



**General Certificate of Secondary Education
June 2013**

Additional Science

AS2HP

(Specification 4409)

Unit 6: Additional Science 2 (Higher tier)

Final

Mark Scheme

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all examiners participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for standardisation each examiner analyses a number of students' scripts: alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, examiners encounter unusual answers which have not been raised they are required to refer these to the Principal Examiner.

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Quality of Written Communication and levels marking

In Question 1(c) candidates are required to produce extended written material in English, and will be assessed on the quality of their written communication as well as the standard of the scientific response.

Candidates will be required to:

- use good English
- organise information clearly
- use specialist vocabulary where appropriate.

The following general criteria should be used to assign marks to a level:

Level 1: basic

- Knowledge of basic information
- Simple understanding
- The answer is poorly organised, with almost no specialist terms and their use, demonstrating a general lack of understanding of their meaning, little or no detail
- The spelling, punctuation and grammar are very weak.

Level 2: clear

- Knowledge of accurate information
- Clear understanding
- The answer has some structure and organisation, use of specialist terms has been attempted but not always accurately, some detail is given
- There is reasonable accuracy in spelling, punctuation and grammar, although there may still be some errors.

Level 3: detailed

- Knowledge of accurate information appropriately contextualised
- Detailed understanding, supported by relevant evidence and examples
- Answer is coherent and in an organised, logical sequence, containing a wide range of appropriate or relevant specialist terms used accurately.
- The answer shows almost faultless spelling, punctuation and grammar.

Question 1

question	answers	extra information	mark
1(a)	any one from: <ul style="list-style-type: none"> • same amount / size (pieces) of egg (white) • same temperature • same concentration of enzyme • repeat (the whole investigation) • greater range of pH / more pH values • smaller intervals between pH values 	do not accept the same pH ignore factors already identified in method eg volume of solution / enzyme / acid / number of cubes accept eg put (all) in a water bath do not accept suggestions that introduce a new independent variable (eg do at more temperatures)	1
1(b)(i)	Enzyme A – stomach Enzyme B – small intestine / pancreas	do not accept large intestine allow ileum ignore intestine unqualified	1 1
1(b)(ii)	any one from: <ul style="list-style-type: none"> • enzyme (A) works best in acidic conditions • stomach contains / makes (hydrochloric) acid 	accept low pH or pH below 7 for acid allow stomach is acid	1

Question 1 continues on the next page

Question 1 continued

question				mark
1(c)	Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 3.			6
0 marks	Level 1 (1-2 marks)	Level 2 (3-4 marks)	Level 3 (5-6 marks)	
No relevant content.	At least one enzyme is named or the reaction an enzyme is involved in or the use of the products.	At least one enzyme is named and the reaction the enzyme is involved in or at least one enzyme is named and the use of its product or at least one reaction is described and the use of the product.	At least one enzyme is named and the reaction the enzyme is involved in and the use of its products and further information provided as described in Level 2 for a further enzyme, reaction, use.	
Examples of biology points made in the response: <ul style="list-style-type: none"> • (E) protease • (R) (protease) digests protein • (R)(protein) to amino acids • (U) (protease) in (biological) detergents / washing powder / removes stains in clothes • (U) (protease)(digest protein) in baby food • (E) lipase • (R) (lipase) digests fat / lipid / oil • (R) (lipid / fat / oil) to fatty acids and glycerol • (U) (lipase) in (biological) detergents / washing powder / removes stains in clothes • (E) carbohydrase / amylase • (R) (carbohydrase / amylase) digests / converts starch • (R) (starch) to sugar (syrup) then <ul style="list-style-type: none"> • (E) isomerase • (R) (isomerase) converts glucose / sugar (syrup) • (R) (glucose / sugar (syrup)) to fructose (syrup) • (U) (fructose) in slimming foods NB credit should be awarded for other specific examples of enzymes and their uses.				
Total				10

Question 2

question	answers	extra information	mark
2(a)(i)	calcium chloride (solution)	do not allow calcium chlorine ignore formulae ignore water	1
2(a)(ii)	carbon dioxide	do not allow carbon oxide ignore formulae	1
2(b)	(initial rate is) high the rate decreases the rate becomes zero or the reaction stops	ignore figures unless calculated as a rate accept fast(er) / rapid (at start) accept slows down allow max 2 marks for description of graph in terms of volume of gas produced	1 1 1
2(c)(i)	line from origin to left of original line until end levels out at 80cm ³	tolerance + / - one small square	1 1
2(c)(ii)	particles have more energy (so particles) move faster (so there are) more frequent / energetic collisions	allow harder collisions allow more chance of collisions ignore faster collisions accept more particles have the activation energy needed	1 1 1
Total			10

Question 3

question	answers	extra information	Mark
3(a)(i)	insulator	accept not a conductor(of electricity) accept so you do not get electrocuted ignore references to 'heat' conduction ignore cost and other properties of plastic	1
3(a)(ii)	live	in either order	1
	neutral		1
3(b)(i)	students can choose any cable, but in order to gain marks the physics must be correct for that cable.	allow converse answers	1
	(cable 3 because)		
	(two-core) – does not need / have an earth wire or is double insulated		
	(3000W as) max power of the lawnmower / it needs 2760(W)		
	(flexible plastic) mower must be able to move easily	allow 1 mark for 230 x 12 with incorrect or no answer	2
3(b)(ii)	(RCCB detects a) difference in the (current in the) live and neutral		1
	cuts off the live / circuit		1
Total			9

Question 4

question	answers	extra information	mark
4(a)(i)	(first space) oxygen	allow O ₂ / O ₂	1
	(second space) carbon dioxide	allow CO ₂ / CO ₂	1
4(a)(ii)	lactic acid / lactate		1
	oxidised / oxygen added	allow (more) oxygen taken in	1
	to carbon dioxide (and water)	allow to (re)form glucose	1
4(b)	(100m runners)	accept converse for 10000m runners throughout	
	low oxygen supply (to muscles)		1
	(so) more anaerobic respiration or less aerobic respiration	} if no reference to 'more' max 2 marks for marking points 2, 3, 4	1
	(so) more lactic acid produced		1
(so) greater oxygen debt (to repay)	1		
Total			9

Question 5

question	answers	extra information	mark
5(a)	(albino / albinism) allele / gene is recessive	allow albinism is recessive accept albinism is not dominant allow normal / non-albino (gene / allele) is dominant	1
	heterozygote (also) has a dominant / non-albino / normal allele / gene	allow would need two recessive alleles / genes to be albino allow would need to be homozygous (recessive) to be albino	1
5(b)(i)	double helix	both ideas required allow description eg like a twisted ladder accept a diagram	1
5(b)(ii)	DNA is / has a code / instructions	allow DNA controls protein production	1
	(change in DNA causes) different amino acids to be present	allow amino acids are in a different order / wrong allow required amino acids are missing	1
	amino acids cannot link / join to form tyrosinase	amino acids linked / joined to make different / no protein or enzyme	1
Total			6

Question 6

question	answers	extra information	mark
6(a)	(group of) animals / plants / organisms that reproduces / breeds successfully (within the group)	accept breed to produce fertile offspring allow (group of organisms) that cannot reproduce successfully with another group	1
6(b)	are isolated / separated		1
	different (environmental) conditions on Anguilla (than Guadeloupe)	allow different environment / habitat accept reasonable suggestions of environmental conditions	1
	best suited survive / least suited die	allow 'survival of the fittest'	1
	changes / differences prevent (successful) breeding (with original species)	allow mating for breeding	1
Total			5

Question 7

question	answers	extra information	mark
7(a)	exothermic	ignore chemical	1
7(b)(i)	(small pieces) provide larger surface area (for reaction to take place on)		1
	(so rate of) reaction is faster	accept (so) more frequent (particle) collisions take place if no other marks awarded allow 1 mark for provides large surface area and reaction is fast	1
7(b)(ii)	$4\text{Fe} + 3\text{O}_2 \rightarrow 2\text{Fe}_2\text{O}_3$	ignore state symbols allow correct multiples the reactants can be in either order	
		1 mark for correct formulae do not allow Fe_2 or charges 1 mark for correct balancing	1 1
		allow $2\text{Fe} + 3\text{O} \rightarrow \text{Fe}_2\text{O}_3$ for 1 mark	

Question 7 continues on the next page

Question 7 continued

question	answers	extra information	mark
<p>7(c)</p>	<p>any 4 from:</p> <p>(reusable)</p> <ul style="list-style-type: none"> • reaches a higher temperature • can be used more times / again • uses up smaller amounts of (finite) resources • doesn't give heat out for as long • (reference to cost of) energy needed to reverse reaction (and reuse) • is more difficult to use as it has to be placed in boiling water before reuse • ref to safety aspects of having to use boiling water • may use more energy (to reuse) as need to use boiling water <p>or</p> <p>the energy needed to reuse may be less than the energy needed to make a new hand warmer</p> <ul style="list-style-type: none"> • the candidate states an opinion which is then justified 	<p>ignore use of figures unqualified</p> <p>accept converse answers for disposable hand warmer</p> <p>ignore reusable</p> <p>accept uses less (finite) resources</p> <p>accept less expensive to use</p>	<p>4</p>
<p>Total</p>			<p>9</p>

Question 8

question	answers	extra information	mark
8	sodium bromide	accept potassium bromide / lithium bromide	1
	silver nitrate	do not accept lead bromide or silver bromide	1
	any two from: <ul style="list-style-type: none"> • mix <u>solutions</u> together • filter (precipitate formed) • wash and dry (the precipitate) 	allow any other named metal bromide	2
Total			4

Question 9

question	answers	extra information	mark
9(a)(i)	less energy used	ignore cheaper ignore references to rate of reaction allow less heating required allow less electricity / power used	1
9(a)(ii)	(so) ions are free to move	allow (the charged) particles are free to move do not allow electrons are free to move	1
9(b)(i)	$\text{Na}^+ (+ e^-) \rightarrow \text{Na}$		1
9(b)(ii)	reduction	allow reducing ignore electrolysis	1
9(b)(iii)	any three from: <ul style="list-style-type: none"> • chloride ions / Cl^- attracted (to the positive electrode) • (where) the (chloride) lose(s) electron(s) or (chloride) is / are oxidised • to form (chlorine) atoms / molecules • chlorine / Cl_2 (gas) is produced / released 	do not accept chlorine is attracted accept $2\text{Cl}^- \rightarrow \text{Cl}_2 + 2e^-$ or $2\text{Cl}^- - 2e^- \rightarrow \text{Cl}_2$ for 2 marks for bullet points 2 and 3	3
Total			7

Question 10

question	answers	extra information	Mark
10(a)(i)	222	in this order only	1
	86	ignore anything in boxes other than numbers	1
10(a)(ii)	(alpha / radiation) has low penetration or cannot get through skin	max 1 mark if wrong type of radiation accept does not travel very far (in air) or accept cannot penetrate wrapper / paper	1
	so is (only) dangerous when <u>inside the body</u>	ignore dangerous / harmful when eaten	1
	because it is (highly) ionising / causes mutation / causes (named) cancer		1
10(b)	1600 / 1.6×10^3 or 1.6 <u>thousand</u>	accept for 2 marks any answer in range 1500 – 1700 or 1.5×10^3 to 1.7×10^3 or 1.5 – 1.7 <u>thousand</u> allow 1 mark for any answer in range 1.5 to 1.7 or evidence from graph or numerical working of correct indication of half-life	2
10(c)	Technetium(-99) / Tc(-99)	accept converse arguments for justification marks	1
	idea of gamma can be detected outside the body / passes through skin		1
	half-life is long enough to get sufficient readings or short enough to not be (too) dangerous or does not stay in the body very long or requires a lower dosage / amount of tracer	If Rn-210 allow max 1 mark for half-life long enough to get sufficient readings or short enough to not be (too) dangerous or lower dosage needed If Cs-137 allow max 1 mark foremits gamma radiation that can be detected outside the body / passes through skin	1
Total			10

Question 11

question	answers	extra information	Mark
11(a)	dust and gas	accept remnants of a supernova accept hydrogen for gas ignore other gases	1
	pulled together by gravitational attraction / gravity		1
11(b)(i)	forces are balanced	accept outward force is balanced with inward force accept the outward / radiation pressure balances gravitational force do not accept outward energy	1
11(b)(ii)	(expands to become) red super giant	allow diagrammatic representation max 2 marks if order incorrect do not accept super red giant	1
	(becomes a) supernova or explodes		1
	(may then become) a Neutron star		1
	or (may then become) a black hole		1
		ignore references to (planetary) nebula or ejections of gas layers	

Question 11 continues on the next page

Question 11 continued

question	answers	extra information	mark
11(c)	<p><i>1st incorrect idea:</i> not all elements are made in stars</p> <p><i>Change:</i> only elements up to iron are created in stars</p> <p>or</p> <p>the heaviest elements are formed only in supernova explosions</p> <p><i>2nd incorrect idea:</i> not all stars explode</p> <p><i>Change:</i> only the more massive stars (go on) to supernova / explode</p> <p>or</p> <p>smaller stars do not (go on) to supernova / explode</p> <p>or</p> <p>stars form red (super) giants at the end of the main sequence</p>	<p>for 1 mark</p> <p>for 2 marks as incorrect idea implied</p> <p>for 1 mark</p> <p>for 2 marks as incorrect idea implied</p> <p>allow only stars (much) bigger than the sun go supernova / explode</p> <p>accept smaller / some stars form white / black dwarfs</p>	<p>2</p> <p>2</p>
Total			11

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