OCR
RECOGNISING ACHIEVEMENT

GCSE

Additional Science B

General Certificate of Secondary Education

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

Mark Scheme for June 2013

Oxford Cambridge and RSA Examinations

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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.

For answers marked by levels of response:

a. **Read through the whole answer from start to finish**

b. **Decide the level** that **best fits** the answer – match the quality of the answer to the closest level descriptor

c. **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

d. 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.

Annotations

Annotation	Meaning
	correct response
	incorrect response
	benefit of the doubt
	benefit of the doubt **not** given
	error carried forward
	information omitted
	ignore
	reject
	contradiction
	Level 1
	Level 2
	Level 3

Subject-specific Marking Instructions

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

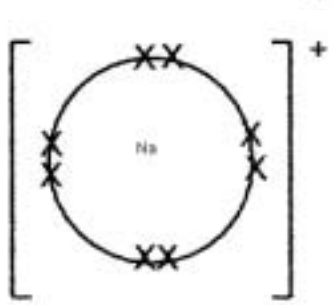
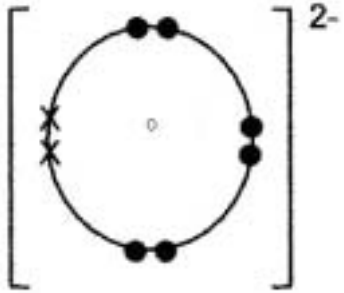
Question			Answer	Marks	Guidance
1	(a)	(i)	**A** is 40 (1) **B** is 28 (1)	2	
		(ii)	those with white paint / in area **A** are more easily seen / caught by predators (1) **but** those with white paint / in area **A** are more easily seen by predators so the population estimate for area **A** is too high (2) **or** those with white paint / in area **A** are more easily seen by Lily so the population estimate for area **A** is too low (2)	2	**allow** reverse arguments referring to area **B** throughout **allow** white paint could scare predators (1) so population estimate for area **A** is too low (1) **allow** paint might affect the chance of predation / ease of recapturing **for one mark** **ignore** references to movement between areas

Question			Answer	Marks	Guidance
	(b)		**Level 3 (5–6 marks)** **Explains how the action of woodlice / earthworms increases rate of decay by increasing the surface area for decomposers to work on** **AND** **that this provides elements and describes a function of at least one of the elements.** Quality of written communication does not impede communication of the science at this level. **Level 2 (3–4 marks)** **Describes the action of woodlice / earthworms at the correct level** **AND** **that this provides a named mineral or named element and describes a function of at least one of the minerals / elements** Quality of written communication partly impedes communication of the science at this level. **Level 1 (1–2 marks)** **Describes the action of woodlice / earthworms at the correct level** **OR** **appreciates that decay provides minerals / elements** Quality of written communication impedes communication of the science at this level. **Level 0 (0 marks)** Insufficient or irrelevant science. Answer not worthy of credit.	6	**This question is targeted at grades up to A*.** **Indicative scientific points may include:** **action of woodlice / earthworms:** • increases decay (of vegetation) (level 1 & 2) • earthworms aerate the soil (level 1 & 2) • feed on dead and decaying material (level 1 & 2) • increase decay by increasing surface area (level 3) • for saprophytes / decomposers (level 3) **decay provides elements:** • N / nitrogen for amino acids • P / phosphorus for DNA / cell membranes • K / potassium to help enzymes • Mg / magnesium for chlorophyll **decay provides minerals:** • nitrates for proteins / growth • phosphates for respiration / growth • potassium for respiration / photosynthesis • magnesium for photosynthesis **Use the L1, L2, L3 annotations in scoris. Do not use ticks.** **ignore** detritivores decay or decompose dead material **allow** earthworms die and decay / earthworm faeces decay as an alternative to increases the rate of decay at level 1
			Total	**10**	

Question			Answer	Marks	Guidance
2	(a)	(i)	**any two from:** as the distance increases the number of bubbles decreases / ora (1) as distance increases light or energy decreases / ora (1) as light intensity increases the number of bubbles increases (1) **and** distance or light (intensity) affects (the rate of) photosynthesis **or** photosynthesis produces oxygen (1)	3	 **allow** as distance increases less oxygen or gas released / ora (1) **ignore** air but **allow** air bubbles **not** other named gases **ignore** heat **allow** more oxygen or gas released as light increases / ora (1) **BUT** **allow** increased light (intensity) increases (the rate of) photosynthesis (2)
		(ii)	use a measuring cylinder / syringe (2) **or any two from** measure **volume** (of oxygen) (1) use of ruler (to measure gas collected) (1) measure height of gas / measure height of oxygen (1)	2	
	(b)	(i)	<u>turgid</u> (1)	1	**ignore** turgor (pressure)
		(ii)	(on land, plant cells need water) for support / for cooling (1)	1	**allow** gets warmer on land **allow** stabilise / prevent wilting **allow** store water **ignore** turgor pressure / flaccid
			Total	**7**	

Question			Answer	Marks	Guidance
3	(a)	(i)	idea that it is a closed system / the water is recycled (1)	1	**allow** no waste / no water is released from greenhouse **allow** does not leak **ignore** water / fertiliser / pollution does not get into rivers / does not leach into rivers
		(ii)	idea that we have become more **aware** of pollution / idea that we have more **evidence** of pollution (1)	1	 **ignore** increased population **ignore** there is more pollution now
	(b)		plants can take up minerals / fertiliser from low concentrations (1) active transport is used (1)	2	**allow** plants take up minerals / fertilisers against a concentration gradient **allow** idea that there is plenty of oxygen in the water so active transport is not limited (1)
	(c)		**any two from:** guard cells take in water (1) by osmosis (1) guard cells become turgid / swell up (1) guard cells change shape (due to differing thickness of cell wall) (1)	2	
	(d)		**any two from:** hollow / lack cytoplasm / tubes (1) thick / strong / waterproof (cell) wall (1) no end walls / (1) reference to lignin (1)	2	**ignore** any functions eg carries water from roots **allow** xylem is dead (1)
			Total	**8**	

Question			Answer	Marks	Guidance
4	(a)		17 (protons) (1) 18 (neutrons) (1)	2	
	(b)		**particle** **relative electric charge** **relative mass** electron **-1** 0.0005 neutron **0** 1 proton +1 **1**	2	all 3 correct (2) 1 or 2 correct (1) **allow** neutral
			Total	**4**	

Question			Answer	Marks	Guidance
5	(a)		$CaCl_2$ (1)	1	**not** CaCl2 / $CaCl^2$ **allow** as product of equation
	(b)		sodium ion drawn with either a full outer shell or an empty one and a charge of +1 **or** structure of sodium ion showing complete electron shells and a charge of +1 i.e. [Na]$^+$ **or**  (1) one oxide ion drawn with 8 electrons in outer shell and charge of *–2*  (1)	2	**allow** electrons drawn as all dots or all crosses **allow** correct structures without brackets **ignore** inner shells **not** $(Na_2)^{2+}$ or $(Na)_2^{2+}$ **allow** Na^+ or $2(Na)^+$ or $(Na^+)_2$ or two sodium ions drawn **if the electrons lost by sodium atoms are drawn more than once, answer scores zero if this is the only diagram shown** eg either on the oxide ion outer shell or on the sodium atom(s) with an arrow showing it / them being transferred to the oxygen atom **if a covalently bonded structure is shown in the diagram answer scores 0, but if covalent in the writing and correct diagram then ignore writing** **not** O_2^{2-} **allow** a maximum of one mark for either: correct electronic structure of sodium ion and oxide ion (1) **or** correct charges on ions – this is independent of the electronic structures drawn eg Na^+ O^{2-} (1)

Question			Answer	Marks	Guidance
	(c)		(high melting point because) there are **strong** attractions / forces / bonds between (positive and negative) ions (1) (does not conduct electricity as a solid) as ions cannot move / ions are in fixed positions (1)	2	**not** references to intramolecular / intermolecular forces **not** covalent **ignore strong** attractions / bonds between particles but **allow strong** attractions / bonds between charged particles **allow** idea that it requires a lot of energy to break the ionic bonds **ignore** (charged) atoms **allow strong** electrostatic attractions between ions **ignore** reference to electrons
			Total	**5**	

Question			Answer	Marks	Guidance
6	(a)		linking absence of bromide (ions) to test with silver nitrate solution (1) linking presence of sulfate (ions) to test with barium chloride solution (1)	2	**ignore** yes or no **eg** bromide (ions) would give a cream precipitate with silver nitrate (1) **allow** idea that sample contains iodide (ions) (1) **allow** idea that sulfate (ions) present but no bromide (ions) for one mark
	(b)		$BaCl_2 + Na_2SO_4 \rightarrow BaSO_4 + 2NaCl$ correct reactants and products (1) correct balancing (1)	2	**allow** any correct multiple, including fractions **allow** = / ⇆ instead of → **not** and / & / '+ energy' balancing mark is dependent on the correct formulae but **allow** 1 mark for a balanced equation with a minor error in subscripts / formulae eg BaCl2 + $Na_2SO_4 \rightarrow$ BaSO4 + 2NaCl
			Total	**4**	

Question			Answer	Marks	Guidance
7	(a)		(dark) grey solid (1)	1	**allow** purple solid or violet solid **ignore** blue solid or black solid or blue / black solid **allow** crystals for solid
	(b)		-189 to -260 (1)	1	**allow** answers given as range if it falls within the stated values
	(c)		sodium + bromine → sodium bromide	1	**not** sodium bromine **allow** = instead of → **not** and / & / instead of + **allow** correct formulae but equation does not need to balance eg Na + Br_2 → NaBr **allow** mix of correct formulae and words **ignore** $Na^+ + Br^-$ → NaBr
			Total	**3**	

Question			Answer	Marks	Guidance
8	(a)		metal **A** (1) **because** low(est) density (1)	2	 **allow** lightweight / other wires are too dense (1) **ignore** light but **allow** light density **ignore** references to other properties **allow** metal B because it has a high electrical conductivity for maximum of one mark
	(b)		(only) work at (very) low temperatures (1)	1	**allow** (only) work at temperatures less than -150^{0}C **allow** (only) work when (very) cold
			Total	**3**	

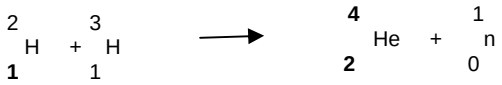
Question			Answer	Marks	Guidance
9		✎	**Level 3 (5–6 marks)** **Answer includes a piece of evidence used by both AND** **includes an idea used by Newlands and an idea used by Mendeleev.** Quality of written communication does not impede communication of the science at this level. **Level 2 (3–4 marks)** **Answer includes a piece of evidence used by both and includes an idea used by Newlands or Mendeleev OR** **answer includes an idea used by Newlands and an idea used by Mendeleev** Quality of written communication partly impedes communication of the science at this level. **Level 1 (1–2 marks)** **Answer includes a piece of evidence used by both OR** **includes an idea used by EITHER Newlands or Mendeleev** Quality of written communication impedes communication of the science at this level. **Level 0 (0 marks)** Insufficient or irrelevant science. Answer not worthy of credit.	6	**This question is targeted at grades up to A.** **Indicative scientific points may include:** **Evidence used by both:** • arranged elements so that elements with similar chemical properties / reactivity were grouped together • arranged elements in order of their (atomic) mass **Newlands:** • realised elements with similar chemical properties were 8 positions away from each other • this is similar to musical notes in an octave • pattern does not work for all elements **Mendeleev:** • left gaps for elements not yet discovered • accurately predicted the properties of elements yet to be discovered • ignored hydrogen as it did not fit pattern • realised that not all elements had been discovered **Use the L1, L2, L3 annotations in scoris. Do not use ticks.**
			Total	**6**	

Question			Answer	Marks	Guidance
10	(a)		idea that **electrons** move (1) **but** electrons move to the cloth / from the brush (2) **and** leaving the brush positively charged (1)	3	protons or positive electrons or positive particles moving = 0 marks for the question **allow** negative charges move to the cloth / from the brush (1) **ignore** electrons attracted to cloth
	(b)		electrons ..... negative (1) attract..... struck (1)	2	**both needed** **both needed**
			Total	**5**	

Question			Answer	Marks	Guidance
11	(a)		2 4 0.5 (2)	2	all 3 currents correct = 2 marks 1 or 2 currents correct = 1 mark
	(b)		**A compared to B** idea that **A** has a high**er** resistance than **B** because it is a long**er** wire / ora (1) **but** doubling the length doubles resistance / ora (2) **AND** **A compared to C** idea that **A** has low**er** resistance than **C** because it is thick**er** / ora (1) **but** idea that halving the thickness increases resistance by 4 / ora (2) **maximum three marks for question**	3	**ignore** any references to current throughout **allow** the long**er** the wire the high**er** the resistance / ora (1) **ignore** strong**er** resistance / weak**er** resistance **allow** resistance is proportional to length (2) **allow** the thinn**er** the wire the high**er** the resistance / ora (1) **ignore** strong**er** resistance / weak**er** resistance **allow** resistance is inversely proportional to thickness^2 (2)
			Total	**5**	

Question			Answer	Marks	Guidance
12	(a)		**Level 3 (5–6 marks)** **Identifies C / gamma should be used.** **AND** **the answer justifies this with reference to length of half life** **AND** **the ability to penetrate out of the body.** Quality of written communication does not impede communication of the science at this level. **Level 2 (3–4 marks)** **Identifies C / gamma should be used.** **AND** **the answer justifies this with reference to length of half life or the ability to penetrate out of the body.** Quality of written communication partly impedes communication of the science at this level. **Level 1 (1–2 marks)** **Identifies C / gamma should be used** **OR** **answer makes any relevant reference to a property of one of the types of radiation.** Quality of written communication impedes communication of the science at this level. **Level 0 (0 marks)** Insufficient or irrelevant science. Answer not worthy of credit.	6	**This question is targeted at grades up to C.** **Indicative scientific points at all levels may include:** **Identification of source** • source **C** / gamma source selected **Explanations – half life** • refer to half-life of **C** being very short / little radiation emitted after a few half-lives • gamma / **C** would decrease faster (so causing less harm) **Explanations – penetration** • gamma / **C** penetrates further (than alpha or beta) • gamma / **C** would leave body and be detected • gamma is least ionising **Indicative scientific points at level 1, if no other marks scored, may include:** • refer to relatively long half-life of **A** • very long half-life of **B** • idea of **A** / alpha and **B** / beta staying in the body too long • alpha / **A** and beta / **B** could harm inside of body / tissue / organs etc • alpha **A** and beta / **B** would be stopped by body / not leave body **Use the L1, L2, L3 annotations in scoris. Do not use ticks.**

Question			Answer	Marks	Guidance
	(b)		idea that Sheng Li / radiographer's advice based on scientific data / specialist knowledge (1) idea that data shows dose from scan is much less than he will get from everyday exposure / less than the level allowed in jobs such as airline pilot / in nuclear industry (1)	2	eg Sheng Li is a qualified radiographer (1) **allow** benefit outweighs the risks (1)
	(c)		particles clos**er** together in **M** / particles furth**er** apart in **L** (1) areas of compression and rarefaction / idea of **repeating areas** of high and low pressure (1)	2	**allow** particles are close in **M** and apart in **L** (1)
			Total	**10**	

Question			Answer	Marks	Guidance
13	(a)	(i)	40 (years) (2)	2	incorrect answer = zero marks but if no answer on the answer line, look for correct lines drawn on graph for one mark
		(ii)	25 (g) (1)	1	
	(b)	(i)	1 for number on H **and** 4 (top) 2 (bottom) (1) 	1	**complete balancing needed for the mark**
		(ii)	**high** temperature **and** (high) pressure or **high** pressure **and** (high) temperature (1)	1	**any order both needed** **ignore** extreme temperature or extreme pressure **ignore** (high) heat
			Total	**5**	

Question			Answer	Marks	Guidance
14	(a)		using ultrasound does not involve injection / idea that it is non-invasive / does not involve an injection / does not damage cells or tissues / less risk from ultrasound (than radioactivity) / idea that injections are painful / ora (1)	1	**ignore** ultrasound is easier / quicker **allow** ultrasound is safer / less harmful (1) **allow** injections are more stressful (1)
	(b)	(i)	1.50 (metres squared) (1)	1	**allow** 1.5 (1) **allow** 1.49 to 1.51 (1)
		(ii)	4 (1) healthy (as less than 4.2) (1)	2	**allow** ecf from (c)(i) **allow** normal / just above normal (1) **allow** ecf from cardiac index calculation e.g. an answer 4.5 would mean she is unhealthy can score the conclusion mark
	(c)		120 (2) but 1800 as number for total value (1)	2	
	(d)	(i)	**any two from:** the larger the animal, the longer it lives / ora (1) the larger the animal, the slower its heart rate / ora (1) the longer it lives, the slower the heart rate / ora (1)	2	
		(ii)	live longer (than expected for their size / heart rate) (1) idea of health care / lack of predation / less competition for food (1)	2	
			Total	**10**	

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