



# **General Certificate of Secondary Education**

*Science A 4406*

**SCA1FP      Unit 5**

## **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. Boldening

- 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 boldened. 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 12 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.

## SCA1FP

## Question 1

question	answers	extra information	mark
1(a)(i) G	A – (cell) membrane	must be in correct order	1
	B – cytoplasm	accept phonetic spelling – see marking guidance 3.6	1
	C – nucleus		1
1(a)(ii) G	eye	accept eyeballs accept retina / rods / cones  do <b>not</b> accept behind the eye(ball)s	1
1(b) G	<u>skin</u>	ignore other organs eg arms / legs	1
	ear	allow muscle(s)	1
	tongue <b>or</b> nose	ignore feet allow mouth ignore skin	1
<b>Total</b>			<b>7</b>

## SCA1FP

## Question 2

question	answers	extra information	mark
<b>2(a)</b> G	ovary	must be in correct order	1
	sperm	accept phonetic spelling – see marking guidance 3.6	1
	uterus		1
<b>2(b)(i)</b> E	more embryos transferred in older women / average increases with age	ignore chance of pregnancy / number of treatments	1
<b>2(b)(ii)</b> E	(many) embryos die / destroyed / do not survive	answer must relate to data in table  allow low success rate / often does not work allow could lead to multiple births  ignore less successful in older women ignore older women should not have babies ignore not natural / finance ignore religion / 'against God's will'	1
<b>Total</b>			<b>5</b>

## SCA1FP

## Question 3

question	answers	extra information	mark
<b>3(a)</b> G	ingest pathogens	deduct 1 mark for each extra box ticked	1
	produce antibodies		1
	produce antitoxins		1
<b>3(b)</b> E	are not killed / affected (by antibiotic)	allow antibiotic does not work / does not cure allow bacteria immune (to antibiotic) allow infection not killed  ignore bacteria mutated	1
<b>3(c)(i)</b> A	(antibiotic) Y		1
<b>3(c)(ii)</b> E	8	allow 54–46 for 1 mark	2
<b>3(c)(iii)</b> E	any <b>two</b> from: <ul style="list-style-type: none"> <li>• overuse / widespread use / over prescription</li> <li>• inappropriate use / use for eg sore throats / viral infections</li> <li>• mutation / change to DNA (in bacteria)</li> <li>• natural selection / description</li> </ul>	OWTTE  ignore people not finishing course of antibiotics ignore wrong antibiotic given	2
<b>Total</b>			<b>9</b>



**SCA1FP**

**Question 4**

question	answers	extra information	mark
<p><b>4</b> <b>G</b></p>		<p>extra line from box in left hand cancels the mark</p>	<p><b>4</b></p>
<p><b>Total</b></p>			<p><b>4</b></p>

**SCA1FP****Question 5**

<b>question</b>	<b>answers</b>	<b>extra information</b>	<b>mark</b>
<b>5(a)</b> G	carbon dioxide	each extra box ticked cancels one mark	1
	water		1
<b>5(b)</b> G	sulfur dioxide	must be in correct order	1
	acid rain	accept phonetic spelling – see marking guidance 3.6	1
	particles		1
	dimming		1
<b>Total</b>			<b>6</b>

## SCA1FP

## Question 6

question	answers	extra information	mark
6(a) E	use of limewater / calcium hydroxide solution	ignore extinguishes flame allow bicarbonate indicator	1
	cloudy if carbon dioxide present	only scores if first marking point correct allow turns yellow for bicarbonate indicator	1
6(b) G	clay	do <b>not</b> accept sand / water / stones	1
6(c)(i) E	strength / hardness / brittleness / toughness	OWTTE do <b>not</b> accept density ignore amount of fibre	1
6(c)(ii) E	thickness (of slabs) / size or mass of ball	allow (same) ball ignore size of slab do <b>not</b> accept same slab / position of slab / height of ball / amount of fibre	1
6(c)(iii) G	70 (cm)	allow answers in range 68–72 inclusive	1

Question 6 continues on next page . . .

## SCA1FP

## Question 6 continued . . .

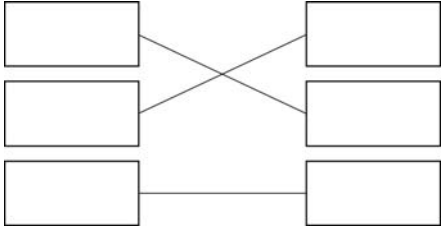
question	answers	extra information	mark
6(c)(iv) E	adding fibre increases the strength / hardness / toughness / of concrete	answer must relate to amount of fibre  allow correct quantitative answers allow the higher the percentage of fibre the higher the ball has to be dropped (to crack concrete)  do <b>not</b> allow height of ball affects amount of fibre in concrete	1
6(d)(i) G	carbon dioxide  water	ignore formulae if correct chemical name given  must be in correct order  accept CO <sub>2</sub>  do <b>not</b> accept CO2  accept H <sub>2</sub> O  do <b>not</b> accept H2O do <b>not</b> accept hydroxide  ignore hydrogen oxide	1  1
6(d)(ii) E	neutralise soil / make soil less acid / removes acid / to make soil alkaline / increases pH	ignore references to plant growth / fertilisers  do <b>not</b> accept kills acid	1
<b>Total</b>			<b>10</b>

**SCA1FP****Question 7**

<b>question</b>	<b>answers</b>	<b>extra information</b>	<b>mark</b>
<b>7</b> G	kinetic	must be in correct order	1
	electrical	accept phonetic spelling – see marking guidance 3.6	1
	sound		1
<b>Total</b>			<b>3</b>

## SCA1FP

## Question 8

question	answers	extra information	mark
<b>8(a)</b> G		all 3 correct for <b>2</b> marks 1 or 2 correct for <b>1</b> mark  extra line from statement box cancels mark	<b>2</b>
<b>8(b)</b> G	solid  liquid  gas	all 3 correct for <b>2</b> marks 1 or 2 correct for <b>1</b> mark  must be in correct order	<b>2</b>
<b>Total</b>			<b>4</b>

## SCA1FP

## Question 9

question	answers	extra information	mark
9(a) G	water	allow H <sub>2</sub> O / OH <sub>2</sub>	1
9(b)(i) E	water (filled heater)  highest power (output) / most powerful / highest number of watts	allow 3kW  only scores if first marking point correct  allow highest energy / heat <u>output</u> allow has more power  ignore stores most energy / references to heat	1  1
9(b)(ii) E	7.5 (kWh)	E = P × t  allow 1 mark for correct substitution into correct equation ie 1.5 × 5 <b>or</b> 1500 × 5 or 7500 <b>or</b> 1.5 × 300 or 450 <b>or</b> 1.5 × (5 × 3600) or 27 000 <b>or</b> 1500 × 300 or 450 000 <b>or</b> 1500 × 5 × 3600 or 27 000 000	2

Question 9 continues on the next page . . .

## SCA1FP

## Question 9 continued . . .

question	answers	extra information	mark
9(c) E	27 000	$E = m \times c \times \theta$  allow <b>1</b> mark for correct substitution into correct equation: $2 \times 900 \times 15$ <b>or</b> $2000 \times 900 \times 15$ <b>or</b> 27 000 000	2
<b>Total</b>			<b>7</b>



## SCA1FP

## Question 10

question	answers	extra information	mark
10(a) A	convection		1
10(b) E	<p>any <b>two</b> from:</p> <ul style="list-style-type: none"> <li>easier / clearer to read <b>or</b> reading error less likely / takes readings for you</li> <li>greater resolution / temperature displayed to two decimal places</li> <li>more frequent readings</li> <li>more data</li> <li>live graphical representation</li> </ul>	<p>ignore precision / accurate / reliable / sensitivity</p> <p>ignore readings every second / plots graph / quicker</p> <p>allow references to safety allow no need to open lid (thus preventing cooling)</p>	2
10(c)(i) E	black is a better <u>emitter</u> / <u>radiator</u> of energy / infrared radiation	<p>allow heat for full marks there must be a comparison in terms of emission / radiation</p> <p>allow <b>1</b> mark for: temperature of black can decreases faster / more <b>or</b> water in black can has reached room / constant temperature whilst water in white can is still cooling <b>or</b> correct description of temperature drop in both cans after 14 minutes</p>	2

Question 10 continues on the next page . . .

## SCA1FP

## Question 10 continued . . .

question	answers	extra information	mark
10(c)(ii) E	(any) line drawn between the white can and black can lines on graph <b>starting at 100</b> (°C)		1
	line shows the same trend as white can line <b>or</b> black can line	second mark only scores if first marking point correct  do <b>not</b> award this mark if line shows intentional rise at any point	1
<b>Total</b>			<b>7</b>

## SCA1FP

## Question 11

question	answers	extra information	mark
11(a) E clip with 11(b)	shaded grows longer / faster / more	ignore grows better allow correct figures	1
11(b) E clip with 11(a)	(more) auxin / hormone on shaded side  so stimulates (more) growth on shaded side / cells elongate more on shaded side	accept auxin / hormone moves to shaded side accept auxin / hormone destroyed by light  do <b>not</b> accept auxin / hormone killed  OWTTE	1  1
<b>Total</b>			<b>3</b>

## SCA1FP

## Question 12

question	answers	extra information	mark
12 E			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	There is a brief description of the evidence for or against the newspaper's claim, including either evidence for or evidence against.	There is a description of some of the evidence for <b>and</b> evidence against the newspaper's claim, with at least <b>one</b> example of evidence for <b>and one</b> example of evidence against. There is an attempt at a conclusion.	There is a clear and detailed description of the evidence for <b>and</b> evidence against the newspaper's claim, with at least <b>one</b> example for <b>and</b> at least <b>two</b> examples against. A reasoned conclusion is given. The description must include reference to polyphenols.

Question 12 continues on the next page . . .

## SCA1FP

## Question 12 continued . . .

question	answers	extra information	mark
	<p><b>examples of the points made in the response</b></p> <p>Evidence supporting the newspaper claim:</p> <ul style="list-style-type: none"> <li>• the study included a control group / one group given a placebo</li> <li>• all participants ate the same amount of chocolate each day</li> <li>• results showed a decrease in total cholesterol / an increase in ‘good’ cholesterol / a decrease in ‘bad’ cholesterol in the group that ate the dark chocolate</li> </ul> <p>Evidence against the newspaper claim:</p> <ul style="list-style-type: none"> <li>• no results given for (dark) chocolate without polyphenols</li> <li>• only type 2 diabetes patients tested</li> <li>• small sample tested / only 12 tested</li> <li>• unequal numbers of males and females</li> <li>• other health issues / age not controlled</li> <li>• rest of diet not controlled</li> <li>• chocolate contains high levels of fat / sugar / could cause other health issues eg weight gain</li> <li>• long term effects not known / trial only 16 weeks</li> </ul> <p>Argued conclusion made with an attempted justification</p>	<p><b>extra information</b></p> <p>allow (dark) chocolate worked / reduced (risk of) heart disease</p>	
<b>Total</b>			<b>6</b>

## SCA1FP

## Question 13

question	answers	extra information	mark
13(a) G	11.35	only acceptable answer	1
13(b) E	increases (tensile) strength	allow stronger	1
	decreases melting point	allow mp	1
	decreases density	ignore figures	1
13(c) E	(joint / solder) stronger or lower working temperature / so lead pipes do not melt	allow firmer / more solid  ignore lower melting point unqualified  ignore references to poison / weight	1
<b>Total</b>			<b>5</b>

## SCA1FP

## Question 14

question	answers	extra information	mark
14(a) E	helps to distribute energy throughout beaker	allow heat / thermal energy allow keeps all water at same temperature	1
	all of oil (in tube) more likely to be at same temperature / oil likely to be at same temperature as thermometer		1
14(b)(i) E	any <b>two</b> from: <ul style="list-style-type: none"> <li>ball falls faster in <b>A</b> than in <b>B</b></li> <li><b>A</b> has a lower viscosity than <b>B</b></li> <li>increasing the temperature decreases the viscosity / increases the speed of the ball</li> <li>increasing temperature has a greater effect on the viscosity of <b>A</b> than <b>B</b></li> </ul>	allow descriptions of viscosity eg <b>A</b> is thinner  ignore lighter / heavier ignore references to density ignore reference to size of molecules	2
14(b)(ii) E	<b>B</b> has a longer chain than <b>A</b> / <b>B</b> has more carbon atoms than <b>A</b>	allow they have different numbers of carbon atoms / chain lengths / size of molecules	1
<b>Total</b>			<b>5</b>

## SCA1FP

## Question 15

question	answers	extra information	mark
15(a) E	highest <u>proportion</u> / <u>percentage</u> of (input) energy wasted	<b>NB this answer gains 2 marks</b>  allow higher / greater allow ratio  accept for <b>1</b> mark lots of energy wasted <b>or</b> allow for <b>1</b> mark wastes most energy	2
15(b) E	10 % (or 0.1 if % sign crossed out)	efficiency = $\frac{\text{useful energy out}}{\text{total energy in}} (\times 100\%)$  allow <b>1</b> mark for the correct substitution into the correct equation eg $(5/50) \times 100$ <b>or</b> $(1/10) \times 100$  allow <b>1</b> mark if 0.1 is given as the answer, but % sign is still present	2
15(c) E	heats it (the surroundings) <b>or</b> increases the temperature	allow given off as heat  ignore global warming	1
15(d) E	<u>lowest</u> energy input / needed / used	allow input only 2 J	1

Question 15 continues on the next page . . .



## SCA1FP

## Question 15 continued . . .

question	answers	extra information	mark
15(e)(i) E	filament (bulb)	allow <b>1</b> mark for filament bulb being chosen provided a reason is given (reason may be incorrect, but sensible eg cheapest)	1
	lifespan is <u>longest</u> for the purchase cost	accept cost per hour is least / hours per £ is most accept relevant calculation	1
15(e)(ii) E	<u>longest</u> lifespan	allow lasts 25 000 hours do <b>not</b> accept most cost-effective	1
<b>Total</b>			<b>9</b>

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