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Science A SCA2FP

(Specification 4406)

Unit 6: Science A2

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

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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 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 15(b) 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.

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Question 1

question	answers	extra information	mark
1(a)	light → chemical	1 mark each must be in correct order	2
1(b)(i)	25 (kilojoules)		1
1(b)(ii) View with (b)(i)	75 (kilojoules)	allow ecf from (b)(i) answer for 100 − their value in (b)(i)	1
1(b)(iii)	respiration the surroundings		1 1
Total			**6**

Question 2

question	answers	extra information	mark
2(a)(i)	at X = 5 at Y = 3	both needed for **1** mark	1
2(a)(ii)	any **one** from: • more oxygen at X • less pollution / sewage at X • better quality (water) at X	allow converse answers answer must be comparative allow cleaner allow less harmful	1
2(b)	not enough oxygen (at Y)	allow less oxygen at Y than X do **not** allow there isn't any oxygen	1
Total			**3**

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Question 3

question	answers	extra information	mark
3(a)	the soil bacterium		1
	an enzyme		1
	cotton plant		1
3(b)	**economic advantage**		
	any **one** from:		
	• (higher yield) so can sell more	allow farmer makes more money	1
	• less spent (on pesticides)		
	environmental disadvantages		
	any **two** from:		
	• may kill useful / other insects		
	• may cause wild plants to produce the poison	allow example eg bees	2
	• may affect ecosystem / food chain	ignore environment	
Total			**6**

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Question 4

question	answers	extra information	mark
4(a)(i)	any **one** from: • 5 g / mass / same amount of grass cuttings • left 1 week / same length of time • same starting temperature	allow same size flask ignore volume ignore room temperature	1
4(a)(ii)	any **one** from: • allows oxygen / air in • allows carbon dioxide out • prevents build-up of pressure	allow lets gases in / out	1
4(a)(iii)	no or little water / moisture	allow liquid allow it's dry	1
4(a)(iv)	speeds it up / increases it		1
4(b)	any **two** from: • releases substances / minerals that plants need to grow • reduces the amount of waste • reduces cost of buying fertilisers / saves money	allow helps plants grow allow compost	2
Total			**6**

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Question 5

question	answers	extra information	mark
5(a)	2nd diagram - 400 cm^3 of vegetable oil floating on 40 cm^3 of lemon juice		1
5(b)(i)	better texture than the vegetable oil and lemon juice mixture thicker than oil		1 1
5(b)(ii)	egg yolk	allow egg / yolk	1
Total			**4**

Question 6

question	answers	extra information	mark
6(a)	pressing		1
6(b)	energy nutrients	 allow fats / vitamins ignore protein / minerals / carbohydrates	1 1
6(c)	carbon-carbon		1
Total			**4**

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Question 7

question	answers	extra information	mark
7(a)(i)	78 %		1
7(a)(ii)	A – nitrogen	allow N_2 N must be uppercase and 2 must be subscript ignore N	1
	B – oxygen	allow O_2 O must be uppercase and 2 must be subscript ignore O	1
7(b)(i)	any **two** from: • level *up* to 1900 (allow 1890 to 1910) • increasing from 1900 to today *(allow 1890 to 1910)* • increased more rapidly in last 50 years	 allow increased by 90 (ppm), allow answers in the range 88–92 if no other marks gained allow **1** mark for it has increased	2
7(b)(ii)	(fossil) fuels	accept coal / oil / (natural) gas / peat allow petrol / diesel / methane	1
Total			**6**

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Question 8

question	answers	extra information	mark
8(a)(i)	the continents (of South America and Africa) fit together (like a jigsaw)	allow countries for continents allow there are similar fossils / same species or same rock (types) (in South America and Africa) if not given in part (a)(ii)	1
8(a)(ii)	there are similar / same fossils (in South America and Africa)	allow same species or same rock (types) accept the continents (of South America and Africa) fit together (like a jigsaw) if not given in part (a)(i) allow countries for continents	1
8(b)	any **one** from: • Wegener had no evidence / could not prove that continents move • they thought the continents were fixed / couldn't move • Wegener was not respected by other scientists	allow countries for continents allow evidence not strong enough allow Wegener was not a geologist	1
8(c)	Glossopteris / similar fossils in Australia **or** Africa	allow in both / all three places	1
8(d)(i)	mantle		1

Question 8 continues on the next page

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Question 8 continued

question	answers	extra information	mark
8(d)(ii)	centimetres		1
8(e)	any **two** from: • earthquakes • volcanoes • mountain formation	 accept tsunamis accept volcanic eruptions	2
Total			**8**

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Question 9

question	answers	extra information	mark
9(a)	transverse		1
9(b)(i)	700 400	in either order	1 1
9(b)(ii)	stays the same		1
Total			**4**

Question 10

question	answers	extra information	mark
10(a)	1st box ticked		1
10(b)(i)	continuous reflected ray parallel to incident ray (by eye) an arrow shown correctly	 arrow must be drawn on a continuous ray reflected by top mirror	1 1
10(b)(ii)	normal		1
Total			**4**

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Question 11

question	answers	extra information	mark
11(a)	2.5(cm)	10/4 for **1** mark	2
11(b)(i)	3 (m/s)	allow 0.5 × 6 for **1** mark	2
11(b)(ii)	any **one** from: • cheaper • (easier) to make adjustments • easier to handle • external conditions can be controlled • for safety • fit for purpose	allow to see if it works / floats / has faults	1
Total			**5**

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Question 12

question	answers	extra information	mark
12(a)(i)	point at 30 cm^2 circled		1
12(a)(ii)	any **one** from: • repeat it • discard it • ignore it		1
12(b)	any **two** from: • as area increases, voltage increases • voltage increases quickly at first then less quickly • voltage constant after area 21 – 25 cm^2 • if no area exposed, zero voltage	allow 0.5(V) is maximum voltage allow graph levels off allow no light for **2** marks accept as area increases, voltage increases quickly at first but at a slower rate afterwards	2

Question 12 continues on the next page

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Question 12

question	answers	extra information	mark
12(c)(i)	any **two** from: • no electricity / light at night • reduced electricity / light when cloudy • fewer daylight hours in winter • may not meet demand • National Grid can supply electricity • can sell electricity (to National Grid) • if they break / malfunction	 allow other described weather conditions eg foggy allow not sunny (all the time) allow cannot produce enough electricity allow not working if no other marks gained allow **1** mark for unreliable	2
12(c)(ii)	any **two** from: (**solar**): • renewable • no carbon dioxide /greenhouse gases / global warming • no sulfur dioxide • no particulates / soot / smoke	it = solar cells allow converse answers in terms of coal ignore cheap electricity allow less for no if no examples of pollution given allow no / less air pollution / atmospheric pollution / harmful gases ignore mining ignore fossil fuels ignore conserves coal reserves	2
Total			**8**

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Question 13

question	answers	extra information	mark
13(a)(i)	any **two** from: • food • mates • territory / space	 ignore habitat, land ignore water	2
13(a)(ii)	any **two** adaptations with explanations from: • long / thick hair or wool (for) insulation • small surface area : volume ratio (therefore) lose less energy • small ears / tail (therefore) lose less energy	**1** mark for adaptation **1** mark for correct explanation ignore prevents / no heat loss allow a lot of allow long / thick / a lot of fur ignore fat although reason can still be credited ignore coat allow (to) trap energy / heat / air allow to keep warm ignore large body mass although reason can still be credited allow (to) keep warm allow heat for energy ignore (to) insulate allow (to) keep warm allow heat for energy ignore (to) insulate only allow big tusks if qualified eg digging through snow / ice for (food) for **2** marks ignore references to predators and prey only allow big feet if qualified eg for walking on snow / ice for **2** marks	4

Question 13 continues on the next page

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Question 13

question	answers	extra information	mark
13(b)(i)	natural selection		1
13(b)(ii)		ignore answers about Darwin's theory	
	if some animals grew a long nose / acquired characteristic (during their lifetime)	allow trunk for nose allow used trunk / nose / it a lot allow stretched trunk / nose / it	1
	their offspring would inherit / also have a long nose	do **not** accept references to genes / DNA / chromosomes	1
Total			**9**

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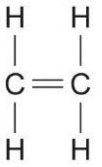
Question 14

question	answers	extra information	mark
14(a)	C_2H_4	allow displayed formula  if both molecular and displayed formulae are given mark the molecular formula allow H_4C_2 upper case letters do **not** accept numbers as superscripts	1
14(b)(i)	catalyst steam	must be in correct order	1 1
14(b)(ii)	cracking	ignore thermal decomposition	1
14(c)(i)	PLA is biodegradable (so) less need for landfill	it = PLA must relate to waste disposal allow converse answers allow decomposes / decays / rots / breaks down (naturally) ignore easier to dispose allow (so) waste not around as long ignore animals can eat it for **2** marks allow PLA is biodegradable and poly(ethene) is non-biodegradable	1 1

Question 14 continues on the next page

SCA2FP

Question 14 continued

question	answers	extra information	mark
14(c)(ii)	PLA from renewable resource / doesn't use up finite resources	ignore global warming ignore references to waste disposal eg burning ignore recycling ignore cost accept poly(ethene) is made from oil / non-renewable resource allow cornstarch / it is renewable / can be grown	1
14(c)(iii)	any **one** from: • needs (large amount of) land • destruction of the rainforest • less crops grown for food • food prices may increase • takes time to grow (cornstarch)	ignore properties accept deforestation allow may need to import food allow won't grow all year ignore cost	1
Total			**8**

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Question 15

question	answers	extra information	mark
15(a)(i)	coal		1
15(a)(ii)	any **two** from: • tidal • wave • biofuel / biomass • solar • geothermal	ignore coal, oil, natural gas, nuclear, hydroelectricity and wind allow waste incineration / burning allow named biomass eg wood ignore Sun ignore water	2

15(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 5 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.	A brief description of an advantage of the chosen energy resource **or** a disadvantage of the rejected energy resource has been given. There is little scientific terminology used.	A clear description of either advantages **and / or** disadvantages have been described. Some scientific erminology is used.	A detailed description of advantages of the chosen energy resource **and** disadvantages for the rejected energy resource have been described. Scientific terminology is used accurately.

Question 5 continues on the next page

SCA2FP

Question 15 continued

question	answer	extra information	mark
	physics responses	ignore circling of nuclear / wind ignore references to any other energy resources	
	nuclear:		
	advantage:		
	• large amount of energy released (per kg of fuel)		
	• large fuel reserves	allow there is a lot of uranium (in the ground)	
	• reliable electricity supply		
	disadvantage:		
	• radioactive waste	allow waste is harmful / dangerous ignore nuclear waste	
	• waste remains radioactive for many years	accept waste has a long half-life allow dangerous / harmful for radioactive	
	• waste has to be stored (for many years)	allow difficult to dispose of	
	• non-renewable	allow unsustainable or will (eventually) run out	
	• high decommissioning cost		
	• high commissioning cost	allow cost more to build	
	• long time needed to build		
	• long start-up time		
	• risk of meltdown / large scale disaster	allow named disaster eg Chernobyl, Fukushima, Japan	
	• (fuel) has to be mined	ignore visual pollution / eyesore for both energy resources ignore air pollution / greenhouse gases / carbon dioxide for both energy resources ignore cost of electricity for both resources	

Question 15 continues on the next page

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Question 15 continued

question	answer	extra information	mark
wind: **advantage**: • renewable • land still useable beneath turbines • no fuel cost • short start-up time • short time needed to build • set up cost is lower **disadvantage**: • unreliable (wind / electricity) • very large number of turbines needed (1000s) • high set up cost (for many turbines) • connection to National Grid is difficult / expensive • (single turbine has) low output		ignore the UK is very windy allow sustainable or won't run out allow wind is free allow kills birds allow noisy / noise pollution ignore causes headaches / migraines ignore visual pollution / eyesore for both energy resources ignore air pollution / greenhouse gases / carbon dioxide for both energy resources ignore cost of electricity for both resources	
Total			**9**

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