GCSE

Science A (Route 2)

SCA1FP

Mark scheme

4406

June 2016

Version 1.0: Final Mark Scheme

Mark schemes are prepared by the Lead Assessment Writer 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 associates 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 associate understands and applies it in the same correct way. As preparation for standardisation each associate 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, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Assessment Writer.

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

Information to Examiners

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 Assessment Objectives and specification content that each question is intended to cover.

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 bullet points 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.

2.4 Any wording that is underlined is essential for the marking point to be awarded.

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 errors / 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	green, 5	0
2	red*, 5	1
3	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Student	Response	Marks awarded
1	Neptune, Mars, Moon	1
2	Neptune, 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, 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 or by each stage of a longer calculation.

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 is 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.

3.8 Accept / allow

Accept is used to indicate an equivalent answer to that given on the left-hand side of the mark scheme. Allow is used to denote lower-level responses that just gain credit.

3.9 Ignore / Insufficient / Do <u>not</u> allow

Ignore or insufficient is used when the information given is irrelevant to the question or not enough to gain the marking point. Any further correct amplification could gain the marking point.

Do **not** allow means that this is a wrong answer which, even if the correct answer is given, will still mean that the mark is not awarded.

4. Quality of Communication and levels marking

In Question **15(b)** students are required to produce extended written material in English, and will be assessed on the quality of their 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.

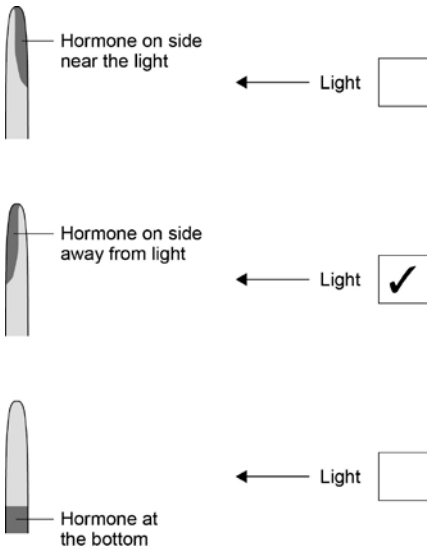
The following general criteria should be used to assign marks to a level:

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.

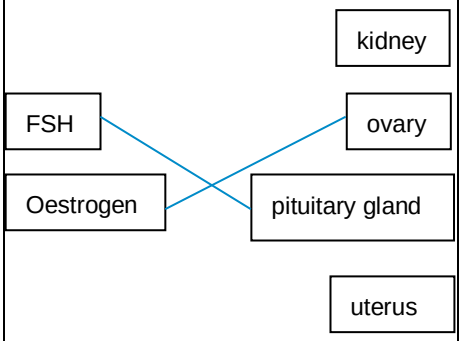
Question 1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
1(a)	Auxin	extra ticks negate mark	1	AO1 B1.2.3b
1(b)(i)	Towards the light	extra ticks negate mark	1	AO1 B1.2.3a
1(b)(ii)		extra ticks negate mark	1	AO2 B1.2.3b,c
Total			**3**	

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
2(a)	Dependent variable		1	AO2 B1.2.1a
2(b)(i)	55	answer line takes precedence	1	AO2 B1.2.1a
2(b)(ii)	bar correctly plotted at 55	allow ecf from part **(b)(i)** ignore width of bar	1	AO2 B1.2.1a
2(b)(iii)	any **one** from: • older children / boys / girls had better coordination • boys had better coordination than girls • boys' and girls' coordination skills were very similar at age 15	allow answer based on their graph allow older children / boys / girls caught the ball more often allow boys caught the ball more often than girls	1	AO3 B1.2.1a
2(c)	any **one** from: • practice • height of person • height ball bounced from • force applied to ball (when bounced) • amount of sport they do • amount of time spent playing computer games • right / left handedness • injury / disability • property of ball / surface		1	AO3 B1.2.1a
Total			**5**	

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
3(a)	**Hormone** **Organ**  	extra lines from hormone negates mark	1 1	AO1 B1.2.2d
3(b)	*Advantage* any **one** from: • stops a woman getting pregnant • allows people to choose when to start a family • easy to use *Disadvantage* any **one** from: • side-effects • needs to be taken regularly • may be harder to get pregnant later on • may encourage unsafe sex	accept to control periods / menstrual cycle ignore references to religion / beliefs accept description, eg headaches, weight gain, sickness allow does not protect against STIs allow not 100 % effective	1 1	AO1, AO3 B1.2.2e
Total			**4**	

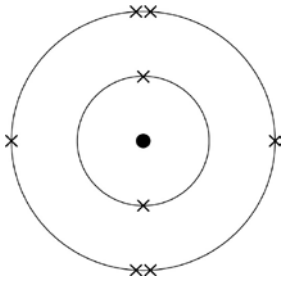
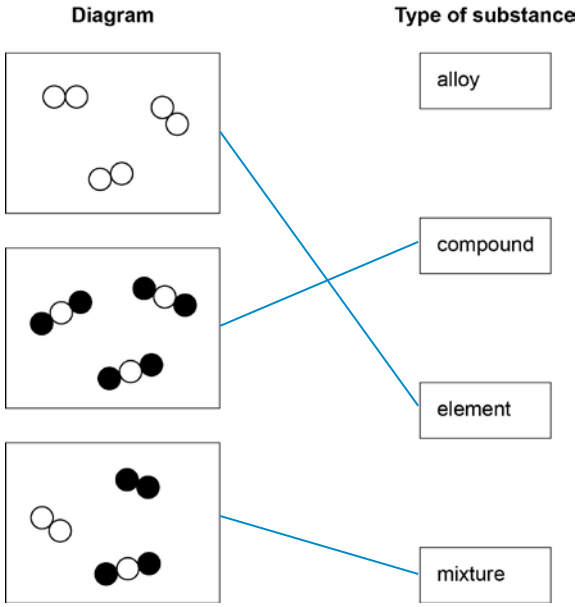
Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
4(a)	Anabolic steroid		1	AO1 B1.3.1i
4(b)(i)	76.8 (metres)		1	AO2 B1.3.1i
4(b)(ii)	2009	ignore any reference to distance	1	AO2 B1.3.1i
4(b)(iii)	any **one** from: • athletes stopped taking drugs / (anabolic) steroids • athletes did not want to risk being caught for taking drugs / (anabolic) steroids • athletes did not want to risk being banned (from competing)	allow the drug cheats were banned allow changed weight / shape of discus	1	AO3 B1.3.1i
Total			**4**	

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
5(a)	(nicotine / drug is) addictive **or** they become dependent on the drug / nicotine	allow reference to withdrawal symptoms	1	AO2 B1.3.1e,h
5(b)(i)	any **one** from: • treatment that does not contain the drug / nicotine / anything • fake drug / treatment		1	AO1 B1.3.1b
5(b)(ii)	any **two** from: • (nicotine) nasal spray was most successful • (nicotine) patch was least successful • (nicotine) gum, (nicotine) patch and (nicotine) inhaler had similar success • all treatments were more successful than a placebo • placebos did have some effect	allow comparison of any two of these allow all treatments had some success	2	AO3 B1.3.1e
Total			**4**	

Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
6(a)(i)			1	AO2 C1.1.1h
6(a)(ii)	-1		1	AO1 C1.1.1d
6(b)	16		1	AO2 C1.1.1g
6(c)		extra line from diagram negates mark	1 1 1	AO2 C1.1.1a,b C1.1.3a C1.4.1b
Total			**6**	

Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
7(a)		ignore references to other properties		AO2, AO3 C1.3.3a,b, c
	(aluminium) has a low density	allow (aluminium) is lighter (than copper)	1	
	(copper) better conductor than aluminium	ignore references to density	1	
7(b)	Cast iron is brittle.		1	AO1 C1.3.2a,c
7(c)(i)		ignore references to reactivity / properties		AO2, AO3 C1.3.1a,b, d,f,h
	less copper (in Earth's crust)	allow the converse	1	
	lower percentage of copper in ore	allow more stages in process to extract copper	1	
7(c)(ii)	aluminium extraction uses large amounts of energy.		1	AO1 C1.3.1e,i
7(d)(i)	(copper sulfide +) oxygen → copper + (sulfur dioxide)	allow O_2 for oxygen allow Cu for copper	1	AO2 C1.3.1f
7(d)(ii)	copper / Cu^{2+} ions are positive		1	AO1 C1.1.3a C1.3.1f,h
	(so) move to the negative (electrode)	accept (so) are attracted to the negative (electrode) allow opposites attract	1	

7(e)	bioleaching		1	AO1 C1.3.1g
7(f)	any **one** from: • conserves copper resources • less copper ore is mined • less energy is used • less damage to environment	ignore references to cost	1	AO1 C1.3.1j
Total			**11**	

Question 8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
8(a)	concrete **or** mortar		1	AO1 C1.2.1g
8(b)(i)	decomposition		1	AO1 C1.2.1b
8(b)(ii)	carbon dioxide	allow CO_2	1	AO1 C1.2.1e
8(b)(iii)	To neutralise acids		1	AO1 C1.2.1d
Total			**4**	

Question 9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
9(a)	evaporation		1	AO1 P1.1.3b
9(b)	any **two** from: • temperature increases • becomes (more) windy • becomes less humid		2	AO1 P1.1.3b
Total			**3**	

Question 10

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10(a)(i)	area		1	AO1 P1.1.3c
10(a)(ii)	radiation		1	AO1 P1.1.1c
10(a)(iii)	more quickly		1	AO1 P1.1.1b P1.1.3d
10(b)(i)	30 (J)		1	AO2 P1.2.1a
10(b)(ii)	30% **or** 0.3	accept for **2** marks a correct answer using their **(b)(i)** accept for **1** mark the correct substitution $efficiency = \frac{30}{100}$ (× 100) accept for **1** mark the correct substitution $efficiency = \frac{part\ (b)(i)}{100}$ (× 100) provided no subsequent steps allow for **1** mark either 30 without % or 0.3 with % **or** equivalent using ecf	2	AO2 P1.2.1d
Total			**6**	

Question 11

Question	Answers	Extra information	Mark	AO / Spec. Ref.
11(a)	Length of each metal rod Thickness of each metal rod		1 1	AO3 P1.1.3a
11(b)(i)	any **one** from: • (the wax melts in the) shortest time • the pin falls off the copper first		1	AO3 P1.1.3a
11(b)(ii)	the time for the pins to fall would be shorter (because) more energy is transferred (to the metals) ***or*** *idea of* increasing rate of energy transfer	allow wax melts quicker allow 'heat' for energy allow for **1** mark only the pin on the copper would still fall first	1 1	AO2, AO3 P1.1.3a
11(c)	solids. particles. electrons.	correct order only	1 1 1	AO1 P1.1.3a
Total			**8**	

Question 12

Question	Answers	Extra information	Mark	AO / Spec. Ref.
12(a)(i)	6 (kWh)		1	AO2 P1.3.1d
12(a)(ii)	480 (p)	accept £4.80 does not score if unit is omitted	1	AO2 P1.3.1d
12(b)(i)	loft insulation	allow 0.16	1	AO3 P1.1.4b
12(b)(ii)	2 (years)		1	AO2 P1.1.4b
12(b)(iii)	any **one** from: • keeps house warm(er) • reduces noise from outside • (more) difficult to break • less condensation • it has a smaller U-value than single glazed	allow adds value to the house	1	AO3 P1.1.4b
Total			**5**	

Question 13

Question	Answers	Extra information	Mark	AO / Spec. Ref.
13(a)	24 / 24.4 / 24.39 Healthy weight	do **not** allow 24.3 / 24.38 description must agree with calculated BMI allow healthy mass	1 1	AO2, AO3 B1.1.1a
13(b)(i)	The rate of all the chemical reactions in a person's body		1	AO1 B1.1.1c
13(b)(ii)	any **one** from: • amount of activity / exercise • proportion of muscle to fat • inherited factors • age • gender	accept hormone levels allow diseases **or** infection allow air temperature	1	AO1 B1.1.1c
Total			**4**	

Question 14

Question	Answers	Extra information	Mark	AO / Spec. Ref.
14(a)	pathogen(s)	ignore bacteria / viruses / fungi / germs	1	AO1 B1.1.2a
14(b)	(white blood cells): produce <u>antibodies</u> (to kill microorganisms / pathogens) ingest microorganisms pathogens / bacteria / viruses produce <u>antitoxins</u> (to counteract toxins released by pathogens)	 allow produce <u>antibodies</u> (to kill bacteria / viruses / fungi) accept <u>antibodies</u> cause microorganisms to clump together	 1 1 1	AO1 B1.1.2c,d
14(c)	rapid response / increase of white blood cells (to) produce the <u>correct / specific antibody</u>	need *idea of* rapid response **or** accept *idea of* recognition of microorganism, eg reference to memory cells allow a description, eg produce antibodies against the chicken pox virus	1 1	AO1 B1.1.2e,l
Total			**6**	

Question 15

Question	Answers	Extra information	Mark	AO / Spec. Ref.
15(a)(i)	174 (°C)	allow values in range 166 – 176	1	AO3 C1.4.2c
15(a)(ii)	$C_{10}H_{22}$		1	AO2 C1.4.1c C1.4.2a
15(a)(iii)	contain carbon and hydrogen only		1	AO1 C1.4.1c

QWC Mark Scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
15(b)			6	AO1, AO2, AO3 C1.4.3a,c,e

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	At least **one** effect given for biodiesel **or** at least **two** direct comparisons made from the table.	Advantage(s) **and** disadvantage(s) given for biodiesel, including **two** effects **or** advantages **or** disadvantages given for biodiesel with linked effects **or** a full comparison using the table with at least **one** effect.	Advantages **and** disadvantages of biodiesel, with linked effects given.

examples of the points made in the response	**extra information** if formulae given they must be written correctly ignore references to cost, flammability, viscosity, volatility, energy required for production ignore pollution unqualified	
advantages of biodiesel • less carbon dioxide (produced) • fewer particulates (produced) • (so) fewer respiratory problems (E) • less greenhouse gases (E) • less global warming (E) • less global dimming (E) • from renewable resource (E)	ignore oil/petroleum diesel is running out allow carbon neutral (E)	
disadvantages of biodiesel • more nitrogen oxides (produced) • more acid rain (E) • large area of land needed (E) • fields could be used for crops (E) • deforestation (E)	allow *idea of* food shortages **or** increase in food prices (E) allow loss of habitat / biodiversity (E) allow *idea of* less reliable (E)	

Total			**9**

Question 16

Question	Answers	Extra information	Mark	AO / Spec. Ref.
16(a)(i)		answers must be in the correct order		AO1 P1.3.1a
	electrical	ignore electric / electricity	1	
	light	allow sound	1	
16(a)(ii)	it is transferred to the surroundings / tablet	allow it goes into the air allow it is wasted as 'heat' / thermal energy	1	AO1 P1.2.1c
	the surroundings / tablet get(s) warmer	allow the air heats up	1	
16(b)(i)	86 400 (joules)	allow for **1** mark 24 or correctly calculated energy following an incorrect conversion of time allow for **1** mark 3 × 8 × 3600 **or** 3 x 28 800 provided no subsequent steps given	2	AO2 P1.3.1c
16(b)(ii)	the battery life (of the laptop) is shorter	allow the battery (of laptop) does not last as long	1	AO1, AO2 P1.3.1b
	(because) more energy is transferred each second	allow energy is transferred faster allow a calculation of time using $\text{time} = \frac{\text{energy}}{\text{power}}$ time = 1728 (s) **or** 0.48 (h) **or** 28.8 (minutes) ignore laptop has a higher power	1	
Total			**8**	