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**GCSE**  
**COMBINED SCIENCE: TRILOGY**  
**8464/C/2F**

Chemistry Paper 2F

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**Mark scheme**

June 2021

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Version: 1.0 Final Mark Scheme



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](http://aqa.org.uk)

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## 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 **not** 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	(the symbol) $\rightleftharpoons$	allow description of reversible sign	1	AO1 5.6.2.1
01.2	white  blue	must be in this order	1  1	AO1 5.6.2.2
01.3	to prevent reaction with water vapour (in the air)	allow to prevent reaction with moisture allow to keep water out	1	AO3 5.6.2.2
01.4	<p style="text-align: center;"><b>Substance</b></p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="border: 1px solid black; padding: 5px; width: 150px; text-align: center;">Sodium chloride solution</div> <div style="border: 1px solid black; padding: 5px; width: 150px; text-align: center;">Water</div> </div> <div style="display: flex; justify-content: center; align-items: center; margin: 10px 0;"> <div style="border: 1px solid black; padding: 5px; width: 100px; text-align: center;">Compound</div> <div style="border: 1px solid black; padding: 5px; width: 100px; text-align: center;">Element</div> <div style="border: 1px solid black; padding: 5px; width: 100px; text-align: center;">Hydrocarbon</div> <div style="border: 1px solid black; padding: 5px; width: 100px; text-align: center;">Mixture</div> </div> <p style="text-align: center;">do <b>not</b> accept more than one line from a box on the left</p>	<p><b>Description of substance</b></p>	1  1	AO2 5.1.1.2
01.5	evaporation <b>or</b> crystallisation		1	AO1 RPA 13
01.6	(filtering) to remove solids  (sterilising) to kill bacteria	allow to kill microbes	1  1	AO1 5.10.1.2

<b>01.7</b>	ground water		1	AO1 5.10.1.3
<b>01.8</b>	screening and removal of grit		1	AO1 5.10.1.3
<b>Total</b>			<b>11</b>	



Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	bar drawn to 54 (%)	allow a tolerance of $\pm \frac{1}{2}$ a small square	1	AO2 5.9.3.1
02.2	city centre		1	AO3 5.3.1.4 5.9.3.1
02.3	less traffic	allow fewer lorries / cars	1	AO3 5.9.3.1
	(because) fewer people working	allow (because) no school allow (because) businesses / factories closed	1	
02.4	(mean =) $\frac{35 + 37 + 37 + 34 + 37}{5}$ = 36 (arbitrary units)		1	AO2 5.9.3.1
			1	
02.5	catalysts are <b>not</b> used up in a reaction  catalysts lower the activation energy of a reaction		1	AO1 5.6.1.4
			1	
02.6	finite resource		1	AO2 5.8.1.2 5.10.1.1
02.7	limewater		1	AO1 5.8.2.3
<b>Total</b>			<b>10</b>	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	any <b>two</b> from: <ul style="list-style-type: none"> <li>• global warming</li> <li>• melting polar ice caps</li> <li>• rising sea levels</li> <li>• flooding</li> <li>• crop failure</li> </ul> <b>or</b> famine <ul style="list-style-type: none"> <li>• extremes of weather</li> <li>• loss of habitats</li> </ul>	do <b>not</b> accept acid rain do <b>not</b> accept global dimming do <b>not</b> accept references to ozone  ignore temperature rise	2	AO1 5.9.2.3
03.2	constant  (then) increases	allow no change allow stays same  ignore values if given	1  1	AO2 5.9.2.2
03.3	(1950) 0.030 <b>and</b> (2000) 0.036  (0.036 – 0.030) = 0.006 (%)	allow correct use of incorrectly determined percentage reading(s)  ignore + or –	1  1	AO2 5.9.2.2
03.4	any <b>one</b> from: <ul style="list-style-type: none"> <li>• combustion of fuel</li> <li>• deforestation</li> <li>• population increase</li> </ul>	allow any named activity which burns fuel	1	AO1 5.9.2.2

<b>03.5</b>	extrapolation on graph		1	AO3 5.9.2.2
	determine value from extrapolation at 2050	allow a value in the range 0.044 to 0.050  allow a tolerance of $\pm \frac{1}{2}$ a small square	1	
<b>Total</b>			<b>9</b>	

Question		Extra information	Mark	AO / Spec. Ref.
04.1	any <b>one</b> from: <ul style="list-style-type: none"> <li>occurred (4.6) billion years ago</li> <li>limited evidence</li> </ul>	ignore nobody was there ignore no proof	1	AO1 5.9.1.2
04.2	oceans		1	AO1 5.9.1.2
04.3	<p><b>Gas</b></p> <p><b>What produced the gas</b></p> <p>do <b>not</b> accept more than one line from a box on the left</p>		1  1	AO1 5.9.1.2 5.9.1.3
04.4	the atmosphere of Mars does not contain enough oxygen		1	AO3 5.9.1.3
04.5	argon	allow Ar	1	AO2 5.9.1.1

<b>04.6</b>	$\frac{78}{21}$		1	AO2 5.9.1.1
	= 3.714	do <b>not</b> accept a subsequent step in the calculation	1	
	= 3.7	allow an answer correctly calculated to 2 significant figures which uses the values in the question	1	
<b>Total</b>			<b>9</b>	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	as population increased, copper production increased		1	AO3 5.10.1.1
05.2	(copper ore) (70 × 100 =) 7000  (recycled copper) (27 × 100 =) 2700  (7000 – 2700 =) 4300 (MJ)	allow correct use of incorrectly determined values for MP1 (copper ore) and/or MP2 (recycled copper)	1  1  1	AO2 5.10.2.2
05.3	any <b>one</b> from: <ul style="list-style-type: none"> <li>• reduces acid rain</li> <li>• reduces respiratory problems (in humans)</li> </ul>	allow sulfur dioxide causes acid rain allow sulfur dioxide causes respiratory problems (in humans)	1	AO1 5.9.3.2
05.4	$\frac{75}{100} \times 8$  = 6 (g)		1  1	AO2 5.10.1.1

05.5	Scrap steel is added to iron from a blast furnace	Extraction	1	AO2 5.10.2.2
	A glass bottle is refilled	Quarrying		
		Reacting		
		Recycling	1	
		Reusing		
do <b>not</b> accept more than one line from a box on the left				

05.6	B, C, D, A		1	AO1 5.10.2.2
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<b>Total</b>			<b>10</b>	
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Question	Answers	Extra information	Mark	AO / Spec.
06.1	<b>independent</b> concentration (of hydrochloric acid)		1	AO1 5.6.1 RPA11
	<b>control</b> any <b>one</b> from: <ul style="list-style-type: none"> <li>• temperature (of hydrochloric acid)</li> <li>• volume of (hydrochloric) acid</li> <li>• length of magnesium</li> <li>• surface area of magnesium</li> </ul>	allow same mass of magnesium allow same form of magnesium  ignore amount	1	
06.2	all points correctly plotted	allow a tolerance of $\pm \frac{1}{2}$ a small square allow 1 mark for 4 or 5 points correctly plotted	2	AO2 5.6.1 RPA11
	line of best fit	must include 0,0	1	
06.3	the rate decreases		1	AO3 5.6.1 RPA11
06.4	the magnesium reacted more quickly		1	AO3 5.6.1.2



<b>06.5</b>	rate increases	allow reaction happens faster	1	AO1
	(because) particles have more energy	allow (because) particles move faster allow (because) more particles have energy greater than the activation energy	1	5.6.1.2 5.6.1.3
	(so) more frequent collisions		1	
<b>Total</b>			<b>10</b>	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	plankton  or  (ancient) biomass	allow microscopic plants / animals	1	AO1 5.7.1.1
07.2	propane	allow C <sub>3</sub> H <sub>8</sub>	1	AO1 5.7.1.1

Question	Answers	Mark	AO / Spec. Ref.
07.3	<b>Level 2:</b> Scientifically relevant features are identified; the way(s) in which they are similar / different is made clear and (where appropriate) the magnitude of the similarity / difference is noted.	4–6	AO3
	<b>Level 1:</b> Relevant features are identified and differences noted.	1–3	AO1 AO2
	<b>No relevant content</b>	0	
	<b>Indicative content</b> <ul style="list-style-type: none"> <li>• methane has 1 carbon atom, hexane has 6</li> <li>• methane has 4 hydrogen atoms, hexane has 14</li> <li>• both contain C – H bonds</li> <li>• only hexane contains C – C bonds</li> <li>• both are hydrocarbons</li>   <li>• hexane has a higher melting point than methane (or converse)</li> <li>• hexane has a higher boiling point than methane (or converse)</li> <li>• methane is a gas at room temperature</li> <li>• hexane is a liquid at room temperature</li>   <li>• both are small molecules</li> <li>• hexane has larger molecules than methane</li> <li>• weak forces between molecules</li> <li>• forces between hexane molecules stronger than between methane molecules</li>   <li>• hexane is more viscous than methane</li> <li>• both are flammable</li> <li>• methane is more flammable than hexane (or converse)</li> <li>• possible products of combustion from both are: carbon, carbon monoxide, carbon dioxide, water</li> <li>• neither conduct electricity</li> </ul>		5.2.2.4 5.7.1.1 5.7.1.3

<b>07.4</b>	$C_8H_{18}$		1	AO2 5.3.1.1 5.7.1.4
<b>07.5</b>	bromine (water) turns (from orange / brown) to colourless	MP2 is dependent on MP1 allow decolourises ignore clear	1 1	AO1 5.7.1.4
<b>Total</b>			<b>11</b>	