SPECIMEN MATERIAL

GCSE
COMBINED SCIENCE: SYNERGY

PAPER 3H

Mark scheme

Specimen 2018

Version 1.0

Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. The final mark scheme will include any amendments made at the standardisation events which all examiners participate in and is the scheme which is 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 that 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.

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 and underlining

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 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	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

Marks should be awarded for each stage of the calculation completed correctly, as students are instructed to show their working.

Full marks can, however, be given for a correct numerical answer, without any working shown.

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 Ignore / Insufficient / Do not allow

Ignore or insufficient are 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 as well, will still mean that the mark is not awarded.

4. Level of response marking instructions

Extended response questions are marked on level of response mark schemes. Level of response mark schemes are broken down into levels, each of which has a descriptor. The descriptor for the level shows the average performance for the level. There are marks in each level.

Before you apply the mark scheme to a student's answer read through the answer and annotate it (as instructed) to show the qualities that are being looked for. You can then apply the mark scheme.

Step 1 Determine a level

Start at the lowest level of the mark scheme and use it as a ladder to see whether the answer meets the descriptor for that level. The descriptor for the level indicates the different qualities that might be seen in the student's answer for that level. If it meets the lowest level then go to the next one and decide if it meets this level, and so on, until you have a match between the level descriptor and the answer. With practice and familiarity you will find that for better answers you will be able to quickly skip through the lower levels of the mark scheme.

When assigning a level you should look at the overall quality of the answer and not look to pick holes in small and specific parts of the answer where the student has not performed quite as well as the rest. If the answer covers different aspects of different levels of the mark scheme you should use a best fit approach for defining the level and then use the variability of the response to help decide the mark within the level, ie if the response is predominantly level 3 with a small amount of level 4 material it would be placed in level 3 but be awarded a mark near the top of the level because of the level 4 content.

Step 2 Determine a mark

Once you have assigned a level you need to decide on the mark. The descriptors on how to allocate marks can help with this. The exemplar materials used during standardisation will help. There will be an answer in the standardising materials which will correspond with each level of the mark scheme. This answer will have been awarded a mark by the Lead Examiner. You can compare the student's answer with the example to determine if it is the same standard, better or worse than the example. You can then use this to allocate a mark for the answer based on the Lead Examiner's mark on the example.

You may well need to read back through the answer as you apply the mark scheme to clarify points and assure yourself that the level and the mark are appropriate.

Indicative content in the mark scheme is provided as a guide for examiners. It is not intended to be exhaustive and you must credit other valid points. Students do not have to cover all of the points mentioned in the Indicative content to reach the highest level of the mark scheme.

You should ignore any irrelevant points made. However, full marks can be awarded only if there are no incorrect statements that contradict a correct response.

An answer which contains nothing of relevance to the question must be awarded no marks.

Question 1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	products below reactants correct energy profile activation energy correctly labelled energy given out correctly labelled		1 1 1 1	AO1/1 AO1/1 AO2/1 AO2/1 4.7.4.4
01.2	31 (%)		1	AO2/1 4.7.4.4
01.3	the products would be above the reactants		1	AO2/1 4.7.4.4
01.4	catalysts increase rate of reaction so products formed in less time **or** catalysts lower activation energy so lowers energy requirements **or** catalysts not used up in the reaction so only an initial outlay needed **or** only a small amount of catalyst needed so small initial cost	**1** mark for each property **1** mark for each explanation explanation must be linked correctly to the property to gain the mark	max. 4	AO1/1 AO2/1 4.7.4.6

Question 1 continues on the next page

Question 1 continued

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5	Protein		1	AO1/1 4.7.4.7
01.6	high temperatures extremes of pH		1 1	AO1/1 4.7.4.7
01.7	lactase acts as the lock, lactose is the key (substrate) lactase has an active site which will only fit lactose molecules so lactase will not work with other molecules		1 1 1	AO1/1 AO1/1 AO2/1 4.7.4.7
Total			**16**	

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	3.3×10^2 m/s		1	AO1/1 4.7.1.1

Question	Answers	Mark	AO / Spec. Ref.
02.2	**Level 2:** A detailed and coherent explanation of the shape of the graph and what it says about the motion of the car between each point is given. Values from the graph are clearly referred in a logical and consistent way.	3–4	AO3/1a
	Level 1: An attempt at an explanation of the motion of the car is given, which may be incomplete or not in a logical sequence. Values from the graph may not be referred to or referred to incorrectly.	1–2	
	No relevant content.	0	
	Indicative content • between **A** and **B** car is moving from origin • the gradient of the line shows it's moving at a constant speed • speed between these points is 250/20 = 12.5 m/s • between **B** and **C** car is stationary/not moving • because between these points the graph is flat • showing that the car's speed is 0 m/s • between **C** and **D** car is moving further from origin • at a constant speed • speed is 250/20 = 12.5 m/s • movement between these points is the same as at **A–B** • because the gradient is the same • between **D** and **E** moves towards origin • at a constant speed • speed is 500/30 = 16.7 m/s • gradient between **D** and **E** shows that car moves faster **or** at a greater speed than between any other points		4.7.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	kinetic energy = 0.5 × mass × $(\text{speed})^2$	allow $E_k = ½ mv^2$	1	AO1/1 4.7.1.9
02.4	$½ \times 1\,650 \times 30^2$ = 742.5 (kJ)	 answer must be in kJ for mark allow 742.5 with no working shown for **2** marks	1 1	 AO2/1 4.7.1.9

Question 2 continues on the next page

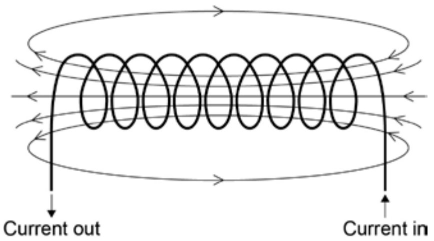
Question 2 continued

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.5	**Level 3:** A detailed and coherent explanation is given of why the man may not be able to stop in time, clearly and logically linking factors that could affect the braking in the situation given		5–6	AO2/1
	Level 2: An explanation is given, with an attempt at linking factors affecting braking distance to the situation given. Links made between factors and explanation may not be complete and the logic may be unclear.		3–4	AO2/1 AO1/1
	Level 1: Simple relevant statements made about factors affecting braking, but no attempt to link to explanations of how they are relevant in the situation given		1–2	AO1/1
	No relevant content.		0	
	Indicative content • overall stopping distance related to thinking distance and braking distance • factors affecting thinking distance: o driver could be distracted o driver could be tired o driver could be on medication that affects thinking (eg make drowsy) o driver could have drunk alcohol o mean that reaction time will be longer so will not brake as quickly • factors that affect braking distance: o condition of car (eg worn brakes means can't stop as quickly, wear on tyres reduces friction with road) o speed car is travelling (faster means more kinetic energy) o condition of the road (eg the road is wet so friction between tyres and road reduced)			4.2.1.6 4.6.1.1 4.7.1.9 4.7.1.10
Total			**14**	

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	acceleration = change in velocity / time taken	allow a = Δv/t	1	AO1/1 4.7.1.4
03.2	$= \frac{(5 - 3)}{6}$ –0.33 (m/s^2)	allow 0.33 m/s^2 with no working shown for **2** marks	1 1	AO2/1 4.7.1.4
03.3	force = mass × acceleration	allow F = m a	1	AO1/1 4.7.1.6
03.4	70 × 0.33 23.1 (N)	allow ecf from 4.3 allow 23.1 with no working shown for **2** marks	1 1	AO2/1 4.7.1.6
03.5	before throwing the bag the momentum of the skater and bag is zero when it is thrown the bag has momentum forwards because momentum before = momentum after the skater has equal backwards momentum so will move backwards		1 1 1 1	AO1/1 4.7.1.8
Total			**10**	

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	Fe_2O_3 + 3 CO → 2Fe + 3 CO_2	correct formulae of reactants correct formulae of products correct balancing	1 1 1	AO2/1 4.8.2.1
04.2	iron loses oxygen – reduction carbon gains oxygen – oxidation		1 1	AO1/1 4.7.5.5
04.3	any **four** from: • resources for manufacture are limited • recycling reduces the use of resources • reduces energy consumption in extraction/manufacture • reduces waste from processing and extraction • reduces environmental impact of extraction		4	AO1/1 4.8.2.1 4.8.2.2 4.8.2.3 4.8.2.9 4.4.1.5
04.4		field lines going through and around coil correct directional arrows	1 1	AO1/1 4.6.3.4

Question 4 continues on the next page

Question 4 continued

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.5	any **two** from: • use many coils **or** tight coils **or** long wire (1) • to give a strong magnetic field for lifting heavy objects (1) **or** • add an iron core • to increase field circuit for lifting **or** • include a switch in circuit • so can drop/pick up cars	**1** mark for suggestion, **1** mark for correctly linked explanation explanation must be correctly linked to the suggestion to gain the mark	max. 4	AO1/1 4.6.3.4
Total			**15**	

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	did not appear because they had not been discovered **or** they are unreactive **or** they did not form compounds		1	AO1/1 4.5.1.1
05.2	arranged in order of atomic/proton number elements in the same group have the same number of electrons in the outer shell		1 1	AO1/1 4.5.1.1
05.3	chlorine>bromine>iodine table shows that chlorine displaces bromine and iodine and bromine displaces iodine		 1 1	 AO3/1b 4.5.1.5
05.4	$Cl_2(aq) + 2\ Br^-(aq) \rightarrow$ $Br_2(aq) + 2\ Cl^-(aq)$	correct formulae correct balancing correct state symbol	1 1 1	AO1/1 AO2/1 AO1/1 4.5.1.5, 4.5.2.1
05.5	the further down the group, the halogen becomes less reactive because outer electrons are further from the nucleus so less attractive force on an incoming electron		1 1	AO1/1 4.5.1.5
Total			**10**	

Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	1 950/2 500 x 100		1	AO2/1 4.8.2.2
	78 (%)		1	
06.2	expected mass of aluminium			AO2/1 4.5.2.3
	1950 × 54/102		1	
	= 1032.35		1	
	mass not collected			
	1032.35 – 1 000			
	=32.4	allow 32.4 with no working shown for **3** marks	1	
		incorrect number of sig. figs max **2** marks		
06.3	because oxygen is formed at the anode		1	AO1/2 4.8.2.2
	which reacts with the carbon anode to produce carbon dioxide		1	
	and wears it away		1	
06.4	power = $1.5 \times 10^5 \times 4$		1	AO2/1 4.7.2.7
	= 6.0×10^5 W		1	AO2/1 4.7.2.7
	24 hours = $24 \times 60 \times 60 = 8.64 \times 10^4$ seconds		1	AO2/1 4.7.2.8
	energy transferred = $6.0 \times 10^5 \times 8.64 \times 10^4$	allow ecf from power calculation	1	AO2/1 4.7.2.8
	= 5.184×10^{10}	allow 5.184×10^{10} with no working for **5** marks	1	AO2/1 4.7.2.8

Question 6 continues on the next page

Question 6 continued

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.5	3 moles of electrons are needed to produce 27 g or 0.027 kg aluminium		1	AO2/1 4.5.2.5
	so moles of electrons to produce 1 000 kg = 1 000/0.027 x 3		1	
	= 111 000	allow 111 000 with no working shown for **3** marks incorrect no. of sig. figs max **2** marks	1	
Total			**16**	

Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	*x* axis scale correct		1	AO2/2
	y axis scale correct		1	4.7.3.2
	all points plotted correctly	± ½ small square	1	
	curve correct, omitting the anomalous point		1	
07.2	relative formula mass of NH_4NO_3 = 14 + (4 × 1) + 14 + (3 × 16) = 80		1	AO2/2 4.5.2.4 4.5.2.6 4.7.3.2
	mass of ammonium nitrate in 1 dm^3 at 20 ^oC = 190 × 10 = 1 900 g		1	
	number of moles of ammonium nitrate in 1 900 g = 1 900/80 = 23.75 mol		1	
07.3	small beads would dissolve slower than fine powder		1	AO3/1b 4.7.3.2 4.7.4.2
	because the surface area of the bead is less than fine powder		1	
07.4	increasing the temperature at equilibrium will reduce the amount of ammonia produced		1	AO2/1
	because the reaction is exothermic		1	AO1/1
	increasing the pressure at equilibrium will increase the amount of ammonia produced		1	AO2/1
	because the equilibrium will shift towards the smaller number of molecules in the equation (which is ammonia)		1	AO1/1 4.7.4.10
Total			**13**	

Question 8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08	**Level 3:** A detailed and coherent explanation applying knowledge of the properties of nanotubes, with clear and logical links to reasons why carbon nanotubes have these properties		5–6	AO2/1
	Level 2: Description contains relevant statements that demonstrate clear knowledge of the properties of nanotubes. Attempt made to link properties to explanation of why these properties occur, but logic may be unclear		3–4	AO1/1
	Level 1: Simple relevant statements of the properties of nanotubes, demonstrating knowledge, but no linking to an explanation of why these properties occur.		1–2	AO1/1
	No relevant content.		0	
	Indicative content properties: • high tensile strength • high electrical/thermal conductivity • high melting point explanations: • nanotubes are fullerenes based on hexagonal rings of carbon atoms • which means that each carbon forms three covalent bonds with three other carbon atoms • covalent bonds are strong **or** need a lot of energy to break them • so nanotubes are strong/have high tensile strength • and have a high melting point • the structure means that one electron from each carbon atom is delocalised • as in metals and graphite, the delocalised electrons can move throughout the structure • allowing the carbon nanotube/fullerene to conduct thermal energy and electricity			4.8.1.1 4.6.2.4 4.6.2.7
Total			**6**	

aqa.org.uk

Copyright © 2016 AQA and its licensors. All rights reserved.
AQA Education (AQA) is a registered charity (registered charity number 1073334) and a company limited by guarantee registered in England and Wales (company number 3644723). Registered address: AQA, Devas Street, Manchester M15 6EX

21 April 2016