General Certificate of Secondary Education

Science A 4406

SCA1HP Unit 5

Mark Scheme

2012 examination – June series

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 meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting 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 the standardisation meeting each examiner analyses a number of students' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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MARK SCHEME

Information to Examiners

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example: where consequential marking needs to be considered in a calculation; or the answer may be on the diagram or at a different place on the script.

In general the right hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following lines is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. (Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.)

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which students have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error/contradiction negates each correct response. So, if the number of error/contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

Example 1: What is the pH of an acidic solution? (1 mark)

Student	Response	Marks awarded
1	4,8	0
2	green, 5	0
3	red*, 5	1
4	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Student	Response	Marks awarded
1	Neptune, Mars, Moon	1
2	Neptune, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a student writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Full marks can be given for a correct numerical answer, as shown in the column 'answers', without any working shown.

However if the answer is incorrect, mark(s) can be gained by correct substitution / working and this is shown in the 'extra information' column;

3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward are kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.7 Brackets

(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

Quality of Written Communication and levels marking

In Question 8 students 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.

Students 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.

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Question 1

question	answers	extra information	mark
1	A – receptor	ignore organ / nerve	1
	B – sensory	allow sensor	1
	C – CNS / central nervous system	accept spinal cord allow coordinator ignore brain do **not** accept spine	1
	D – motor		1
	E – effector		1
Total			**5**

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Question 2

question	answers	extra information	mark
2		only accept explanation if attempt at description made	
	sterilise Petri dish / agar / loop	accept description of sterilisation method ignore clean or disinfect Petri dish / agar / loop allow wash / clean / disinfect hands **or** do not touch agar / loop / milk with hands allow sterile gloves	1
	to kill / prevent transfer of bacteria / microorganisms	allow so no bacteria on allow fungi ignore viruses / germs	1
	tape the Petri dish lid **or** do not open the lid too far / too long	allow keep the lid on / Petri dish closed	1
	(so) less chance of bacteria / microorganisms getting in **or** less contamination from air	ignore to stop bacteria / microorganisms getting out ignore so air / oxygen does not get in	1
Total			**4**

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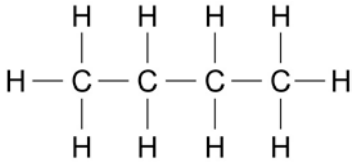
Question 3

question	answers	extra information	mark
3	auxin / hormone involved		1
	gravity / gravitropism / geotropism	ignore references to moisture / water / light / minerals	1
	(causes) auxin / hormone to collect on lower side of root		1
	(hormone) inhibits growth of cells on lower side of root **or** different growth (rates) of cells on upper and lower sides (causes root to grow downwards)		1
Total			**4**

SCA1HP

Question 4

question	answers	extra information	mark
4(a)	C_3H_8	allow H_8C_3 C and H must be upper case 3 and 8 should be subscript do **not** accept superscript 3 or 8	1
4(b)		all bonds must be shown all letters must be upper case ignore circles around letters do **not** allow double bonds	1
4(c)	carbon dioxide + water	answers can be in either order accept carbon dioxide as CO_2 and water as H_2O numbers in formulae must be subscript	1
4(d)	(smoke is) carbon (formed by) incomplete combustion	ignore soot accept insufficient oxygen	1 1
Total			**5**

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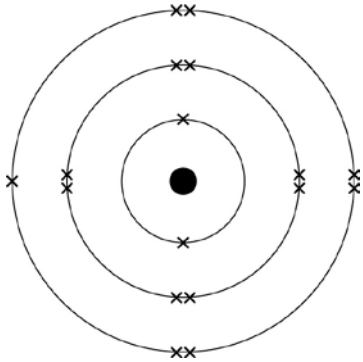
Question 5

question	answers	extra information	mark
5(a)		accept dot / small circle / e instead of any cross electrons need to be arranged as 2, 8, 7 but do not have to be in pairs	1
5(b)		if sharing electrons / covalent bonds mentioned only allow maximum of **2** marks	
	lithium loses electrons	accept for **2** marks lithium has only two electrons left	1
	one electron		1
	to form a positive ion / Li^+ **or** ion has a charge of 1^+	allow lithium (atom) becomes positively charged allow has a complete outer shell / energy level / orbit (of electrons)	1
Total			**4**

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Question 6

question	answers	extra information	mark
6(a)	**economic** any **one** from: • increases jobs • more money in local economy • increase in local trade • more shops / businesses • better transport links **environmental** any **one** from: • future development of quarry eg to lake / reservoir • future development to recreational area • provides different habitat		1 1
6(b)	calcium oxide and carbon dioxide (thermal) decomposition	both products required for mark allow CaO for calcium oxide allow CO_2 for carbon dioxide allow quicklime for calcium oxide	1 1
6(c)(i)	$CaO + H_2O \rightarrow Ca(OH)_2$	correct formulae 3 correct for **2** marks 2 correct for **1** mark ignore attempts to balance equation	2

Question 6 continues on the next page

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Question 6 continued

question	answers	extra information	mark
6(c)(ii)	carbon dioxide		1
	solution goes cloudy (then clear again)	accept milky / forms a white precipitate	1
Total			**8**

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Question 7

question	answers	extra information	mark
7(a)		accept converse statements	
	the lower the temperature the longer the (drying) time	allow a low temperature has a long (drying) time	1
	the higher the humidity the longer the (drying) time	allow a high humidity has a long (drying) time	1
		ignore temperature has a greater effect than humidity	
		if no other marks gained allow **1** mark for comparison of data eg trial 1 is the shortest **and** trial 3 is the longest	
		ignore references to best / worst	
7(b)	any **one** from: • volume / amount of paint (applied) • air flow • type of paint • thickness / viscosity of paint • type of surface painted	ignore number of layers accept thickness of layer accept colour / matt / gloss etc ignore answers in terms of temperature / humidity / (sun)light	1
Total			**3**

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Question 8

question	answers	extra information	mark
8			6

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 4 and apply a 'best-fit' approach to the marking.

0 marks	Level 1 (1–2 marks)	Level 2 (3–4 marks)	Level 3 (5–6 marks)
No relevant content	There is a basic description which includes either a process involved **or** a suggestion for a method of reducing the rate of energy transfer.	There is a clear description which includes **one** process. It also includes feasible suggestions for reducing the rate of energy transfer from roof **and** windows. There is a reasonable attempt to explain why the rate of energy transfer is reduced for **at least one of the methods** using terms like conduction, convection **or** radiation.	There is a detailed description which includes processes **and** feasible suggestions for reducing the rate of energy transfer from roof **and** windows. There is a correct explanation **for both methods** of why the rate of energy transfer is reduced using terms like conduction, convection and radiation.

Question 8 continues on the next page

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Question 8 continued

examples of the points made in the response	extra information
Roof Process: • convection / hot air rises (within roof space) • conduction through roof • radiation by the roof / tiles	ignore heat / energy rises
Method: • (loft) insulation / fibreglass • shiny / reflective material	allow reduce temperature of house
Explanation: • reduces convection • reduces conduction • reduces radiation • (insulation) traps air	answers must link to process / method
Windows Process: • conduction through glass	
Method: • double glazing • reflective coating on glass	allow curtains allow thicker glass
Explanation: • layer of air **or** a vacuum (between glass) • (air) is a poor conductor / good insulator • (reflective coating) reduces radiation	accept argon / krypton / xenon for air for curtains: trapping air (between curtain and window) for thicker glass: is a better insulator allow reduce temperature inside house and explanation in terms of temperature difference between inside and outside of house - credit only once

Total			**6**

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Question 9

question	answers	extra information	mark
9(a)		apply list principal for each method	
	conduction	any order	1
	convection		1
9(b)	reflector of infrared radiation	allow reflector of infrared / IR / radiation / heat / energy ignore bounces off	1
	or poor emitter of (infrared) radiation	do **not** accept **no** radiation emitted	
9(c)	3(kg)	allow **1** mark for evidence of correct calculation of temperature change (78 °C) allow **1** mark for correct substitution and rearrangement 982 800/(4200 × 78) if temperature change is incorrect but used correctly in calculation allow maximum of **2** marks	3

Question 9 continues on the next page

SCA1HP

Question 9 continued

question	answers	extra information	mark
9(d)	18 000 (joules)	allow **1** mark for correct substitution (10×1800) **or** ($10 \times 30 \times 60$) allow **1** mark for an answer of 300 an answer 10×0.5 or 5 gains **1** mark ignore incorrect units for compensation marks if answer given is 0.005 kWh award **2** marks	2
9(e)	any **one** from: • uses less electricity / energy • reduced cost • instant availability of hot water	allow saves energy **o**r wastes less energy ignore power allow it's quicker allow you don't have to wait	1
Total			**9**

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Question 10

question	answers	extra information	mark
10(a)	alters body chemistry / chemical processes		1
	(so) suffer withdrawal symptoms (without the drug)	allow (so) crave the drug ignore other descriptions	1
10(b)		mark for explanation marks can be gained from yes **and** no explanations if it is clear whether applies to yes or no	
	yes		
	no non-drinkers use hard drugs		1
	less alcohol drunk less (hard drugs) use or description of pattern from table		1
	comparative figures used eg 14% of binge drinkers / 11% of regular drinkers / 3% of occasional drinkers / 0% of non drinkers use hard drugs	at least 2 comparative figures needed allow other correct figures if drug(s) named 0% of non-drinkers use hard drugs gains first marking point	1
	no no information about number in sample / might be based on only a few people / only surveyed 18–24-year-olds (young people) **or** percentage who take drugs is low (1) (hard drug use) may be linked to other factors (1)	max **2** marks for explanation of no answer	
Total			**5**

SCA1HP

Question 11

question	answers	extra information	mark
11(a)	104 / 103.68 / 103.7	1 mark for mass = 32 × 1.8 × 1.8	2
11(b)		if weight category stated mark according to this otherwise mark according to mass calculated in part (a)	
	increase exercise		1
	(to) expend more energy **or** (to) increase metabolic rate	allow use / burn more energy / fat	1
	eat less	allow eat less calories ignore eat a balanced diet	1

	(increase exercise **or** eat less) to lose (body) mass / weight	credit lose (body) mass / weight only once
		
		these answers are all valid for a mass of 82 kg or greater given in part (a) or if obese / overweight given in part (b)
		
		if answer to part (a) is 62–81 kg or healthy weight given in part (b) accept:
		• no changes needed for **1** mark
		• because he is a healthy weight for **1** mark
		
		if answer to part (a) is 61 kg or less or underweight in part (b) accept:
		• eat more food for **1** mark
		• to gain body mass for **1** mark
			1

Total			**6**

SCA1HP

Question 12

question	answers	extra information	mark
12(a)	progesterone		1
	fewer / less side effects	allow named side effect eg less chance of nausea / headaches / blood clots / high blood pressure second mark only awarded if correct hormone given if no hormone given second mark can be awarded	1
12(b)	(sharp / sudden / large) temperature increase	allow correct figures eg 36.4–37.6 / 37.8	1
	(when) LH peaks / is high	allow peak of FSH / oestrogen / hormones	1
	LH / luteinising hormone causes ovulation / egg release		1
	(therefore) high chance of egg being there to be fertilised		1
Total			**6**

SCA1HP

Question 13

question	answers	extra information	mark
13(a)	protons = 79	allow proton number is 79 ignore atomic number	1
	electrons = 79		1
	neutrons = 118		1
	protons and neutrons in nucleus **and** electrons in shells / energy levels / orbits around nucleus	allow for **1** mark, protons, neutrons and electrons if no other mark obtained	1
13(b)(i)	supply of copper(-rich) ores is limited **or** to limit the environmental impact (of traditional mining) **or** more economical than other methods	allow can extract copper from low grade ores ignore environmentally friendly unqualified ignore it is cheaper unless qualified	1
13(b)(ii)	plants (grown on land containing copper)		1
	(plants) absorb copper compounds / ions	allow minerals ignore copper / metal	1
	(plants) burned to produce ash / metal compounds		1
Total			**8**

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Question 14

question	answers	extra information	mark
14	any **four** from (see this page and the following page): arguments for biodiesel: • burning biodiesel produces low amounts of particulates so less global dimming • absorbs carbon dioxide when plants are growing so carbon dioxide released when burnt equals carbon dioxide taken in • removes need to dispose of cooking oil • using a renewable resource so conserving crude oil / non-renewable resources	to obtain all four marks, at least one argument for biodiesel and one argument against biodiesel must be given if no fuel named assume it refers to biodiesel accept unburnt hydrocarbons / soot as alternatives to particulates accept carbon neutral	4

Question 14 continues on the next page

SCA1HP

Question 14 continued

question	answers	extra information	mark
14	arguments against biodiesel: • burning biodiesel produces high amounts of nitrogen oxides so more acid rain formed • deforestation leads to a reduction in absorption of carbon dioxide so increased global warming • production of biodiesel leads to increased carbon dioxide output so overall is not carbon neutral • production of fuel crops rather than food crops could lead to food shortages / food price increases conclusion supported by the argument presented	<u>Compensation marks</u> apply if 0 or 1 mark scored: • **three / four** comparisons **from table** = **2** marks • **two** comparisons **from table** = **1** mark compensation marks added to previous marks scored but restricted to maximum of **2** marks for question total	1
Total			**5**

SCA1HP

Question 15

question	answers	extra information	mark
15(a)	perfect insulator **or** no energy transfer	 allow no energy lost allow heat for energy ignore efficiency	1
15(b)(i)	lots of energy needed to raise temperature / heat up 1 kg of material by 1 °C	allow hold / store a lot of energy / heat allow takes a long time to heat up	1 1
15(b)(ii)	copper pipes contain water at room temperature / 20 °C (therefore) no temperature gradient / difference	ignore thickness of wall and specific heat capacity allow (so) same temperature as inside	1 1
Total			**5**

SCA1HP

Question 16

question	answers	extra information	mark
16(a)	(liquid C)	no mark awarded for stating liquid C no marks awarded if liquid A or B chosen	
	(causes) biggest temperature decrease	allow cools quicker / the quickest	1
	(because it) evaporates quickest	allow evaporates quicker allow most / more evaporated ignore references to boiling	1
16(b)	all of the liquid has evaporated	accept no net energy transfer allow it was dry	1
16(c)	particles with most energy / highest speed evaporate	allow hottest particles	1
	these particles escape from the (surface of the) liquid	accept overcoming the attractive forces (between particles)	1
	decreasing mean energy of particles (left in liquid)	allow some reference to the total energy of the liquid reducing	1
	which lowers the temperature	ignore cool down	1
Total			**7**

UMS Conversion Calculator www.aqa.org.uk/umsconversion