GCSE
COMBINED SCIENCE: TRILOGY
8464/C/2F

Chemistry Paper 2F

Mark scheme

June 2023

Version: 1.0 Final

2 3 6 G 8 4 6 4 / C / 2 F / M S

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.

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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 their judgement
- 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 (for example, a scientifically correct answer that could not reasonably be expected from a student's knowledge of the specification).

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**.
Alternative words in the mark scheme are shown by a solidus 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 errors / 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** magnetic materials.

[2 marks]

Student	Response	Marks awarded
1	iron, steel, tin	1
2	cobalt, nickel, nail*	2

3.2 Use of symbols / formulae

If a student writes a chemical symbol / formula instead of a required chemical name, or uses symbols to denote quantities in a physics equation, 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. At any point in a calculation students may omit steps from their working. If a subsequent step is given correctly, the relevant marks may be awarded.

Full marks are **not** awarded for a correct final answer from incorrect working.

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

An error can be carried forward from one question part to the next and is shown by the abbreviation 'ecf'.

Within an individual question part, an incorrect value in one step of a calculation does not prevent all of the subsequent marks being awarded.

3.6 Phonetic spelling

Marks should be awarded if spelling is not correct but the intention is clear, **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.

3.11 Numbered answer lines

Numbered lines on the question paper are intended to support the student to give the correct number of responses. The answer should still be marked as a whole.

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, if necessary, 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. 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 1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	a limited resource		1	AO1 5.7.1.1 5.10.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.2	plankton		1	AO1 5.7.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.3	mixture		1	AO1 5.7.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.4	evaporate condense		1 1	AO1 5.2.2.1 5.7.1.2

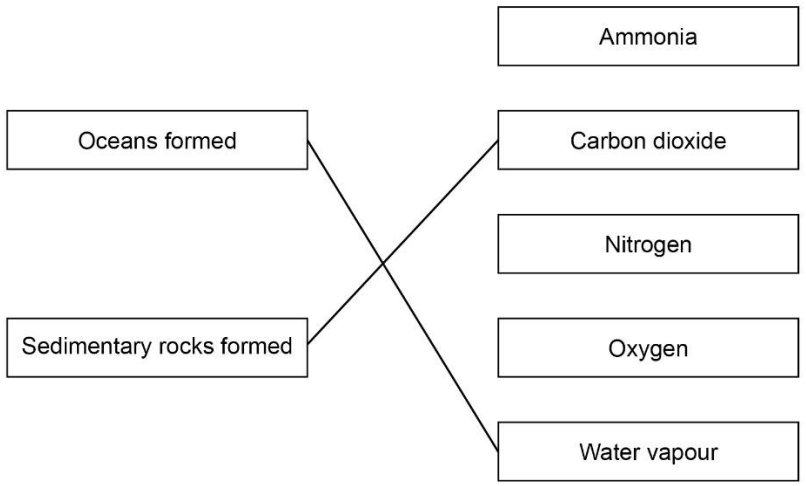
Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5	fuels		1	AO1 5.7.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.6	burning splint		1	AO1 5.8.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.7	(percentage =) $\frac{1.53 \times 100}{5.20}$		1	AO2 5.7.1.2
	= 29.42		1	
	= 29.4 (%)	allow a correctly calculated answer to 3 significant figures from an incorrect calculation which uses values given in the question	1	

Total Question 1	**10**

Question 2

Question	Answers	Mark	AO / Spec. Ref.
02.1	 do **not** accept more than one line from a box on the left	1 1	AO1 5.9.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.2	nitrogen		1	AO2 5.9.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	(number of times more =) $\frac{95}{0.04}$ = 2375 = 2.375×10^3	 allow a correctly calculated answer in standard form from an incorrect calculation which uses values given in **Table 1**	1 1 1	AO2 5.9.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.4	increased		1	AO2 5.9.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.5	(mass CO_2 =) $\frac{17.2}{4}$ = 4.3 (kg)		1 1	AO2 5.9.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.6	photosynthesis		1	AO1 5.9.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.7	any **two** from: (forest area) • increases in Africa • increases in Europe • decreases in South America • decreases in Asia		2	AO2 5.9.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.8	6 (%)		1	AO2 5.9.2.1 5.9.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.9	(**A**) reuse (**B**) recycle		1 1	AO2 5.10.2.2

Total Question 2	**15**

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	wear safety glasses / goggles	allow tie hair back	1	AO3 5.10.1.2 RPA13

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	heat until the mass of the evaporating basin and contents does not change use 25 cm^3 of water for each experiment		1 1	AO3 5.10.1.2 RPA13

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.3	no dissolved solids (in distilled water)		1	AO3 5.10.1.2 RPA13

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.4	to kill bacteria		1	AO1 5.10.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.5	rate		1	AO1 5.6.2.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.6	white		1	AO1 5.8.2.4

Question	Answers	Mark	AO / Spec. Ref.
03.7	**Level 2:** 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.	3–4	AO3
	Level 1: Relevant features are identified and differences noted.	1–2	AO2
	No relevant content	0	
	Indicative content **relevant features** • fluoride reduces tooth decay (in all age groups) • the reduction in tooth decay using fluoride generally increases with age • tooth decay increases in 25-54 age groups • tooth decay decreases in 55-64 age group • tooth decay increases in 65-74 age group **magnitude** • fluoride has the least effect in the 25-34 age group • fluoride has the greatest effect in the 55-64 age group • using fluoride decreases tooth decay by 2% in 25-34 age group • using fluoride decreases tooth decay by 3% in 35-44 age group • using fluoride decreases tooth decay by 9% in 45-54 age group • using fluoride decreases tooth decay by 10% in 55-64 age group • using fluoride decreases tooth decay by 7% in 65-74 age group		5.10.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.8	any **one** from: • could be a risk to health • could have side effects • could discolour teeth • people should be able to decide for themselves		1	AO2 5.10.1.2

Total Question 3	12

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	hydrogen peroxide → water + oxygen	allow H_2O_2 for hydrogen peroxide allow H_2O for water allow O_2 for oxygen	1	AO2 5.6.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.2	mass of catalyst volume of hydrogen peroxide solution		1 1	AO3 5.6.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.3	all points plotted correctly line of best fit	allow a tolerance of ± ½ a small square allow at least 3 points plotted correctly for **1** mark	2 1	AO2 5.6.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	manganese dioxide any **one** from: • steepest curve • reaction finishes first • greatest volume of oxygen (in given time)	allow ecf from question **04.3**	1 1	AO3 5.6.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.5	accurate		1	AO1 5.6.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.6	increase		1	AO1 5.6.1.2 5.6.1.3 5.6.1.4

Total Question 4	**10**

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	$CH_4 + \mathbf{2}\,O_2 \rightarrow CO_2 + \mathbf{2}\,H_2O$		1	AO2 5.7.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2		allow converse throughout		AO3 5.7.1.3
	hydrocarbon molecules in petrol have fewer carbon atoms than those in diesel		1	
	petrol has a lower boiling point (range) than diesel		1	
		allow petrol is more flammable than diesel		
		allow petrol is less viscous than diesel		

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3	oxygen		1	AO1 5.8.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.4	air	allow the atmosphere allow from volcanoes	1	AO1 5.9.1.1 5.9.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.5	global dimming		1	AO2 5.9.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.6	(carbon monoxide is) colourless **or** (carbon monoxide is) odourless	ignore clear	1	AO1 5.9.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.7	(diesel) burns at a high temperature **or** (diesel) burns at a temperature greater than 100 °C		1	AO2
	(which is) above the boiling point of water		1	AO3 5.2.2.1 5.9.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.8	sulfur dioxide (is produced when diesel is burnt)		1	AO1 5.9.3.1 5.9.3.2
	(which causes) acid rain		1	
	(which results in) any **one** from: • damage to buildings / statues / bridges • damage to trees / plants • damage to aquatic life • acidification of lakes / rivers / soil • respiratory problems	allow (which affects) asthma	1	

Total Question 5	**12**

Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	stationary phase		1	AO1 5.8.1.3 RPA12

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.2	any **one** from: (the substances) • move at different speeds • have different solubilities • have different attractions for the (chromatography) paper		1	AO2 5.8.1.3 RPA12

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.3	1		1	AO1 5.8.1.3 RPA12

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.4	(R_f =) $\frac{4.77}{5.30}$ = 0.9		1 1	AO2 5.8.1.3 RPA12

Question	Answers	Mark	AO / Spec. Ref.
06.5	**Level 3:** The method would lead to the production of a valid outcome. The key steps are identified and logically sequenced.	5–6	AO1 5.8.1.3
	Level 2: The method would not necessarily lead to a valid outcome. Most steps are identified, but the method 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 • **draw a pencil line** • near the bottom edge of the (chromatography) paper • **put a small dot of black ink on the pencil line** • put a small volume of water / solvent in a beaker • **place the (chromatography) paper in the solvent** • the dots of ink should be above the level of the water / solvent • support the paper in this position • put a lid on the beaker • **leave to run** • mark position of solvent front • remove from beaker and leave to dry • **determine R_f values** • measure distance of all dots from start line • measure distance of solvent front from start line • calculate R_f values for all dots • compare with known R_f values		

Total Question 6	11