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 2015

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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.

Annotations used in scoris

Annotation	Meaning
	correct response
	incorrect response
	benefit of the doubt
	benefit of the doubt **not** given
	error carried forward
	information omitted
	ignore
	reject
	contradiction

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	H_2O and O_2 (1) with correct balancing ie $6H_2O$ and $6O_2$ (2)	2	
b	**any three marks but maximum of two from each section:** Low temperatures: reference to slow(er) enzyme action (1) temperature becomes a limiting factor in photosynthesis (1) respiration / reproduction is slow(er) / stops (1) Salt levels: bacteria / cells would lose water (1) by osmosis (1) water needed in bacteria for chemical reactions / photosynthesis / enzyme action / as a solvent (1)	3	**not** enzyme denatures / enzyme killed **ignore** stops growing **allow** stops multiplying
	Total	**5**	

Question	Answer	Marks	Guidance
2 a	(passes up the) xylem (1) (pulled up by) transpiration / evaporation of water from the leaves (1)	2	**not** phloem
b	to prevent evaporation (from the water in the measuring cylinder) (1)	1	**allow** idea that any water lost must have passed through the plant / idea that water can't escape into the air / stops water loss
c i	B (1)	1	**allow** correct answer ticked, circled or underlined on graph if answer line is blank
ii	(lower light intensity so) stoma(ta) close (1) because guard cells change shape / become flaccid (1)	2	**ignore** guard cells close / pores close **allow** stomata will not open **allow** not swollen / less swollen / not turgid / less turgid
	Total	**6**	

Question	Answer	Marks	Guidance
3	**[Level 3]** answer includes level 3 reference to the role of at least one mineral / element in plant growth **and** uses the graphs to link the increasing fertiliser **use** to a decrease in the **area** of land needed to maintain the **yield** of grain production. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **[Level 2]** answer includes reference to two minerals / elements provided by fertilisers **and** uses the graphs to link the increase **use** of fertiliser to increased **yield** of grain production. **Or** answer includes level 3 reference to the role of at least one mineral / element in plant growth **Or** uses the graphs to link the increasing fertiliser **use** to a decrease in the **area** of land needed to maintain the **yield** of grain production. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **[Level 1]** answer includes reference to one mineral / element provided by fertilisers **and** describes one trend shown in one of the graphs. 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 A*** **Indicative scientific points at level 3 may include:** • Nitrates / nitrogen are needed for proteins / amino acids • Phosphates / phosphorus for respiration / DNA / cell membranes • Magnesium for photosynthesis / chlorophyll • Potassium for respiration / photosynthesis / enzymes • Production of grain has slightly increased over the years despite a fall in the area of land used • Use of fertilisers has increased yield so less land is needed to grow the same amount / more grain **Indicative scientific points at level 2 may include:** • Fertilisers contain nitrates / nitrogen / N / phosphates / phosphorus / P / magnesium / potassium / K • the use of fertiliser has increased meaning the production of grain has increased **Indicative scientific points at level 1 may include:** • Fertilisers contain nitrates / nitrogen / N / phosphates / phosphorus / P / magnesium / potassium / K • the use of fertiliser has increased • the production of grain has increased / (approx) stayed the same • the area of land used has decreased **Use the L1, L2, L3 annotations in Scoris. Do not use ticks.**
	Total	**6**	

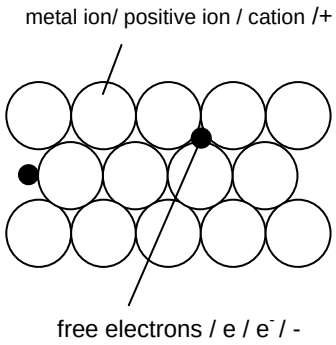
Question	Answer	Marks	Guidance
4 a	**Any two from:** feed on dead material (1) by extracellular digestion / releasing enzymes (onto the material) (1) digested / broken down food absorbed (1)	2	 **allow** feed on detritus **allow** eat as alternative to feed by releasing enzymes onto dead material (2)
b i	16.7 (1)	1	**not** 16.6 / 16.66 / 16.666 etc **allow** 16.6 recurring / 16.67 if answer line blank look in table
ii	A (1) earthworms / woodlice can get into the bag (1) they increase the surface area of the leaves (for the bacteria / fungi / saprophytes / decomposers to work on) (1)	3	if **A** not selected then no marks **allow** more detritivores in the bag **ignore** decomposers **allow** break up the leaves / break the leaves down into smaller pieces **ignore** just break down the leaves **allow** reference to more oxygen allowed in (1) **ignore** more air
iii	**any two from:** bacteria / fungi / saprophytes / decomposers respire slower / stop respiring (1) bacteria / fungi / saprophytes / decomposers reproduce slower / stop reproducing (1) reference to slower enzyme action (1)	2	**allow** ORA throughout **allow** bacteria / fungi / saprophytes / decomposers die or numbers decrease **allow** one mark for detritivores are less active (1)
	Total	**8**	

Question	Answer	Marks	Guidance
5 a	**A** (1)	1	**allow** $CuCO_3 \rightarrow CuO + CO_2$
b	**E** (1)	1	**allow** $2K + 2H_2O \rightarrow 2KOH + H_2$
c	**C** (1)	1	**allow** $K - e^- \rightarrow K^+$
d	**F** (1)	1	**allow** $Cu^{2+} + 2OH^- \rightarrow Cu(OH)_2$
	Total	**4**	

Question	Answer	Marks	Guidance
6	**[Level 3]** **Explains how far the results support the conclusion by reference to one supporting result and one that is not supporting** **AND** **a description of the flame test** Quality of written communication does not impede communication of the science at this level (5 – 6 marks) **[Level 2]** **Explains how far the results support the conclusion by reference to one supporting result or one that is not supporting** **AND** **a description of the flame test** Quality of written communication partly impedes communication of the science at this level (3 – 4 marks) **[Level 1]** **Explains the results of any one test** **OR** **gives a description of the flame test** **OR** **states what two of the chemical tests are testing for** 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 C and D** **Relevant scientific points supporting could include** • barium chloride / white precipitate indicates sulfate present **Relevant scientific points not supporting could include** • flame test / yellow flame indicates presence of sodium • silver nitrate / the yellow precipitate indicates iodide present / silver nitrate doesn't test for either iron (II) or sulfate • sodium hydroxide / brown precipitate indicates iron(III) / should go green with iron (II) **Relevant scientific points about flame tests could include** • put substance into a (blue Bunsen) flame • use of a flame test wire / splint / spray • observe the colour of the flame **Use the L1, L2, L3 annotations in scoris. Do not use ticks.**
	Total	**6**	

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>7 a</td><td><table><tr><th>Region</th><th>Percentage of water resource needed each day in %</th></tr><tr><td>A</td><td>60</td></tr><tr><td>B</td><td>50</td></tr><tr><td>C</td><td>96</td></tr><tr><td>D</td><td>50</td></tr><tr><td>E</td><td>20</td></tr></table>(1)</td><td>1</td><td>both answers needed for the mark</td></tr>
<tr><td>b</td><td>idea that most of the water available is needed /
idea that the water used is close to the total available
(1)</td><td>1</td><td>allow there is very little spare water available (and so could easily run out if there was a problem)
allow only 4% reserve each day

ignore 96% is used / it will run out / there is not enough / 4%</td></tr>
<tr><td></td><td>Total</td><td>2</td><td></td></tr>
</table>

Question	Answer	Marks	Guidance
8 a	closely packed metal ions (1) in a sea of electrons / with free electrons / with delocalised electrons (1)  	2	**not** intermolecular forces / covalent bonding / ionic bonding / (metal) molecules = 0 for the question **ignore** atoms **allow** positive atoms, cations, positive ions instead of metal ions marks can be awarded from a **labelled** diagram needs to be minimum of six ions to score metal ion mark
b	high melting point because strong attraction / strong (metallic) bonds / strong forces between metal ions and (delocalised) electrons (1) conducts electricity because electrons can move / it has free electrons / it has delocalised electrons (1)	2	**not** intermolecular forces / ionic bonds / covalent bonds **allow** positive atoms, cations, positive ions instead of metal ions **allow** lots of energy to break bonds / overcome attractions / forces / overcome electrostatic attractions **ignore** atoms **ignore** electromagnetic bonds
	Total	**4**	

Question	Answer	Marks	Guidance
9 a	idea that there is more evidence being found (1) idea that better technology / equipment available nowadays (1)	2	**allow** idea that finding out more about them / making new discoveries / making new developments / better understanding / scientists are still working on the topic **ignore** reference to discoveries of new elements
b	contains 16 protons because this is the atomic / proton number (1) contains 16 neutrons as this is the difference between mass number and atomic number / number of protons (1) contains 18 electrons as two more than proton number (1)	3	**allow** clear indication on symbol that 16 is the number of protons / bottom number on the symbol is the number of protons **allow** 32 – 16 = 16 **allow** ECF eg if they give number of protons as 18, then allow 32 – 18 = 14 **allow** 16 + 2 = 18 if incorrect number of protons given, **allow** a mark for a clear explanation that it has 2 more electrons than the number of protons stated **allow** ECF **allow** 16 protons, 16 neutrons, 18 electrons for one mark if no other marks scored
	Total	**5**	

Question	Answer	Marks	Guidance
10 a	6 (1)	1	more than one answer = 0
b i	strong attraction between positive and negative ion (1)	1	**not** strong covalent bond, strong metallic bond / intermolecular forces or references to molecules **allow** strong ionic bond / ions have strong bonds **ignore** strong bonds unless qualified **allow** it takes a lot of heat energy to break or overcome the ionic bonds
ii	**any two from** Mg^{2+} has a higher charge (than Na^{+}) (1) O^{2-} has a higher charge (than Cl^{-}) (1) greater attraction between ions (1)	2	**assume answers refer to magnesium oxide** **allow ora** **allow** Mg^{2+} is smaller (than Na^{+}) **not** atom **allow ora** **allow** O^{2-} is smaller (than Cl^{-}) **not** atom charge on ions in MgO greater than in NaCl (2) **not** strong covalent bond, strong metallic bond / intermolecular forces or references to molecules **allow** stronger ionic bonds **ignore** strong bonds unless qualified **if no other marks scored** then identifying Mg^{2+} **and** O^{2-} (1)
	Total	**4**	

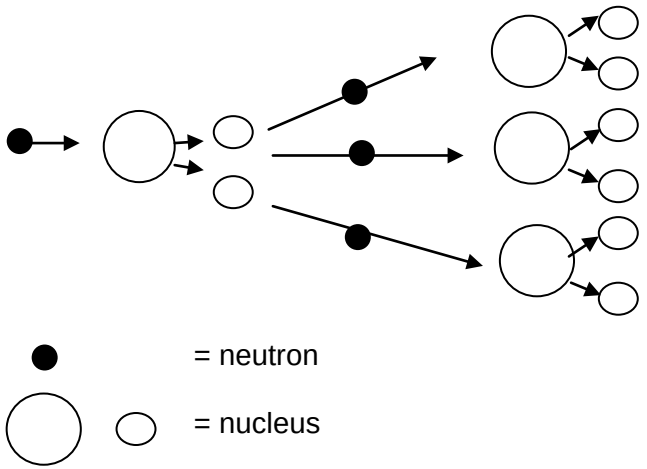
Question	Answer	Marks	Guidance
11 a	16(.0) (ohms) (2) **but if incorrect** $\frac{8}{0.5}$ (1)	2	**if answer line blank allow answer in table**
	B (1) (and) **D** (1)	2	either order
b	**Total**	**4**	

Question	Answer	Marks	Guidance
12 a	time taken for count rate / activity to drop to half its value (1)	1	**allow** time for half the mass of isotope to decay (1) **allow** time for half the atoms / nuclei to decay (1) **ignore** time to give out half the radiation / half of the time taken for the substance to decay / **ignore** time for half the atom / nucleus to decay
b	8 hours (2) **but if incorrect** ideas that 3200 to 400 or 400 to 50 are 3 half-lives (1)	2	 **allow** 3200 – 1600 – 800 - 400 / 400 – 200 – 100 – 50 (1)
c	**any two from:** the type of radiation (emitted) (1) how penetrating the radiation is (1) how ionising is it (1)	2	 **allow** is it alpha / beta /gamma **ignore** can **it** penetrate the skin (as this is referring to the isotope) is it beta / gamma as they can penetrate (2) cannot use alpha as it does not penetrate (2) cannot use alpha as it is too ionising (2) **ignore** references to harmful / damaging
	Total	**5**	

Question	Answer	Marks	Guidance
13 a	**[Level 3]** **Identifies the mistake in the wiring of kettle 2** **AND** **explains why kettle 1 is safe** **AND** **explains why kettle 2 is unsafe.** Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **[Level 2]** **identifies the mistake in the wiring of kettle 2 AND explains why kettle 1 is safe** **OR** **identifies the mistake in the wiring of kettle 2 AND explains why kettle 2 is unsafe** **OR** **explains why kettle 1 is safe AND explains why kettle 2 is unsafe** Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **[Level 1]** **Identifies the mistake in the wiring of kettle 2** **OR** **explains why kettle 1 is safe** **OR** **explains why kettle 2 is unsafe.** 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 about mistake in the wiring of kettle 2** • fuse is in the neutral wire / is in the wrong place • should be in the live wire **Indicative scientific points about why kettle 1 is safe:** • if large current / live wire touches metal case then large current to earth • fuse melt / blows / breaks so kettle not live • current stops **Indicative scientific points about why kettle 2 is NOT safe:** • if large current / live wire touches metal case • fuse does not melt / blow / breaks so kettle live • current does not stop **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**

b	current = 10.9 (A) (1) fuse rating = 13 (A) (1)	2	**allow** 11 / 10.87 / 10.870 / 10.8696 etc **not** 10.8 or 10.86 or 11.0 **allow** ecf from current value fuse chosen must be appropriate to the current given eg if current is calculated as 2A then fuse should be 3A
	Total	8	

Question	Answer	Marks	Guidance
14 a	<u>at positive plate:</u> ball becomes positively charged / loses electrons (1) <u>at negative plate:</u> ball receives negative charge / electrons (1) <u>consequence</u>: positive ball repelled from positive plate / positive ball attracted to negative plate / negative ball repelled from negative plate / negative ball attracted to positive plate (1)	3	**unless qualified 'it' refers to ball** **allow** ball gains a positive charge **not** ball gains positive charge**s** If no other mark awarded allow: each time the ball touches a plate it gains that charge (1)
b	wire mesh is made of metal / wire mesh is a conducting material (1) charge is removed / charge flows to earth (1)	2	**Allow** it / pipe / nozzle / pump for wire mesh **allow** current / electrons for charge **ignore** electricity flows to earth
	Total	**5**	

Question	Answer	Marks	Guidance
15 a	**any two from** neutron collision causes nucleus to split giving several neutrons (1) neutrons collide with other nuclei (1) these neutrons cause more nuclei to split (1)	2	**allow correct answers on a diagram e.g.**  **allow** atoms for nuclei throughout
b	(by inserting) control rods / boron rods (1)	1	**ignore** inserting rods unless qualified by neutron absorption **not** metal rods / graphite rods
	Total	**3**	

Question	Answer	Marks	Guidance
16 a	carbon fibre is strong(er) so screen (it) is less likely to break (1) carbon fibre has low(er) density so computer (it) will be light (1)	2	**allow** ORA throughout **ignore** carbon fibre is light **allow** lightweight **if no other mark awarded allow** carbon fibre / computer is strong(er) and has low(er) density (1)
b i	1.3×10^7 (1) ☐ √ ☐ ☐	1	
ii	8 / 9 (years) (1)	1	**allow** 8.9 / 8.91 / 8.906 etc
iii	**any two from:** can be used because resistance can be less than 30 Ω (1) at 30 Ω / maximum transparency for screens is 87% (1) can give lower resistance but it is not very transparent (1) less transparent than graphene (1)	2	**allow** can be used because it can be less than 30 Ω **allow** maximum is 86 – 88% **allow** as resistance decreases, transparency decreases ORA **ignore** less transparent / low transparency unless qualified
c	**any four from:** strong(er) (1) low(er) density (than carbon fibre or indium) (1) **graphite** will not run out for a long time (1) graphite not run out for 64.5 years (1) it has a high transparency (1) **but** it has a high transparency for its resistance / for a low resistance (2)	4	**ignore** light / **allow** lightweight **ignore** lots of graphene left / **it** will not run out **allow** any value in range 60 -70
	Total	**10**	

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