



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

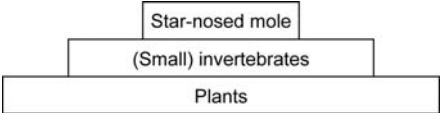
- Knowledge of accurate information
- Clear understanding
- The answer has some structure and organisation, use of specialist terms has been attempted but not always accurately, some detail is given
- There is reasonable accuracy in spelling, punctuation and grammar, although there may still be some 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)	(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)	(strong front limbs) to dig / tunnel	accept any valid reasons allow catch prey	1
1(a)(iii)	(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)	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)	the Sun	accept light ignore heat	1
Total			6

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Question 2

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

SCA2HP

Question 3

question	answers	extra information	mark
3(a)	any four from: <ul style="list-style-type: none"> • decane evaporates / vaporises • broken pottery acts as <u>catalyst</u> • (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)	ethene		1
3(b)(ii)	C_nH_{2n}	C and H must be upper case allow n_2 for $2n$ allow $H_{2n}C_n$	1
3(b)(iii)	second box ticked		1
Total			7

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Question 4

question	answers	extra information	mark
4(a)(i)	the Earth cooled or <u>crust</u> shrank / wrinkled / shrivelled / crinkled		1
4(a)(ii)	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)			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
<p>examples of chemistry points made in the response</p> <p>descriptive points:</p> <ul style="list-style-type: none"> 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 <p>explanation points:</p> <ul style="list-style-type: none"> 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)	uranium / plutonium		1
5(b)	A – boiler / heat exchanger / water heater B – turbine C – generator	allow steam ignore water on its own	1 1 1
5(c)(i)	step-up		1
5(c)(ii)	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)	any two factors from: <ul style="list-style-type: none"> • cost of electricity • amount of electricity / power produced • disposal of waste (radioactive / fossil fuel) or radioactive waste has long half-life • cost of commissioning • cost of decommissioning • <u>availability</u> of uranium / plutonium / nuclear fuel / fossil fuels • availability of sites to build nuclear power stations • security hazard qualified / safety issue qualified • carbon emissions / global warming • start-up time 	ignore cost of fuel ignore pollution unqualified accept waste could be be toxic ignore radiation unqualified ignore demolishing ignore non-renewable / will run out ignore dangerous unqualified if no marks are given allow 1 mark for cost unqualified	2
Total			9

SCA2HP**Question 6 continued . . .**

question	answers	extra information	mark
6(d)	(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

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Question 7

question	answers	extra information	mark
7(a)	<u>genetically</u> identical organism / contains same <u>DNA</u> / <u>genes</u>	owtte	1
7(b)	any four from: <ul style="list-style-type: none"> remove nucleus from a cat's egg cell transfer nucleus from pet cat body cell into empty <u>egg</u> cell apply an electric shock (to egg cell) so it forms an embryo / starts to divide place embryo in <u>womb</u> / <u>uterus</u> of a (female) cat 	ignore grow allow fertilised egg cell for embryo	4
7(c)	any two from: <ul style="list-style-type: none"> clone may have health problems / reduced life span human rights of <u>clone</u> 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

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Question 8

question	answers	extra information	mark
8	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: <ul style="list-style-type: none"> • 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 CO₂ into the air 	allow broken down	4
Total			6

SCA2HP

Question 9

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

SCA2HP

Question 10

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

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Question 11

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

SCA2HP

Question 12

question	answers	extra information	mark
12	<p>well constructed argument including any three from:</p> <ul style="list-style-type: none"> • ethene production from non-renewable resources / sugar cane production from renewable resources • hydrating requires more energy • hydrating process gives off CO₂ due to fuel requirement <p>or</p> <p>fermentation process produces less CO₂ overall</p> <ul style="list-style-type: none"> • but there may be deforestation to (provide farmland) <p>conclusion eg production from ethene more environmentally damaging supported by at least one statement</p>	<p>allow greater greenhouse effect (linked to fuel)</p> <p>allow carbon neutral</p> <p>allow more habitat destruction</p> <p>allow argument reaching different conclusion</p>	<p>3</p> <p>1</p>
Total			4

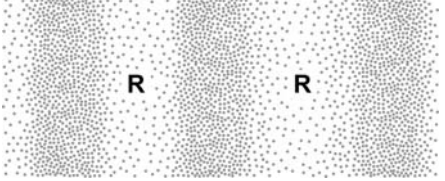
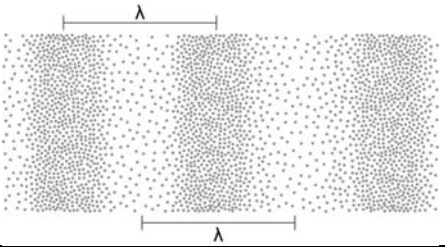
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Question 13

question	answers	extra information	mark
13(a)	reflection	in correct order only	1
	refraction		1
	diffraction		1
13(b)	$10^{-15} \text{ m} - 10^4 \text{ m}$		1
13(c)	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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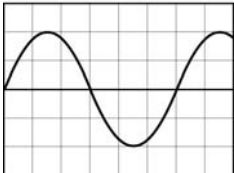
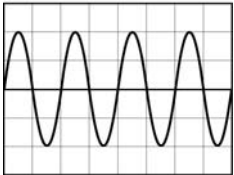
Question 14

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

Question 14 continues on the next page . . .

SCA2HP

Question 14 continued . . .

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

Question 14 continues on the next page . . .

SCA2HP**Question 14 continued . . .**

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

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<http://web.aqa.org.uk/UMS/index.php>