SPECIMEN MATERIAL

GCSE
COMBINED SCIENCE: TRILOGY

PAPER 3: CHEMISTRY 1H

Mark scheme

Specimen 2018

Version 1.1

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.
01.1	A base		1	AO1/1 5.4.2.2
01.2	forces		1	AO1/1 5.2.1.3 5.2.2.3
01.3	calcium loses electrons and oxygen gains electrons two electrons are transferred calcium has a 2^+ charge oxide has a 2^- charge	max 3 for incorrect reference to atom/ion or to oxygen / oxide	1 1 1 1	AO1/1 AO2/1 AO2/1 AO2/1 5.1.1.7 5.2.1.2
Total			**6**	

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	408 kg		1	AO2/1 5.3.1.1
02.2	all points correct	± ½ small square allow **1** mark if 5 points correct	2	AO2/2 5.3.2.5
	best fit line		1	
02.3	$\frac{1989 \times 100}{36}$		1	AO2/1 5.3.25
	5525 dm^3		1	
02.4	relative formula mass of $TiCl_4$ is 190		1	AO2/1 5.3.1.2
	25.26 %		1	
	answer given to 3 significant figures = 25.3 %	25.23% with or without working gains **3** marks	1	
02.5	argon is unreactive		1	AO3/2a
	water (vapour) would react with sodium	allow water (vapour) would react with titanium(IV) chloride	1	5.1.2.4, 5 5.4.1.1
	and air contains oxygen that would react with reactants	allow and air contains oxygen that would react with products	1	

Question 2 continues on the next page

Question 2 continued

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.6	(titanium conducts electricity) because electrons in the outer shell of the metal atoms are delocalised		1	AO1/1 5.2.1.5 5.2.2.8
	and so electrons are free to move	allow the delocalised electrons in the metal carry electrical charge through the metal	1	
	through the whole structure		1	
Total			**15**	

Question 3

Question	Answers	Extra information	Mark	AO / Spec.Ref.
03.1	1 × 10^{-10} m		1	AO1/1 5.1.1.5
03.2	1 / one	allow alkali metals	1	AO3/1a 5.1.1.5, 5.1.2.1, 5.1.2.5
03.3	R and S because they have the same number of protons and a different numbers of neutrons	allow same atomic number, different mass number	1 1 1	AO3/2a AO2/1 AO2/1 5.1.1.5
03.4	**Level 3:** A relevant and coherent explanation of the trend in reactivity. The response makes logical links between the points raised and considers both the number of energy levels and the distance between the nucleus and the outer energy level.		5–6	AO2/1 × 2 AO1/1 × 2 AO1/1 × 2 5.1.2.3 5.1.2.6
	Level 2: Statements that are linked to provide a simple explanation of the trend in reactivity using either the number of energy levels or the distance between the nucleus and the outer energy level.		3–4	
	Level 1: Simple statements made about the halogens or the trend in reactivity.		1–2	
	No relevant comment		0	

Question 3 continues on the next page

Question 3 continued

Question	Answers	Extra information	Mark	AO / Spec. Ref.
	Indicative content Simple statements/descriptions • have 7 electrons in the outer shell • need to gain an electron • form ions with a -1 charge • halogens further down the group are less reactive (or vice versa) • halogens further down the group have more shells or energy levels (or vice versa) Linked statements/explanations • have 7 electrons in the outer shell so need to gain an electron to have the electronic structure of a noble gas • halogens further down the group are less reactive because they have more shells or energy levels (or vice versa) • halogens further down the group have more shells or energy levels so less attractive force on the incoming electron (or vice versa) • halogens further down the group have more shells or energy levels so more 'shielding' against the incoming electron (or vice versa) • outer electrons of halogens further down group are further away from the attractive force of the nucleus (or vice versa) • an electron is less easily gained because there are more shells or energy levels (or vice versa) • an electron is less easily gained because the outer electrons are further from the attractive force of the nucleus (or vice versa)			
Total			**11**	

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	electrodes connected to d.c. power supply by wires electrodes labelled anode (+) and cathode (–)	for this diagram ignore the material used for the electrodes as long as they are made from carbon or metals that are inert	1 1	AO1/2 5.4.3.1, 4
04.2	copper ions cause the blue colour copper ions are reduced/converted to copper ions so the concentration of copper ions decreased	answer must be in terms on copper ions if no other mark awarded allow **1** mark for copper ions are used up during electrolysis	1 1 1	AO1/1 AO2/1 AO2/1 5.4.3.1, 4 5.10.1.4
04.3	copper ions are positive so are attracted to the inert cathode **or** inert negative electrode copper ions gain electrons at the inert cathode **or** inert negative electrode so they are reduced to form copper atoms		1 1 1 1	AO1/1 AO2/1 AO1/1 AO2/1 5.4.3.1, 4

Question 4 continues on the next page

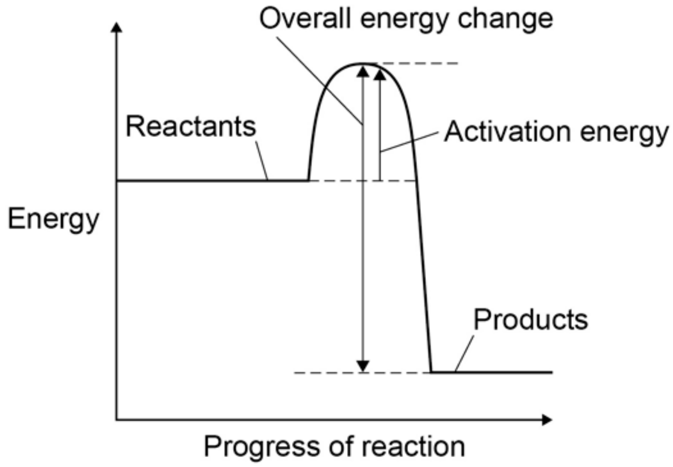
Question 4 continued

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	50 cm^3 contains 4 g $CuSO_4$ M_r $CuSO_4$ = 159.5 4 g $CuSO_4$ reacts with $\frac{4}{159.5} \times$ 56 g Fe = 1.40(43877) = 1.4 (g)	accept 1.4(g) with no working shown for **4** marks allow 1.40(43887) without working shown for **3** marks	1 1 1 1	AO2/1 5.3.2.1, 2, 3, 5
Total			**13**	

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	bonded pair of electrons and 6 non-bonded electrons on chlorine		1	AO1/1 5.2.1.4
05.2	**Level 3:** A detailed and coherent explanation of comparative results of a reaction in terms of concentration and ionisation. The response makes logical links between the points raised and uses sufficient examples to support these links.		5–6	AO3/2b x 2 AO2/2 x 2 AO1/1 x 2 5.4.2.1,2, 4, 5
	Level 2: A description of a reaction with results is given but may miss some details. Links are made but may not be fully articulated and/or precise.		3–4	
	Level 1: Simple statements are made. The response may fail to make logical links between the points raised.		1–2	
	No relevant content		0	
	Indicative content Simple statements/descriptions of a reaction • correct comparative pH, such as, 0–3 (strong) 4–6 (weak) • named reaction, such as, with a reactive metal or a named carbonate • comparative results or observations of the named reaction, such as, faster reaction (strong) or greater volume of gas produced in a given time (strong) Explanations of different results • weak acids are only partially ionised in aqueous solution • strong acids are completely ionised in aqueous solution/ greater concentration of H^+ ions • aqueous solutions of acids at the same concentration/ same state of division of metal / powder, same temperature			
Total			**7**	

Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	the relative energies of the reactants, products and the overall energy change the activation energy 		1 1	AO1/1 5.5.1.2
06.2	(4 × 413) + (2 × 498) = 2 648 (2 × 805) + (4 × 464) = 3 466 (3466 – 2648 =) 818 (kJ/mol)	allow max **2** marks for one ecf	1 1 1	AO2/1 5.5.1.3
06.3	**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 5.4.1.2 5.4.2.15.5.1.1
	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	

Question 6 continues on the next page

Question 6 continued

Question	Answers	Extra information	Mark	AO / Spec. Ref.
	Indicative content Named apparatus • thermometer • measuring cylinder • stirring rod • spatula • plastic cup (with lid) or beaker • stopwatch • filter paper or watch glass • balance Method • weigh the same mass of each metal in each same state of division eg powder • measure a set volume of sulfuric acid into a plastic cup or beaker • measure and record the temperature of the sulfuric acid • add metal W into the plastic cup or beaker • stir and record the highest temperature or record the temperature after a set time • calculate the increase in temperature • repeat the method for metals X, Y and Z • repeat for each metal at least three times to calculate a mean Safe use • comment on safe use should include wearing safety glasses			

Question 6 continues on the next page

Question 6 continued

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.4	**W**>**Y**>**X**>**Z**		1	AO3/2a 5.4.1.2
	reason for position of **W** and **Z**	**W** reacts with most solutions whereas **Z** reacts with none of the solutions	1	
	reason for position of **X** and **Y**	**Y** is more reactive than **X** because **Y** reacts more with sulfuric acid	1	
06.5	magnesium is most reactive because not displaced by any metal		1	AO3/2b 5.4.1.2 5.4.2.1
	zinc is second most reactive because displaced by only one metal		1	
	copper and hydrogen cannot be placed in order of reactivity or are least reactive because		1	
	they both are displaced by the most/three metals		1	
	experiment – add sulfuric acid to copper because copper is less reactive than hydrogen then copper would not react with sulfuric acid to displace hydrogen		1	
Total			**18**	

30 June 2016