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General Certificate of Secondary Education

Science A 4406

SCA2HP Unit 6

Mark Scheme

2012 Examination – January 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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Marking Guidance for Examiners

GCSE Science Papers

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	Pluto, Mars, Moon	1
2	Pluto, 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 4(b) 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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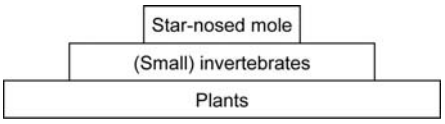
Question 1

question	answers	extra information	mark
1(a)(i) E	(small eyes hidden in fur) to stop soil getting in eyes	accept any valid reasons do **not** accept does not need to see	1
1(a)(ii) E	(strong front limbs) to dig / tunnel	accept any valid reasons allow catch prey	1
1(a)(iii) E	(tentacles that are sensitive to touch) identify / feel organisms	accept any valid reasons allow detect objects in front of it ignore feel where they are going ignore smell	1
1(b)(i) E	correct order of organisms from base to top of pyramid: plants, invertebrates, moles. box sizes decrease from base to top of pyramid  	 allow pyramid shape	1 1
1(b)(ii) E	the Sun	accept light ignore heat	1
Total			**6**

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Question 2

question	answers	extra information	mark
2(a) E	36 (%)	36 (%) gains two marks accept answers in range 32 (%)–42 (%) if answer incorrect give **1** mark for evidence of estimating number of squares as being 8–10.5	2
2(b)(i) E clip with 2(b)(ii)	Greater plantain most abundant on path / walked area Ribwort plantain most abundant away from path / on the field / grass / on area not walked on	for **2** marks a correct statement must be made for each plant. accept answers in terms of quadrat number / start and finish accept for **1** mark where number of one plant high, number of other plant low ignore figures	1 1

Question 2 continues on the next page . . .

SCA2HP

Question 2 continued . . .

question	answers	extra information	mark
2(b)(ii) E clip with 2(b)(i)		if no position given max **1** mark	
	for Greater plantain numbers higher on path	accept converse statements	
	Greater plantain grows flatter / lower to ground / is shorter	ignore surface area	1
	(so) will be damaged less by trampling /will not be pulled out		1
	or		
	for Ribwort plantain numbers higher in field		
	Ribwort plantain has tall leaves **or** is taller	allow tall stems	
	to obtain more light **or** for photosynthesis	ignore Sun ignore references to nutrients ignore competition unless qualified	
2(c) E		answers must refer to named plantain(s) to gain credit	
	Greater plantain would grow better on football pitch / area 1	accept converse argument	1
	(since) more trampling on pitch	if **no** other marks gained, allow **1** mark for more plantains in area 2 because they will not be affected by human activity / example	1
Total			**8**

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Question 3

question	answers	extra information	mark
3(a) E	any **four** from: • decane evaporates / vaporises • broken pottery acts as catalyst • (decane) is split / cracked • thermal decomposition • into octane / alkane • and an alkene / ethene / C_2H_4	allow chains broken allow large molecules into small molecules	4
3(b)(i) E	ethene		1
3(b)(ii) E	C_nH_{2n}	C and H must be upper case allow $_{n2}$ for $_{2n}$ allow $H_{2n}C_n$	1
3(b)(iii) A	second box ticked		1
Total			**7**

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Question 4

question	answers	extra information	mark
4(a)(i) E	the Earth cooled **or** <u>crust</u> shrank / wrinkled / shrivelled / crinkled		1
4(a)(ii) E	insufficient / no evidence for new theory / tectonic theory **or** no evidence against **or** they were not aware of plates / movements **or** no other theory made sense	allow had evidence for old theory ignore no other theories	1

Question 4 continues on the next page . . .

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Question 4 continued . . .

question	answers	extra information	mark
4(b) E			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 information	There is a statement about change **or** an attempt at an explanation of the tectonic theory	There is a statement about change **and** an incomplete explanation of the tectonic theory	There is a statement about change **and** a clear scientific explanation of the tectonic theory

examples of chemistry points made in the response

descriptive points:

- continents have moved apart / together
  or
  continental drift
- move slowly / a few centimetres a year
- now separated by expanses of oceans
- example of movement of one continent

explanation points:

- the (Earth's crust) is made up of (tectonic) plates
- mantle can move (slowly)
- convection currents
- within the mantle
- driven by energy (allow heat)
- released by radioactive processes
- in the core
- cause the plates to move

Total			**8**

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Question 5

question	answers	extra information	mark
5(a) E	uranium / plutonium		1
5(b) E	A – boiler / heat exchanger / water heater B – turbine C – generator	allow steam ignore water on its own	1 1 1
5(c)(i) E	step-up		1
5(c)(ii) E	increases voltage / decreases current decreased energy loss from power cables / wires	ignore changes to power ignore resistance allow step-up for increasing allow heat for energy ignore electricity / power loss do **not** accept <u>no</u> energy loss	1 1

Question 5 continues on the next page . . .

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Question 5 continued . . .

question	answers	extra information	mark
5(d) E	any **two** factors from: • cost of electricity	ignore cost of fuel	2
	• amount of electricity / power produced		
	• disposal of waste (radioactive / fossil fuel) **or** radioactive waste has long half-life	ignore pollution unqualified accept waste could be be toxic ignore radiation unqualified	
	• cost of commissioning		
	• cost of decommissioning	ignore demolishing	
	• availability of uranium / plutonium / nuclear fuel / fossil fuels	ignore non-renewable / will run out	
	• availability of sites to build nuclear power stations		
	• security hazard qualified / safety issue qualified	ignore dangerous unqualified	
	• carbon emissions / global warming		
	• start-up time		
		if no marks are given allow **1** mark for cost unqualified	
Total			**9**

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Question 6

question	answers	extra information	mark
6(a) E	any **one** from: • data may contain anomalies • data may not show sufficient precision • shows range	ignore accuracy / sensitivity / reliability / resolution ignore do not know number of people	1
6(b) E	any **two** from: • age • gender • health / existing cancer • hours used • make / model of phone	allow type of phone	2
6(c) E	any **two** from: • using the corded phone <u>does not</u> increase the risk • mobile phone use has a greater risk (if used for more than 5 years) / corded less harmful • using mobile and cordless phones increases the risk / there is a significant increase in risk from using mobile / cordless phones owtte • risk when using cordless / mobile increases with years of use	allow correct comparisons between any two types of phone allow correct numerical answers	2

Question 6 continues on the next page . . .

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Question 6 continued . . .

question	answers	extra information	mark
6(d) E	(no) not using the mobile would only reduce the risk (slightly) **or** there is still a chance of developing brain cancer (from other causes) **or** could still be using other phones **or** no knowledge of previous phone use **or** no data for no phone use		1
Total			**6**

SCA2HP

Question 7

question	answers	extra information	mark
7(a) E	genetically identical organism / contains same DNA / genes	owtte	1
7(b) E	any **four** from: • remove nucleus from a cat's egg cell • transfer nucleus from pet cat body cell into empty egg cell • apply an electric shock (to egg cell) • so it forms an embryo / starts to divide • place embryo in womb / uterus of a (female) cat	 ignore grow allow fertilised egg cell for embryo	4
7(c) E	any **two** from: • clone may have health problems / reduced life span • human rights of clone argument eg would not have a say in whether they wanted to be a clone • a clone would not have the same personality as the person cloned / ideas of environmental cause of variation	allow do not know side-effects ignore not safe allow might encourage use of (foetal) organs / body parts ignore religion / not natural / cost / ethical	2
Total			**7**

SCA2HP

Question 8

question	answers	extra information	mark
8 E	plants absorb CO_2 for photosynthesis	ignore carbon	1
	all organisms / any named organism respire(s) and release(s) CO_2	ignore breathing ignore carbon	1
	any **four** from: • carbon compounds / named compound made by plants • plants eaten by animals • dead organisms / faeces are decomposed / decayed • by bacteria / microorganisms • dead plants and animals (may) form fossil fuels • when (fossil) fuels are burnt they release CO_2 into the air	allow broken down	4
Total			**6**

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Question 9

question	answers	extra information	mark
9 E	variation exists in the population / a mutation occurred	ignore adaptation	1
	so some head lice resistant to chemical / not killed by it	ignore immune	1
	these survive and breed **or** pass on gene / allele / DNA (for resistance) to next generation	ignore characteristic / chromosome	1
Total			**3**

SCA2HP

Question 10

question	answers	extra information	mark
10(a)(i) E	hydrogenation	accept addition (reaction) accept adds hydrogen owtte ignore hardening	1
10(a)(ii) E	60 °C nickel catalyst	ignore heat	1 1
10(b) E	easy to spread **or** better to use when making cakes / pastries	accept no spillage risk ignore melting	1
Total			**4**

SCA2HP

Question 11

question	answers	extra information	mark
11(a)(i) E	12		1
11(a)(ii) E	(oxygen) produced by algae / plants during photosynthesis		1 1
11(a)(iii) E	catastrophe / volcano / asteroid destroyed most algae / plants	 dependent on first marking point	1 1
11(b) E	gives some support since showed that organic compounds might have been formed in early atmosphere but no evidence of structures / living organisms	allow yes since it showed organic compounds formed	1 1
Total			**7**

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Question 12

question	answers	extra information	mark
12 E	well constructed argument including any **three** from: • ethene production from non-renewable resources / sugar cane production from renewable resources • hydrating requires more energy • hydrating process gives off CO_2 due to fuel requirement **or** fermentation process produces less CO_2 overall • but there may be deforestation to (provide farmland) conclusion eg production from ethene more environmentally damaging supported by at least one statement	allow greater greenhouse effect (linked to fuel) allow carbon neutral allow more habitat destruction allow argument reaching different conclusion	3 1
Total			**4**

SCA2HP

Question 13

question	answers	extra information	mark
13(a) E	reflection refraction diffraction	in correct order only	1 1 1
13(b) A	10^{-15} m – 10^{4} m		1
13(c) E	1.5×10^{10} (hertz) **or** 15 000 000 000	$v = f \times \lambda$ allow **1** mark for correct substitution and transformation $(3 \times 10^{8} / 0.02)$ allow **1** mark for 1.5×10^{8} **or** 150 000 000	2
Total			**6**

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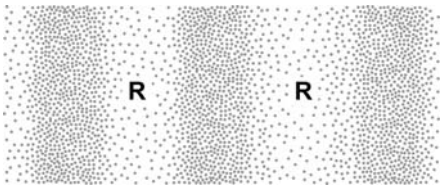
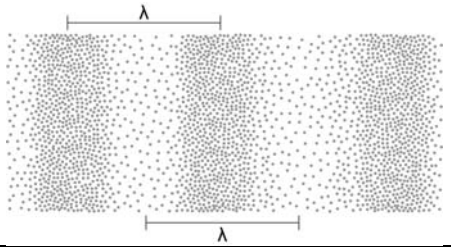
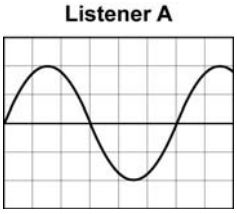
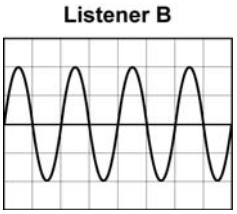
Question 14

question	answers	extra information	mark
14(a) E	same / parallel to		1
14(b)(i) E clip with (b)(ii)	letter R where the particles are furthest apart		1
14(b)(ii) E clip with (b)(i)	student correctly indicates one wavelength	wavelength may be from one rarefaction to the next or from one compression to the next 	1
14(c)(i) E	Doppler (effect)	do **not** allow red shift	1

Question 14 continues on the next page . . .

SCA2HP

Question 14 continued . . .

question	answers	extra information	mark
14(c)(ii) E	listener A's wave trace should have an increased wavelength (compared to the reference wave)	eg 	1
	listener B's wave trace should have a decreased wavelength (compared to the reference wave)	eg 	1
	amplitude of both waves should be the same or smaller than the reference wave	this mark is independent of the first two marks mark can be awarded for two different amplitudes no mark if either trace is not centred on centre horizontal line of oscilloscope screen no mark if either trace has a greater amplitude than the reference wave allow a decreasing amplitude for Listener A's trace and an increasing amplitude for Listener B's trace	1
14(d)(i) E	increased wavelength of light / (spectral) lines move towards the red end of the spectrum	allow decrease in frequency	1

Question 14 continues on the next page . . .

SCA2HP

Question 14 continued . . .

question	answers	extra information	mark
14(d)(ii) E	it is moving towards Earth / us / our solar system / our galaxy / the Sun	allow moving closer	1
Total			**9**

UMS Conversion Calculator
http://web.aqa.org.uk/UMS/index.php