lower than 20000 (1) he receives (far) lower than the level shown to cause cancer / lower than 50000 (1)	2	allow ECF from bi) allow because he is only just above the average
c i	if he starts smoking increase is from 2 to 20 so he is correct (1) if he gets stone worktops then increase is from 2 to 36 so he is correct (1) however, if he does both then increase is from 2 to 260 / 130 times, so he is incorrect (1)	3	allow 2 x 10 instead of from 2 to 20 allow 2 x 18 instead of from 2 to 36 allow 2 x 130 instead of from 2 to 260
ii	spend different amounts of time in kitchen / indoors / may smoke different types of cigarette / how long they have been smoking for / passive smoking / existing lung conditions / may be exposed to other cancer causing agents / different background radiation / different levels of natural radon in some areas / different number of worktops / different types of worktops / different genes / genders / ages (1)	1	ignore existing health conditions unless qualified
	Total	10	

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