Version 1.0

General Certificate of Secondary Education
June 2013

Science A (Combined) SCA2FP

(Specification 4406)

Unit 6

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.

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.

Further copies of this Mark Scheme are available from: aqa.org.uk

Set and published by the Assessment and Qualifications Alliance.

The Assessment and Qualifications Alliance (AQA) is a company limited by guarantee registered in England and Wales (company number 3644723) and a registered charity (registered charity number 1073334).
Registered address: AQA, Devas Street, Manchester M15 6EX.

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 / ; e.g. 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 candidates 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)

Candidate	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)

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

3.2 Use of chemical symbols / formulae

If a candidate 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 14(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.

SCA2FP

Question 1

question	answers	extra information	mark
1		ignore predators or competition throughout	
	(good eyesight) to see its prey / judge distance		1
	(strong sharp claws) to grasp / carry / kill its prey	allow to catch prey	1
	(powerful wings) to swoop to catch its prey / control its flight / fly fast / carry (heavy) prey	allow to fly only if qualified	1
Total			**3**

SCA2FP

Question 2

question	answers	extra information	mark
2(a)(i)	3 (million years ago)		1
2(a)(ii)	orangutans		1
2(b)(i)	natural selection		1
2(b)(ii)	any **one** from: • went against religious beliefs • insufficient evidence (at the time) • mechanism of inheritance / variation not known (at the time) • there were other theories e.g. Lamarck	allow no proof allow people couldn't accept the idea of evolving from other animals	1
Total			**4**

SCA2FP

Question 3

question	answers	extra information	mark
3(a)	gametes genes	in the correct order	1 1
3(b)(i)	embryo transplant		1
3(b)(ii)	the offspring will be identical to each other	extra tick(s) negates mark	1
3(c)	any **one** from: • against many people's beliefs / religion • identical children would be born (to different women) • human rights of children produced • embryos may die / be wasted • may be side effects • against selection of particular characteristics	ignore not natural ignore cost ignore it might not work ignore against God's will allow identical people would exist or problem associated with this allow named example e.g. premature aging, deformities allow could lead to designer babies	1
Total			**5**

SCA2FP

Question 4

question	answers	extra information	mark
4(a)	(temperature) thermometer or temperature probe / sensor (oxygen concentration) oxygen probe / sensor / meter		1 1
4(b)(i)	13 (arbitrary units)	allow values in the range 12.5 – 13.5	1
4(b)(ii)	the greater the concentration of oxygen the faster the rate of decay		1
4(c)	line drawn below line on graph following similar pattern	line starts at 0% oxygen concentration and from 0 – 3 arbitrary units	1
4(d)(i)	microorganisms / bacteria / fungi plants respiration	accept any correct organism allow decomposers / detritivores or named example e.g. worms allow crops or named plants	1 1 1
4(d)(ii)	stable		1
Total			**9**

SCA2FP

Question 5

question	answers	extra information	mark
5(a)	A = mantle B = core	 ignore inner / outer	1 1
5(b)	any **two** from: (Earth has) • smaller percentage carbon dioxide • larger percentage nitrogen • larger percentage oxygen	ignore figures unless qualified allow converse responses allow less allow more allow more	2
5(c)	(Mars) temperature below freezing point of water (Venus) temperature above boiling point of water	allow too cold (for liquid water to form) allow water will freeze or ice will form allow too hot (for liquid water to form) allow water would boil or would be steam / gas if no other mark awarded allow one mark for not enough water vapour	1 1
Total			**6**

SCA2FP

Question 6

question	answers	extra information	mark
6(a)(i)	cracking		1
6(a)(ii)	(pentane) condenses	accept (pentane) liquefies / becomes liquid	1
6(a)(iii)		must be in correct order	
	heptane	do **not** accept heptene	1
	broken pot		1
6(b)(i)	C_nH_{2n}		1
6(b)(ii)	contains a (carbon-carbon) double bond		1
6(b)(iii)	(bromine water) turns from orange	allow brown	1
	to colourless	accept is decolourised ignore clear	1
6(c)		ignore plastic	
	poly(ethene)	allow polyethene accept polythene do **not** allow poly(ethane) or polyethane	1
Total			**9**

SCA2FP

Question 7

question	answers	extra information	mark
7(a)	(oil / chips) oil has higher boiling point (than water) (so) chips cook at a higher temperature	accept water boils at 100 °C allow oil gets hotter (than water) ignore chips cook quicker if no other marks gained allow chips have larger surface area for **1** mark accept for 2 marks chips have a larger surface area (so) energy transfers to potato quicker allow 'heat' for energy	1 1
7(b)	flavour **or** energy content **or** texture	ignore references to health or colour allow taste allow nutrient content allow chips are crisper or boiled potatoes are soggy	1
7(c)	energy nutrients	extra ticks negate marks	1 1
Total			**5**

SCA2FP

Question 8

question	answers	extra information	mark
8(a)	wood		1
8(b)	**advantage:** Breaks in overhead power lines are easier to find than in underground cables. **disadvantage:** Overhead power lines are more dangerous than underground cables if they break.		1 1
8(c)	water turbine	correct order only do **not** accept water vapour	1 1
Total			**5**

SCA2FP

Question 9

question	answers	extra information	mark
9(a)(i)	B		1
9(a)(ii)	longitudinal		1
9(b)(i)	the sound wave travels to the building and back	allow (because) it is an echo	1
9(b)(ii)	0.30 / 0.3	allow **1** mark for $\frac{0.30+0.27+0.33}{3}$ **or** $\frac{0.9}{3}$	2
9(b)(iii)	100 (m)	allow ecf from (b)(ii) with a tolerance of ± 10 (m)	1
9(b)(iv)	use a sound sensor and a datalogger to measure the time		1
9(b)(v)	(amplitude of echo is) smaller	ignore quieter allow lower	1
Total			**8**

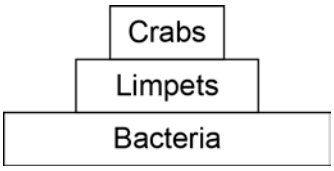
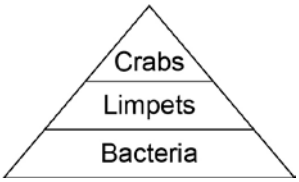
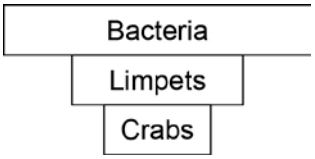
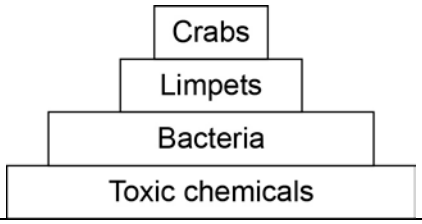
SCA2FP

Question 10

question	answers	extra information	mark
10(a)	increasing energy → infrared visible light gamma (rays)	3 correct = **2** marks 1 or 2 correct = **1** mark allow IR for infrared allow visible or light for visible light	2
10(b)(i)	frequency		1
10(b)(ii)	vacuum		1
10(c)	IR - remote control / fibre optic	ignore phones and cables unless qualified	1
	microwave - mobile phone / satellite (TV)		1
	radio – (terrestrial) TV / radio transmissions	allow walkie talkies	1
	visible light – photography / fibre optic	allow valid examples of communication using visible light e.g. traffic lights, sign language	1
Total			**8**

SCA2FP

Question 11

question	answers	extra information	mark
11(a)	extremophiles	accept named examples eg acidophiles, thermophiles, thermophytes, halophytes	1
11(b)(i)	 correct order of organisms from base to top of pyramid: bacteria, limpets, crabs box sizes decrease from base to top of pyramid	if names given ignore references to producer, primary consumer and secondary consumer if no names given allow **1** mark for a correct pyramid with producer, primary consumer and secondary consumer labelled allow pyramid shape  allow **1** mark for  allow **1** mark for 	2

Question 11 continues on the next page

SCA2FP

Question 11 continued

<table>
<tr><td>11(b)(ii)</td><td></td><td></td><td>6</td></tr>
<tr><td colspan="4">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.</td></tr>
<tr><td>0 marks</td><td>Level 1 (1–2 marks)</td><td>Level 2 (3–4 marks)</td><td>Level 3 (5–6 marks)</td></tr>
<tr><td>No relevant content</td><td>Either a difference or a reason is given.</td><td>A difference is given and an attempt to suggest reason(s) for the difference.</td><td>A difference is given and suitable reasons, which add value, to explain the difference.</td></tr>
<tr><td colspan="2">difference
• food chain near hydrothermal vent begins with bacteria
• food chain near surface of the sea begins with seaweed
• use different energy sources
• producers (in the two chains) are different

examples of scientific points made in the response
• seaweed is an alga
• seaweed absorbs light / energy from sun
• for photosynthesis
• to make glucose / sugar/ carbohydrate / food
• no light at bottom of sea
• plants can’t survive in the dark / conditions at the bottom of sea

• bacteria are extremophiles
• bacteria need different energy source / use chemical energy
• to make carbohydrate / food</td><td colspan="2">extra information

allow no seaweed at the bottom of the sea

allow limpets eat different foods
accept bacteria / limpets / crabs
(in the 2 areas) are different (species)
or
have different adaptations
or
have evolved differently

allow plant

allow chemical energy

allow no sun (light)
allow descriptions of conditions e.g. harsh

allow thermal energy or ‘heat’</td></tr>
<tr><td>Total</td><td></td><td></td><td>9</td></tr>
</table>

SCA2FP

Question 12

question	answers	extra information	mark
12(a)(i)	a continuous straight line missing the anomalous point	the line must touch the other 4 points	1
12(a)(ii)	6 (g) **and** 320 (cm^3) anomalous result	answers must be in this order accept does not lie on line of best fit allow it doesn't fit the pattern	1 1
12(b)	as the mass of hydrogel / pellets increases, the volume of water absorbed increases	do **not** accept cause and effect the wrong way round accept directly proportional allow there is a positive correlation allow use of values to show positive correlation	1
12(c)	any **one** from: • time allowed to absorb • shape of pellets • surface area / size of pellets • temperature of water • volume of water	ignore references to equipment do **not** accept mass / amount of hydrogel pellets allow mass / amount of water allow 500 cm^3 of water allow type of hydrogel / pellet	1
Total			**5**

SCA2FP

Question 13

question	answers	extra information	mark
13(a)	any **two** from: • gives better coating ability • better texture • better appearance • otherwise (oil and water) would separate into layers • more viscous	ignore references to drying time allow fixes colours / paint to surface allow smoother allow thicker allow easier to clean brushes (than oil paints)	2
13(b)(i)	had not been to university / little education / was known as an artist **or** no / not enough proof / evidence for his theory **or** (other scientists) had their own theories / ideas	ignore references to religion ignore they didn't know about . . . e.g. continental drift unless qualified	1
13(b)(ii)	(parts of the Earth's) crust (and upper part of mantle) which has cracked / separated into pieces / plates **or** which are able to move	accept lithosphere allow float above mantle	1 1
Total			**5**

SCA2FP

Question 14

question	answers	extra information	mark
14(a)		ignore quoted figures without comparative statements	
	VAWT generates electricity at (wind) speeds lower than HAWT do	accept for **2** marks generates electricity over a greater range of (wind)speeds	1
	VAWT generates electricity at higher (wind)speeds		1
	VAWT can generate electricity over a longer time period	allow VAWT generates more electricity (over a given time period) allow VAWT doesn't need to turn (into the wind) (ignore the converse) ignore the wind can come from any direction	1
14(b)		if no reference to power / output allow max **1** mark if cause and effect are the wrong way round allow max **1** mark	
	any **two** from: • very little power / output until 2 (m/s) • as wind speed increases, power / output increases . . . • . . . at an increasing rate	 allow no power / output until 2 (m/s) allow a value between 1.5 – 2 (m/s) allow figures to show this	2
14(c)(i)	150 (metres)	allow any value in the range 141 – 159 (metres)	1

Question 14 continues on the next page

SCA2FP

Question 14 continued

question	answers	extra information	mark
14(c)(ii)	(No, because) the sound level is 20dB less than 30dB / less than a whisper at a distance of 1000m (is worth 2 marks)	allow at the nearest house for a distance of 1000m allow **1** mark for reading the sound level at 1000m (20dB) **or** allow **1** mark for (no) the noise level will be very low (at 1000m) allow **1** mark for (Yes) no additional noise is justified in the countryside / on the island **2** marks can be gained for a 'Yes' answer allow **1** mark for (Yes) we don't know how many wind turbines would be installed /many wind turbines create more noise	2
14(d)	reduces energy loss (in cables)	allow 'heat' for energy allow power for energy allow to increase efficiency (of power transmission) ignore less electricity wasted do **not** accept prevents or stops energy loss	1
Total			**9**

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