OCR
Oxford Cambridge and RSA

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.

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

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

Annotation	Meaning
BP	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
BOD	benefit of the doubt
NBOD	benefit of the doubt **not** given
ECF	error carried forward
^	information omitted
I	ignore
R	reject
CON	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	grass clippings – A sawdust – C straw – B (1)	1	
	Total	**7**	

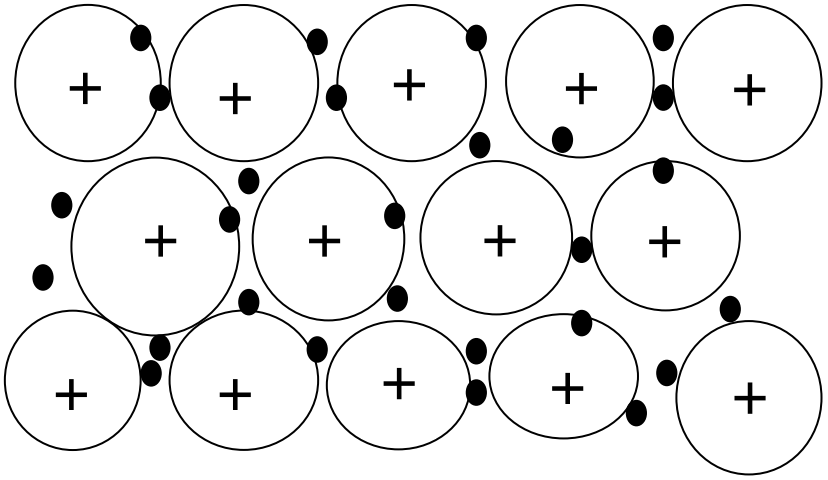
Question	Answer	Marks	Guidance
2	**[Level 3]** Answer includes more than one conclusion on abundance or distribution of organisms. **and** explains one of these conclusions in detail. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **[Level 2]** 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) **[Level 1]** Answer includes a conclusion concerning either the abundance or distribution of organisms There may be limited use of specialist terms. 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)		**This question is targeted up to A** **Indicative scientific points about conclusions may include:** • 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) Allow references to individual species **Indicative scientific points involving explanations may include** • 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)
	Total	**6**	

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**	

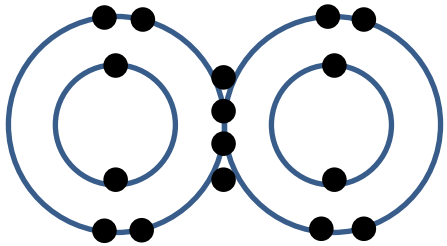
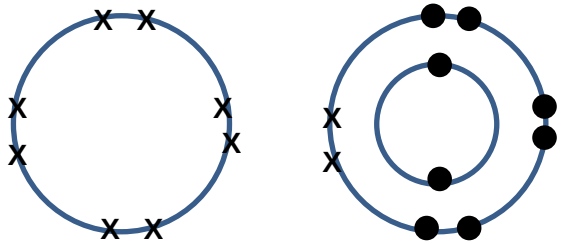
Question	Answer	Marks	Guidance
4 a	**any three from:** thin, so short distance for diffusion (1) stoma(ta) which can open (and close) (1) air spaces (in the spongy mesophyll) allow diffusion (1) broad leaves / large surface area of leaves allow **more** carbon dioxide to enter (1)	3	**allow** gas(eous)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

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

Question	Answer	Marks	Guidance
5 a	<table><tr><td>Number of electrons in outer shell</td><td>7</td></tr><tr><td>Number of occupied shells</td><td>6</td></tr><tr><td>Mass number</td><td>210</td></tr></table>	3	
b i	melting point any value or range of values between -240 and –160 **and** boiling point any value or range of values between -200 and –80 (1)	1	**both** needed for **one** mark **but** melting point must be lower than boiling point to score
ii	gas because the boiling point is below 20 ^{o}C (1)	1	**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
iii	astatine / At_2 / At (1)	1	
c	Cl_2 + 2KAt → 2KC*l* + At_2 correct formulae (1) balancing – dependent on correct formulae (1)	2	**allow** = instead of → **not** and or & instead of + **allow** one mark for correct balanced equation with minor errors of subscript, superscript or case e.g. Cl2 + 2KAT → 2KCl + At2
	Total	**8**	

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

Question	Answer	Marks	Guidance
7 a	Na_2O / ONa_2 (1)	1	**allow** $(Na^+)_2O^{2-}$ **allow** answer on right hand side of equation (the equation does not need to be balanced) eg Na + O_2 -> Na_2O (1)
b	**[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) **[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) **[Level 1]** **States or shows that O_2 is bonded covalently** **OR** **Na_2O by ionic bonding** 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*.** **Indicative scientific points at all levels 2 and 3 could include:** • 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 **allow** Na^+ or an empty shell for electronic structure of sodium ion **ignore** inner shells if drawn **Indicative scientific points at level 1 could include:** • O_2 has covalent bonding • O_2 has shared pairs of electrons • Na_2O has ionic bonding • Na_2O bonding involves electron transfer • Na loses electron and O gains electrons **Use the L1, L2, L3 annotations in scoris. Do not use ticks.** See next page for dot and cross diagrams.

Question	Answer	Marks	Guidance
b			 O_2  sodium ion oxide ion 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
	Total	**7**	

Question	Answer	Marks	Guidance
8 a	**filtration** to remove large / insoluble substances or objects (1) **sedimentation** to let small particles / insoluble particles / suspended particles settle (1) **chlorination** to kill microbes (1)	3	**allow** example of large object eg leaves / sticks / rocks / debris **ignore** just dirt **not** remove molecules / remove small particles, however if answer refers to filtration **by sand** then **allow** removes small particles **not** large particles / molecules **allow** add chlorine to kill bacteria or microorganisms **ignore** reference to germs **allow** any order of the three processes
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(Ω) (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	**any two from:** (very) high frequency sound (1) 20000Hz / 20kHz or above (1) too high to be heard by humans (1)	2	sound above 20 000Hz / 20kHz = (2) **allow** 20000 cycles/ waves per second **allow** above 20000Hz, so cannot be heard by humans = 2 frequency too high to be heard by humans = 2
b	(ultrasound) reflections (from different layers) (1) Idea that echoes (from different layers) take different times to return to the detector (1) BUT the idea of 'deeper' reflections take longer to return scores (2)	2	**ignore** bouncing / rebounding waves
c	breaking / treating kidney stones / AW (1)	1	**allow** cleaning instruments / repair of deep body injury / in cataract removal / teeth cleaning **allow** producing scan / image of named part of body eg pregnancy scan
d	this is the distance between two adjacent rarefactions / AW (1)	1	**Eg** they are two adjacent low pressure areas / they are one complete cycle (1)
	Total	**6**	

Question	Answer	Marks	Guidance
11	**[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) **[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) **[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) **[Level 0]** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	6	**This question is targeted up to grade C** **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 **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 **Description at all levels may include:** • 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 **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**
	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 both needed 2	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 11.5 x 3000 (1) 100	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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