SPECIMEN MATERIAL

GCSE
COMBINED SCIENCE: TRILOGY

PAPER 4: CHEMISTRY 2H

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. 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 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 <u>not</u> 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.

Level of response marking instructions

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.
1.1	Safe to drink		1	AO1/1 5.10.1.2
1.2	To remove undissolved solids		1	AO1/1 5.10.1.2
1.3	the gas is chlorine / Cl_2 which sterilises water		1 1	AO1/2 AO1/1 5.8.2.4 5.10.1.2
1.4	as distance between steel increases strength of concrete decreases change above and change below 1.0 cm separation is compared and described	 must refer to graph values for this mark	1 1	AO2/1 5.10.1.2
Total			**6**	

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
2.1	4 (C_2H_4)		1	AO2/1 5.7.1.4
2.2	cracking involves a catalyst distillation does not **or** distillation does not involve a chemical change but cracking does		1 1	AO1/1 5.7.1.1 5.7.1.2
2.3	Decomposition		1	AO1/1 5.7.1.4

Question 2 continues on the next page

Question 2 continued

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.4	**Level 3:** A logically structured evaluation with links involving several comparisons. Nearly all points made are relevant and correct.		5–6	AO3/1b 5.10.1.1 5.10.2.1
	Level 2:.Some valid comparisons made between the two types of bag. There may be some incorrect or irrelevant points.		3–4	
	Level 1: A vague response with few correct and relevant points and with no direct comparisons.		1–2	
	No relevant content		0	
	Indicative content Accept converse in terms of plastic bags for all statements • Paper bags are made from a renewable resource • Plastic bags are made from a finite resource • Paper bags require more energy to manufacture • Paper bags produce more waste • Paper bags are biodegradable • Paper bags create more CO_2 • CO_2 created by paper bags offset by photosynthesis in growing wood • Paper bag requires much more fresh water • Paper bags cannot be recycled • Agree because non-renewability less important than other factors **or** disagree because of converse **or** can't say because data inconclusive/incomplete			
Total			**10**	

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	**Level 3:**A coherent method is described with relevant detail, which demonstrates a broad understanding of the relevant scientific techniques and procedures. The steps in the method are logically ordered with the dependent and control variables correctly identified. The method would lead to the production of valid results.		5–6	AO1/2 5.6.1.2
	Level 2:. The bulk of a method is described with mostly relevant detail, which demonstrates a reasonable understanding of the relevant scientific techniques and procedures. The method may not be in a completely logical sequence and may be missing some detail.		3–4	
	Level 1: Simple statements are made which demonstrate some understanding of some of the relevant scientific techniques and procedures. The response may lack a logical structure and would not lead to the production of valid results.		1–2	
	No relevant content		0	
	Indicative content • remove bung and add magnesium • start stopclock / timer • measure volume of gas at fixed time intervals • repeat with different concentrations of acid • control volume of acid • control initial temperature of acid • control amount/mass/length/particle size of magnesium			

Question 3 continues on the next page

Question 3 continued

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	6.5 cm^3		1	AO2/2 5.6.1.2
03.3	all points plotted correctly best fit straight line drawn	allow **1** mark for 4 points plotted correctly	2 1	AO2/2 5.6.1.2
03.4	when the concentration of acid increased the rate of reaction increased or vice versa	answer must use the terms 'rate of reaction' linked to 'concentration'	1	AO3/2b 5.6.1.2
3.5	tangent drawn correctly at 20s correct *x* and *y* values eg, 8 and 3 (3/8 =) 0.375 cm^3/s	 allow ecf from step 1 and/or step 2 accept 0.375 with no working shown for these **3** calculation marks	1 1 1 1	AO2/2 5.6.1.1
3.6	concentration of acid decreases so decrease in number of particles so collisions are less frequent	allow surface area of magnesium decreases so number of particles exposed less	1 1	AO2/1 5.6.1.3
Total			**17**	

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
4.1	(medicine is) a mixture **and** (designed as) a useful product		1	AO1/1 5.8.1.2
4.2	sugar / flavouring to make it taste better **or** colouring to make it look more attractive		1 1	AO2/1 5.8.1.2
4.3	$C_8H_9NO_2$ 151	any order of elements	1 1	AO2/1 5.2.1.4 5.3.1.2
4.4	mass of acetylsalicylic acid = 0.3 g = $\frac{0.3}{180}$ (mol) = 0.00167 (mol) 1.67×10^{-3} (mol)	 method mark – divide mass by M_r allow 0.0016666(66) correct answer with or without working scores **4** marks allow ecf from steps1, 2 and 3	1 1 1 1	AO2/1 5.2.1.4 5.3.1.3
Total			**9**	

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
5.1	mobile phase / solvent moves through paper		1	AO1/2 5.8.1.3
	and carries substances different distances		1	
	which depend on their attraction for paper and solvent	allow which depend on solubility in solvent and attraction to paper	1	
5.2	**Level 2:** A relevant and coherent description which provides a clear analysis of the chromatogram. The response makes logical links between the points raised and uses sufficient examples to support these links.		3–4	AO3/2a 5.8.1.3
	Level 1: Simple statements are made which demonstrate a basic attempt to analyse the chromatogram. The response may fail to make logical links between the points raised.		1–2	
	No relevant content		0	
	Indicative content • black ink is a mixture • because more than one spot • contains blue, red and yellow • because R_f values / positions match • does not contain green • contains an unknown • which is insoluble • yellow is most soluble or has highest Rf value, blue is least			

Question 5 continues on the next page

Question 5 continued

Question	Answers	Extra information	Mark	AO / Spec. Ref.
5.3	both measurements from artwork for **1** mark (1.3 ± 0.1 cm and 5.3 ± 0.1 cm) correct equation used for **1** mark 0.25 ± 0.02	accept 0.25 ± 0.02 without working shown for **3** marks allow ecf from incorrect measurement to final answer for **2** marks	1 1 1	AO1/1 AO2/1 AO2/1 5.8.1.3
Total			**10**	

Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
6.1	sediment / limestone formation from carbonates		1	AO1/1 5.9.1.2, 4
6.2	short wavelength radiation passes through atmosphere to Earth's surface Earth's surface radiates different wavelengths which are absorbed by greenhouse gases to produce temperature increase	 allow CH_4 H_2O or CO_2	1 1 1 1	AO1/1 5.9.2.1
06.3	13.8 %	allow values in the range 13.0 to 15.0	1	AO2/1 5.9.2.1
6.4	15.08 (^{o}C)	allow values in the range 15.05 – 15.10	1	AO2/1 5.9.2.1
6.5	correlation between CO_2 levels and temperature despite short-term variations of temperature supported by values from graph which show correlation cannot determine causality from this data or possible causality as increasing use of fossil fuels since 1900 has caused accelerated temperature increase		1 1 1 1	AO2/1 AO3/2b AO2/1 AO3/2b 5.9.2.2
Total			**11**	

Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
7.1	small molecules with weak intermolecular forces (so) only a small amount of energy is needed to separate the molecules	any reference to bonds being weak or being broken negates the second and third mark unless they are stated to be intermolecular bonds or bonds between molecules	1 1 1	AO1/1 AO1/1 AO2/1 5.2.2.4
7.2	decreases because the equilibrium shifts in the endothermic direction	allow reverse reaction favoured if forward reaction is exothermic	1 1	AO2/1 AO1/1 5.6.2.4, 6
7.3	increases because there are more molecules of gas on the left-hand side	or converse	1 1	AO2/1 AO1/1 5.6.2.4, 7
Total			**7**	