GCSE
COMBINED SCIENCE: TRILOGY
8464/C/2H

Chemistry Paper 2H

Mark scheme

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Version: 1.0 Final Mark Scheme

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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 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

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
- the Assessment Objectives, level of demand 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 ecf 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 Allow

In the mark scheme additional information, 'allow' is used to indicate creditworthy alternative answers.

3.9 Ignore

Ignore is 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.

3.10 Do <u>not</u> accept

Do **not** accept 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 two 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.

When assigning a level you should look at the overall quality of the answer. Do **not** look to penalise 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.

Use the variability of the response to help decide the mark within the level, ie if the response is predominantly level 2 with a small amount of level 3 material it would be placed in level 2 but be awarded a mark near the top of the level because of the level 3 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.

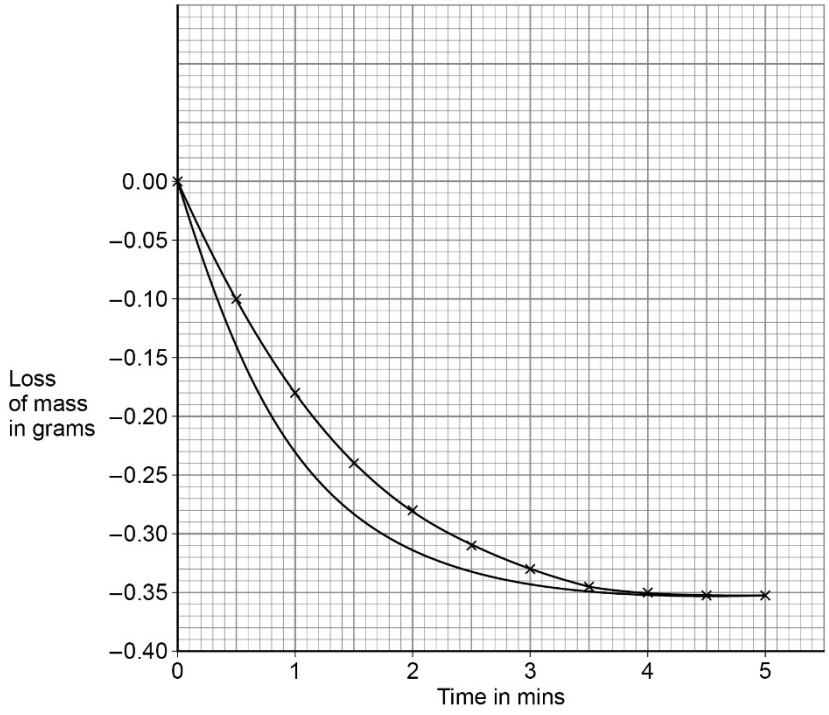
You should ignore any irrelevant points made. However, full marks can be awarded only if there are no incorrect statements that contradict a correct response.

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

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	$C_3H_8 + 5\ O_2 \rightarrow 3\ CO_2 + 4\ H_2O$	allow multiples	1	AO2 5.1.1.1 5.7.1.3
01.2		MP2 is dependent upon correct response in MP1		AO1.2 5.8.2.3
	(bubble gas through) lime water	allow (bubble gas through) calcium hydroxide (solution)	1	
	turns milky / cloudy / white **or** white precipitate forms		1	
01.3	C_3H_6		1	AO2 5.1.1.1 5.7.1.4
01.4		MP2 is dependent upon correct response in MP1		AO1 5.8.2.1
	burning / lit splint	allow flame do **not** accept glowing splint	1	
	burns with a (squeaky) pop sound	allow pops	1	
01.5	bromine (water)	do **not** accept bromide	1	AO1 5.7.1.4
	(colour change) orange	allow 1 mark for colourless (to) orange	1	
	(to) colourless		1	
		ignore clear		
Total			**9**	

Question	Answers	Mark	AO / Spec. Ref.
02.1	**Level 3:** The method would lead to the production of a valid outcome. All key steps are identified and logically sequenced.	5–6	AO3 5.6.1.2
	Level 2: The method would not necessarily lead to a valid outcome. Most steps are identified, but the plan is not fully logically sequenced.	3–4	
	Level 1: The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.	1–2	
	No relevant content	0	
	Indicative content: • use a measuring cylinder / pipette / burette to measure 50 cm^3 of sodium thiosulfate • use a different measuring cylinder / pipette / burette to measure 10 cm^3 of hydrochloric acid • start the timer when the acid is added • record the temperature of the solution after the acid is added • stop the timer when the cross is no longer visible • record the temperature of the solution at the end of the reaction • calculate the mean temperature of the reaction • repeat the experiment at different temperatures • use the same concentration of sodium thiosulfate and same concentration of hydrochloric acid • use the same volume of sodium thiosulfate and the same volume of hydrochloric acid • describe how to heat the thiosulfate / acid solutions		

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.2		ignore signs		AO2 5.6.1.1 5.6.1.4
	(change in mass of gas =) 0.15 **and** (time =) 2		1	
	(rate of reaction =) $\frac{0.15}{2}$	allow correct use of incorrectly determined values for mass and / or time	1	
	0.075 (g/min)		1	

02.3	curve starts at same point, to the left and steeper line levels at –0.35 g the curve below can be awarded 2 marks  	1 1	AO2 5.6.1.1 5.6.1.2 5.6.1.4

Total			**11**

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	microbes chemicals	allow bacteria / pathogens	1 1	AO1 5.10.1.3
03.2	anaerobic digestion		1	AO1 5.10.1.3
03.3	(decrease =) 6.7 (billion) (% decrease =) $\frac{6.7}{8.0}$ × 100 = 84 (%) **alternative approach:** (% now used =) $\frac{1.3}{8.0}$ × 100 (1) = 16.25 (1) (% decrease =) 84 (%) (1)	 allow correct use of an incorrect value for decrease in plastic bag use allow 83.75 / 83.8 (%) allow 83.75 / 83.8 (%)	 1 1 1	AO2 5.10.2.2

03.4	respiratory problems **or** acid rain	allow named respiratory conditions eg asthma allow breathing problems allow consequences of acid rain eg kills aquatic life **or** damages limestone buildings allow smog	1	AO1 5.9.3.2

03.5	(increased) more traffic (decreased) improved efficiency of car engines	allow more cars allow use of catalytic converters allow more electric / hybrid cars allow lower temperature of car engines allow more use of public transport allow more people walk / cycle ignore better designed engines	1 1	AO3 5.9.3.1

Total			**9**

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	dependent		1	AO1 5.10.1.2
04.2	not all water had been removed from the sample	allow description of process	1	AO3 5.10.1.2
	heat to constant mass		1	
	alternative approach:			
	mass included (droplets of) water on the bottom of the evaporating basin (1)	allow bottom of evaporating basin was wet ignore spillages ignore weighing errors		
	dry the bottom of the evaporating basin (1)	allow wipe off droplets		
04.3	$\frac{0.22 + 0.23 + 0.20 + \mathbf{X}}{4} = 0.21$		1	AO2 5.10.1.2
	(**X** =) 0.19 (g)		1	
04.4		allow ecf from question **04.3**		AO2 5.10.1.2
	C		1	
	biggest difference between the maximum and minimum values	allow calculated range if all ranges are shown **A** 0.04; **B** 0.06; **C** 0.15 and **D** 0.12	1	

04.5	(conversion m^3 to cm^3) 1 m^3 = 1 x 10^6 cm^3		1	AO2 5.3.2.5 5.10.1.2
	(mass =) $1 \times 10^6 \times \frac{0.016}{25}$	allow correct use of an incorrect / no conversion value	1	
	= 640 (g)		1	
	= 6.4×10^2 (g)	allow a correctly calculated answer in standard form from an incorrect calculation of mass	1	

Total			**11**

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	plankton	allow biomass allow (marine) animals / organisms ignore plants	1	AO1 5.7.1.1
	buried in mud	allow compressed under mud allow compressed in sedimentary rock ignore fossilised	1	
	over a long period of time **or** over millions of years		1	
05.2	crude oil heated		1	AO1 5.7.1.2
	(hydrocarbons / liquids) evaporate	allow (hydrocarbons / liquids) vaporise / boil	1	
	vapours / gases condense		1	
	fractions have different boiling points **or** fractions collect at different levels depending upon boiling point		1	
05.3	C_nH_{2n+2}		1	AO1 5.7.1.1

05.4		max **2** marks for incorrect reference to particles **/** bonds allow converse		
	the boiling point increases as the number of (carbon) atoms increases		1	AO1
	(because the weak) intermolecular forces increase **or** (because the weak) forces between the molecules increase		1	AO2 AO3
	(and these intermolecular forces increase) as the size of the molecules increases		1	5.2.2.4 5.7.1.3

05.5		MP2 dependent on correct response in MP1		AO3
	(as number of carbon atoms increase) the time increases		1	5.7.1.3
	(because) the viscosity increases		1	

Total			**13**

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	**D B C A**		1	AO1 5.9.2.1
06.2	(maximum % =) 96 (%) (maximum mass =) $\frac{96}{100} \times 5.15 \times 10^{18}$ $= 4.94 \times 10^{18}$ (kg)	allow a value in the range 95 to 97 (%) allow correct use of incorrectly determined percentage allow 4.944×10^{18} (kg)	1 1 1	AO2 5.9.1.1 5.9.1.2 5.9.1.4 5.9.2.2

Question	Answers	Mark	AO / Spec. Ref.
06.3	**Level 2:** Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account.	4–6	AO1 5.9.1.1 5.9.1.2 5.9.1.3 5.9.1.4 5.9.2.2
	Level 1: Facts, events or processes are identified and simply stated but their relevance is not clear.	1–3	
	No relevant content	0	
	Indicative content: during the first billion years of the Earth's existence carbon dioxide levels increased due to • intense volcanic activity from 4.4 to 2.7 billion years ago carbon dioxide levels decreased as • water vapour condensed to form oceans • carbon dioxide dissolved in the oceans • carbonates precipitated • sedimentary rocks formed from 2.7 to 1.7 billion years ago carbon dioxide levels decreased as • algae appeared • plants evolved • algae and plants photosynthesised • sedimentary rocks formed • fossil fuels formed over the past 100-200 years carbon dioxide levels increased due to • the industrial revolution • human activity • the burning of fossil fuels		

Total			10

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	when a reversible reaction occurs in apparatus which prevents the escape of reactants and products	allow when a reversible reaction occurs in a sealed system	1	AO1 5.6.2.3
	(equilibrium is reached) when the forward and reverse reactions occur at (exactly) the same rate		1	
07.2	(as pressure increases) the equilibrium position shifts to the right hand side	allow (as pressure increases) the percentage of product / dinitrogen tetroxide / N_2O_4 increases	1	AO2 5.6.2.4, 5.6.2.6 5.6.2.7
	(because) there are less moles / molecules (of dinitrogen tetroxide) on right hand side	allow (because) there are more moles / molecules (of nitrogen dioxide) on left hand side	1	
07.3	(as temperature increases) equilibrium position shifts to left hand side		1	AO2
	(because the forward) reaction is exothermic **or** (because) the backward reaction is endothermic		1	AO2
	(so) the percentage of product / dinitrogen tetroxide / N_2O_4 decreases		1	AO3 5.6.2.4 5.6.2.6 5.6.2.7
Total			**7**	