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General Certificate of Secondary Education
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Science A SCA1HP

(Specification 4406)

Unit 5: Science A1

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 4 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)	A – (cell) membrane B – cytoplasm C – nucleus	allow phonetic spelling	1 1 1
1(b)	any **two** from: • to react / respond (to the surroundings) • avoid dangers / prevent harm to body • to coordinate behaviour / process information	 ignore brain / nervous system reacts ignore adapt allow examples eg to prevent body being burned by hot object ignore send messages	2
Total			**5**

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Question 2

question	answers	extra information	mark
2(a)	speed / how fast chemical reactions in the body take place	allow rate of ignore rate of metabolism ignore rates of individual reactions eg digestion	1
2(b)(i)	falls rapidly at first (then) falls more slowly / levels off	ignore levelled off / stayed the same allow **1** mark for (metabolic rate) decreases (with age) if no other mark gained ignore references to gender	1 1
2(b)(ii)	any **one** from: • put on weight / mass • loss of appetite • less active / have less energy	 ignore consequences of becoming overweight allow eat less ignore less fit / unhealthy	 1
2(b)(iii)	women have a lower / slower metabolic rate than men	allow converse ignore men have better / more metabolic rate ignore reference to rate of change of metabolic rate	1

Question 2 continues on the next page

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Question 2 cont'd

question	answers	extra information	mark
2(c)	any **two** from: • most / more active • inherited factors / genes • more muscle • greater proportion of muscle to fat	ignore references to age, mass and gender allow does a lot of exercise / physical activity allow has a lot of ignore stronger allow has a high proportion do not credit 2 marks for more muscle to fat	2
Total			**7**

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Question 3

question	answers	extra information	mark
3(a)	blast furnace iron is brittle	allow converse responses allow steel is stronger ignore iron is soft / weak(er) / can be bent or moulded ignore steel is tough / hardwearing / hard	1
	(so) limited uses	allow references to uses of steels eg used as a structural material ignore references to rust / corrosion / reactivity	1
3(b)		independent marks but for 2 marks the property has to relate to the type of steel	
	stainless steel	no marks if say low - carbon steel	1
	(because) resistant to corrosion	allow is less reactive allow does not rust / tarnish / react with water or oxygen / air allow hard / won't bend ignore aesthetic answers ignore strong allow high-carbon steel for 1 mark allow high-carbon steel (because) steel is hard / won't bend for 2 marks ignore strong if no steel mentioned allow 1 mark for a correct property	1
Total			**4**

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Question 4

question	answers	extra information	mark
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 5, and apply a 'best-fit' approach to the marking.		6

0 marks	**Level 1 (1-2 marks)**	**Level 2 (3-4 marks)**	**Level 3 (5-6 marks)**
No relevant content.	A brief reason is given against extraction or for recycling. There is little scientific terminology used.	Some reasons are given with clear statements against extraction and or for recycling. Some scientific terminology is used	Several reasons are given with a detailed explanation against extraction and for recycling. Scientific terminology is used accurately

examples of chemistry points made in the response	**extra information**
	ignore uses and properties of aluminium. Comparative statements count for both methods
extraction:	
• limited resources of aluminium oxide	
• higher temperatures required	allow quoted temperatures eg extracted at 950°C
• large amount of energy required	
• expensive	
• requires mining / quarrying	
• process takes longer / has more stages	
• produces more carbon dioxide / greenhouse gases	
recycling:	
• saves resources	
• cheaper to recycle	
• uses less energy	allow quoted temperatures eg melted / recycled at 700°C
• only needs to be melted	
• less electricity needs to be *used*	
• less effect on environment	
• example *of effect on environment*	eg less destruction of habitats
• avoids need for disposal / use of landfill	
• no need for quarrying	
• sustainable	

Total			**6**

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Question 5

question	answers	extra information	mark
5(a)	hydrogen **and** carbon	both elements in either order needed for mark any additional elements negates the mark	1
5(b)	colourless liquid / condensation in U tube (because) water produced limewater goes cloudy (because) carbon dioxide produced	ignore ice melts	1 1 1 1
Total			**5**

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Question 6

question	answers	extra information	mark
6(a)(i)	80(°C)		1
6(a)(ii)	material C	second marking point scores only if correct material named	1
	temperature increase is slowest / heats up over a longer time period **or** the temperature (after 10 minutes) was the lowest / coolest	allow lower / cooler accept smaller temperature change / rise ignore keeps most heat in if figures quoted need to compare all 3 temperatures	1
6(a)(iii)	material A	second marking point scores only if correct material named	1
	worst insulator / best	allow worse insulator	
	conductor	allow better conductor	
	or		
	the temperature (after 10 minutes) was the highest	allow higher allow lets most / more heat / energy through allow biggest / bigger temperature change allow fastest / faster temperature rise	1

Question 6 continues on the next page

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Question 6 continued

question	answer	extra information	mark
6(b)		all net saving calculations required for 4 marks	
	£4400 (double glazing)		1
	£210 (draught excluders)	allow double glazing not paid for itself (after 10 years)	1
	£1150 (loft insulation)		1
		if no calculation or only 1 calculation of net savings over 10 years, allow **2** marks for 3 calculations; **1** mark for 1 or 2 calculations of savings over 10 years:	
		£600 (double glazing)	
		£300 (draught excluders)	
		£1500 (loft insulation)	
	loft insulation		1
		If no other correct calculations, allow 1 mark for 3 correct payback calculations (83.3 yrs, 3 yrs and 2.3 yrs).	
		2 marks for answer of loft insulation has shortest payback time	
		3 marks for answer of loft insulation justified by correct payback figures	
		If no other calculations allow 1 mark for calculation of savings / cost	
		eg 0.012, 0.33, 0.43 or 1.2%, 33%, 43%	
Total			**9**

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Question 7

question	answers	extra information	mark
7(a)	any **two** from: • white / froth reflects infrared / radiation (back to coffee) • white / froth is a poor emitter of IR • trapped air / froth reduces convection • air /froth is an insulator • froth reduces evaporation	allow energy / heat for IR allow white froth is a poor absorber allow air / froth is a poor conductor	2
7(b)(i)	time at which milk was added	ignore time unqualified allow when milk added	1
7(b)(ii)	4 (minutes) temperature decreased / changed quickly	no marks if time incorrect ignore temperatures	1 1
7(b)(iii)	(cup) A smallest temperature drop / decrease	no marks if cup A not chosen allow smaller allow correct comparative figures allow stayed hottest / hotter allow lost least / less energy / heat ignore cooled slower	1 1
Total			**7**

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Question 8

question	answers	extra information	mark
8	any **four** from: • (misuse) can cause heart / circulatory / breathing problems • causes cancer • it may cause mental illness / depression • it may be addictive • can suffer withdrawal symptoms without it • may lead to use of hard drugs • social / financial problems eg affects relationships / stealing	ignore it's illegal ignore makes you ill/physical problems lung cancer only scores **1** mark allow damages brain (cells) Ignore affects brain allow crave the drug allow wastes / costs a lot of money if no other marks gained allow **1** mark for it may cause health problems (later in life)	4
Total			**4**

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Question 9

question	answers	extra information	mark
9		ignore references to viruses	
	(MRSA is) resistant to / not killed by antibiotics	ignore immune ignore not treated by antibiotics	1
	(as is a) new / different strain / type of bacterium	ignore has mutated ignore new species	1
	(therefore) people are not immune to it	accept can't produce the correct antibodies ignore resistant	1
	(many) patients more susceptible to infection / weaker immune system	ignore references to hygiene	1
Total			**4**

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Question 10

question	answers	extra information	mark
10(a)		allow converse answers	
	Hot(ter) in summer		1
	(so need to) produce more sweat / water	accept (so) evaporation of water / sweat is faster	1
	(to cool down)		
	lower concentration of sodium / ions (in sweat) in summer	allow less sodium / ions in summer	1
	(as) there is more fluid / water / sweat	idea of dilution effect due to increased sweat production ignore references to figures	1
10(b)	1.80 (mg)	allow 1.8, 1.805 or 1.8048 mg allow **1** mark for 0.47 × 8 × 0.48	2
10(c)	**blood:**		
	contains less water / reduced volume	allow (blood) becomes dehydrated allow becomes thicker ignore blood clots ignore concentration of blood	1
	contains less sodium / ions	allow less sugar / nutrients	1
	kidneys:		
	excrete less sodium / ions **or** urine contains less sodium / ions	accept absorb more sodium / ions	1
	excrete less water / urine **or** urine contains less water	accept absorb more water ignore kidneys do not work properly ignore concentration / colour of urine	1
Total			**10**

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Question 11

question	answers	extra information	mark
11(a)(i)	$4Li + O_2 \rightarrow 2Li_2O$	**1** mark for correct symbols and formulae **1** mark for correct balancing of correct equation allow for 1 mark $2Li + O \rightarrow Li_2O$	2
11(a)(ii)	lithium compound / $LiCoO_2$	allow from air / water vapour because the battery / seal / it was damaged	1
11(b)(i)	lithium less dense (than water, so floats) (bubbles / gas because) hydrogen is produced (solution is alkaline because lithium) hydroxide is produced	 allow H_2 capital H and lower case number accept OH^- ions produced allow LiOH	1 1 1
11(b)(ii)	reacts in similar way to lithium because in same group / in group 1 / has one electron in outer shell / is an alkaline metal	accept produces hydrogen and sodium hydroxide allow has similar properties allow a description of reaction eg. sodium moves about allow same number of outer electrons allow for **2** marks: produces hydrogen and sodium hydroxide (because) reacts in a similar way to lithium **or** accept for **1** mark (sodium) is more reactive than lithium accept for **2** marks (sodium) is more reactive than lithium (because) further down group	1 1
Total			**8**

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Question 12

question	answers	extra information	mark
12(a)(i)	global dimming	allow smog	1
12(a)(ii)	incomplete / partial combustion (of hydrocarbon fuels)	allow description eg too little oxygen/ O_2 / air.	1
12(b)(i)	Any **3** from: • limestone is (mainly) calcium carbonate • (calcium / metal) carbonate reacts with acids • carbon dioxide (escapes into the atmosphere) • soluble salt is formed **or** salt washed away	ignore name of acid ignore references to limestone / calcium carbonate dissolving allow correct formula, $CaCO_3$ ignore limestone reacts with acids allow salt dissolves	3
12(b)(ii)	(polycarbonates) contain carbonate (so) could react in a similar way to limestone	allow (windows) made of polycarbonate	1 1
Total			**7**

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Question 13

question	answers	extra information	mark
13(a)	hot air expands **or** particles spread out	 ignore / particles move more **not** (air) particles expand	1
	(so) density of the air decreases	**not** particles become less dense	1
	(so) particles / hot air rises	**not** heat rises	1
	(and) cooler / denser air falls	**not** denser particles /particles contract allow less energetic particles fall if no mark scored allow 1 mark for particles / air moves from hotter / hot area to cooler / cool area	1
13(b)	most appliances waste energy by heating	allow 'heat' for 'heating'	1
	in heaters, heating is a useful energy transfer	 for **1** mark allow: there is no wasted energy for **2** marks allow: there is no wasted energy qualified eg light / sound **or** transfer all energy as heat **or** only produce heat energy	1
Total			**6**

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Question 14

question	answers	extra information	mark
14(a)	radiation	ignore infra red, IR, or heat	1
14(b)(i)	105 000 000	(E = mcθ) accept answers in standard form eg. 1.05 x 10^8 E = 5000 x 4200 x 5 gains **1** mark Unit mark is independent, but must match value given for full marks	2
	J / joules	if no other marks gained 1 mark for any correct unit of energy not lower case j allow Joules allow units in words eg kilojules allow 105 000 kJ or 105 MJ for **3** marks. These figures must have units. allow units written as words Eg. kilojoules not KJ, kj, mJ, Mj	1
14(b)(ii)	6600(s) / 6560(s) / 6563(s) / 6562.5(s)	(E = Pt) allow ecf from (b)(ii) allow answers in minutes and hours provided correct and unit changed on answer line eg. 109/110 minutes or 1.8 hours if correct answer given with incorrect unit, maximum mark of **2** eg 6600 minutes 105 000 000 = 16 000 x t gains 1 mark t = 105 000 000 / 16 000 gains **2** marks t = 105 000 000 / 16 gains **1** mark **or** 6 562 500(s) gains 2 marks	3

Question 14 continues on the next page

14(b)(iii)	energy gained from surroundings / air	allow heat ignore air is warmer or pool is colder	1
Total			**8**

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