Version 1.0

General Certificate of Secondary Education
June 2013

Science A (Combined) SCA2HP

(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.

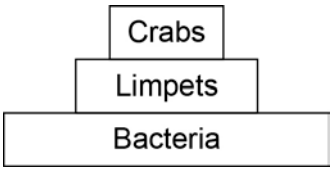
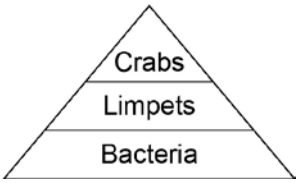
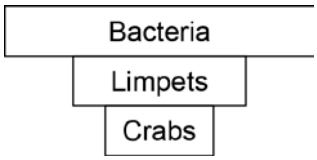
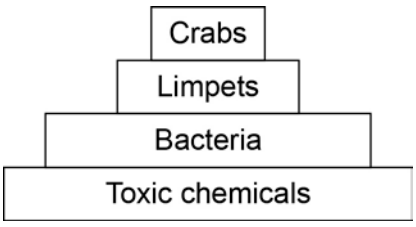
SCA2HP

Question 1

question	answers	extra information	mark
1(a)(i)	3 (millions of years)		1
1(a)(ii)	orangutans		1
1(b)(i)	natural selection	ignore survival of the fittest	1
1(b)(ii)	any **one** from: • insufficient evidence (to convince them) • mechanism of inheritance / variation not known • there were other theories e.g. Lamarck	ignore references to religion allow no evidence / proof allow didn't know about genes / DNA / chromosomes ignore Darwin was not a scientist / respected allow people couldn't accept the idea of evolving from other animals	1
Total			**4**

SCA2HP

Question 2

question	answers	extra information	mark
2(a)	extremophiles	accept named examples e.g. acidophiles, thermophiles, thermophytes, halophytes	1
2(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 2 continues on the next page

SCA2HP

Question 2 continued

2(b)(ii)			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	Either a difference **or** a reason is given.	A difference is given **and** an attempt to suggest reason(s) for the difference.	A difference is given **and** suitable reasons, which add value, to explain the difference.

difference	**extra information**
• food chain near hydrothermal vent begins with bacteria	
• food chain near surface of the sea begins with seaweed	allow no seaweed at the bottom of the sea
• use different energy sources	
• producers (in the two chains) are different	allow limpets eat different foods accept bacteria / limpets / crabs (in the 2 areas) are different (species) **or** have different adaptations **or** have evolved differently
examples of scientific points made in the response	
• seaweed is an alga	allow plant
• seaweed absorbs light / energy from sun	
• for photosynthesis	
• to make glucose / sugar/ carbohydrate / food	allow chemical energy
• no light at bottom of sea	allow no sun (light)
• plants can't survive in the dark / conditions at the bottom of sea	allow descriptions of conditions eg harsh
• bacteria are extremophiles	allow thermal energy or 'heat'
• bacteria need different energy source / use chemical energy	
• to make carbohydrate / food	

Total			**9**

SCA2HP

Question 3

question	answers	extra information	mark
3(a)(i)	a continuous straight line missing the anomalous point	the line must touch the other 4 points	1
3(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
3(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
3(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

Question 3 continues on the next page

SCA2HP

Question 3 continued

question	answers	extra information	mark
3(d)		ignore references to environmental effects	
	to absorb water / urine		1
	(so) baby keeps dry **or** nappy doesn't need changing as often **or** absorbs more water than other materials	allow specific examples of benefits e.g. less nappy rash, less leakage	1
Total			**7**

SCA2HP

Question 4

question	answers	extra information	mark
4(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
4(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
4(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**

SCA2HP

Question 5

question	answers	extra information	mark
5(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
5(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
5(c)(i)	150 (metres)	allow any value in the range 141 – 159 (metres)	1

Question 5 continues on the next page

SCA2HP

Question 5 continued

question	answers	extra information	mark
5(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
5(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**

SCA2HP

Question 6

question	answers	extra information	mark
6(a)	any valid biofuel e.g. biodiesel, rapeseed oil, chicken litter, wood, paper, etc.	allow methane, ethanol	1
6(b)	(biofuel) burned	ignore type of fuel accept combustion	1
	(which) heats water to make steam		1
	steam turns turbine		1
	(then the) turbine turns generator		1
6(c)	any **one** advantage and **one** disadvantage from:		
	Advantages: • No visual pollution • Underground cables are safer e.g. if they break	 allow less likely to break only allow safer if suitably qualified	1
	Disadvantages: • (More) difficult to repair / identify breaks in underground cables • High(er) installation cost	 ignore repair costs	1
Total			**7**

SCA2HP

Question 7

question	answers	extra information	mark
7(a)	microorganisms / bacteria / fungi	allow correct named organisms allow detritus feeders / decomposers / worms	1
	break down / digest / feed on (dead organisms)	accept use carbohydrates / glucose allow decomposes ignore decay/ rot	1
	(and release carbon dioxide when they) respire	do **not** allow respiration if linked to leaves / dead organisms	1
7(b)	any **two** from: • the higher the temperature the faster the rate of decay • the higher the oxygen concentration the faster the rate of decay • the rate increases faster (with increasing oxygen concentration) at 20 °C (than 15 °C)	 allow faster / more carbon dioxide for faster rate of decay allow faster / more carbon dioxide for faster rate of decay	2
7(c)	processes that remove materials (from environment) and processes that return materials (to environment) are balanced	ignore recycling by humans	1
Total			**6**

SCA2HP

Question 8

question	answers	extra information	mark
8(a)	(sexual reproduction involves) the joining / fusion of (male and female) gametes / sex cells / named gametes	accept fertilisation of gametes / sex cells / named gametes for **2** marks allow fertilisation for **1** mark allow gametes / sex cells / named gametes for **1** mark	2
	(so) genetic information / genes / DNA / chromosomes		1
	(from) two parents / mother and father / organisms / individuals (is mixed)	allow (from) each parent / her parents / their parents	1
8(b)(i)	embryo transplant	allow embryo(nic) cloning do **not** accept adult cell cloning	1
8(b)(ii)	any **one** from: • identical babies would be born to different women • reduces gene pool • human rights of babies / embryos • embryos may die / be wasted • may be side effects • against selection of particular characteristics	ignore references to religion or not being natural allow identical people would exist or problem associated with this allow reduces variation in the population allow named example e.g. premature aging, deformities, shorter life span allow could lead to designer babies	1
Total			**6**

SCA2HP

Question 9

question	answers	extra information	mark
9(a)	(sensor used by Group 2) had lower resolution	accept converse answers allow poor / worse resolution allow (sensor used by Group 2) only measured to whole numbers ignore reference to sensitivity / precision / accuracy	1
9(b)	microorganisms / bacteria (in water/ from sewage)	ignore references to plants	1
	used up oxygen	must be linked to microorganisms	1
	during respiration		1
9(c)	freshwater louse number of organisms changes little	correct organism **and** reason needed for mark allow louse / lice	1
Total			**5**

SCA2HP

Question 10

question	answers	extra information	mark
10(a)(i)	80 (%)	allow answers in range 78–80 (%)	1
10(a)(ii)	any **five** from: • (green) plants / algae photosynthesise • take in carbon dioxide (for photosynthesis) • release oxygen (in photosynthesis) • carbon dioxide dissolved in oceans • carbon dioxide locked up in (sedimentary) rocks / carbonates / limestone • carbon dioxide locked up in fossil fuels	max **4** marks if no reference to oxygen ignore changes due to combustion of fossil fuels do **not** accept for / in respiration accept carbon dioxide has decreased and oxygen has increased for **1** mark accept oceans act as reservoir allow locked up in biomass	5

Question 10 continues on the next page

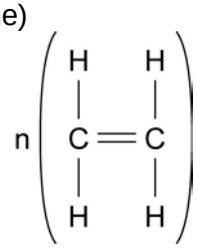
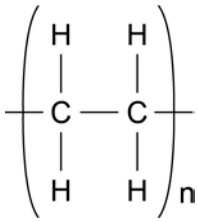
SCA2HP

Question 10 continued

question	answers	extra information	mark
10(b)	any **two** from: • on Mars the temperature is below freezing point of is water / 0°C • on Venus the temperature is above boiling point of water / 100°C • not enough water vapour (in atmosphere) on Venus	allow water is frozen / ice on Mars allow water is a gas / steam or has boiled / evaporated on Venus ignore references to water vapour on Mars	2
Total			**8**

SCA2HP

Question 11

question	answers	extra information	mark
11(a)(i)	C_5H_{12}	ignore attempts at balancing	1
11(a)(ii)	(pentane has higher boiling point as) it condenses **or** (as) it collects as a liquid	accept ethene does not condense accept pentane is a liquid **and** ethene is a gas	1
11(b)	(ethene)  (polyethene) carbon-carbon single bond **and** 4 carbon-hydrogen single bonds  lines correctly drawn to outside of brackets	 do **not** allow additional atoms / elements added	1 1 1
Total			**5**

SCA2HP

Question 12

question	answers	extra information	mark
12(a)		ignore oil heats up faster	
	vegetable oils have higher boiling points (than water)	allow oil gets hotter (than water)	1
	(and so the food cooks faster because) it is at a higher temperature	ignore chips cook quicker accept for **1** mark chips have a larger surface area accept for 2 marks chips have a larger surface area (so) energy transfers to potato quicker allow 'heat' for energy	1
12(b)(i)	contains a (carbon-carbon) double bond	ignore references to alkenes	1
12(b)(ii)	add bromine (water and shake)		1
	(bromine water turns from orange to) colourless	accept is decolourised ignore clear	1
Total			**5**

SCA2HP

Question 13

question	answers	extra information	mark
13(a)(i)	echo	allow echoes	1
13(a)(ii)	any **two** from: • (longitudinal) oscillations are parallel to the direction of energy transfer • (transverse) oscillations are perpendicular / 90° to the direction of energy transfer • (longitudinal waves) show areas of compression and rarefaction	allow vibrations for oscillations allow correct description of particle movement for oscillation allow direction of wave for direction of energy transfer marks can be gained from correctly labelled diagrams ignore references to need for a medium to travel through	2
13(b)(i)	reaction time	allow a description of reaction time allow measuring the time	1
	(as) time measured is very small	allow (as) sound travels quickly	1

Question 13 continues on the next page

SCA2HP

Question 13 continued

question	answers	extra information	mark
13(b)(ii)	0.28(3)	an answer of 283(.3) gains **2** marks allow correct substitution and unit conversion for **2** marks 340 =1200 λ **or** 340 / 1200 = λ provided no subsequent step shown allow correct substitution for **1** mark 340 =1.2 λ **or** 340 / 1.2 = λ provided no subsequent step shown	3
Total			**8**

SCA2HP

Question 14

question	answers	extra information	mark
14(a)	region **A** shows a blue shift **and / or** region **B** shows a red shift		1
	region **A** is moving towards (us / the Earth / our galaxy) **and / or** region **B** is moving away from (us / the Earth / our galaxy)		1
	(so) anticlockwise direction		1
14(b)(i)	frequency	allow number of waves passing a point every second **or** number of oscillations / vibrations per second	1
14(b)(ii)		ignore references to loudness or frequency	
	sound is higher pitched when moving towards students **or** lower pitched when moving away from the students	do **not** allow if also state wavelength gets longer do **not** allow if also state wavelength gets shorter	1
	(caused by the) Doppler effect		1
Total			**6**

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