GCSE
CHEMISTRY
8462/2F

Paper 2 Foundation Tier

Mark scheme

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1 9 6 G 8 4 6 2 / 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.

Further copies of this mark scheme are available from aqa.org.uk

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.

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

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.

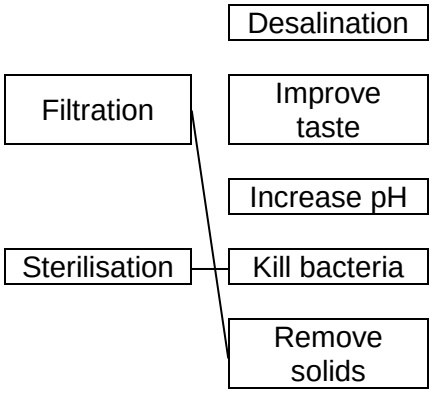
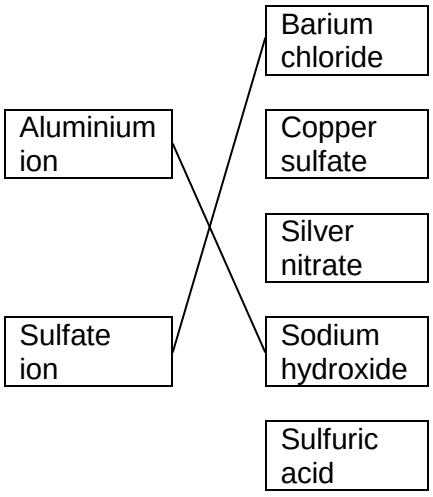
You may well need to read back through the answer as you apply the mark scheme to clarify points and assure yourself that the level and the mark are appropriate.

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 1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1		an extra line from a step to a reason for that step negates that mark	1 1	AO1 4.10.1.2
01.2	chlorine ozone		1 1	AO1 4.10.1.2
01.3	evaporate all water from the sample measure the sample's boiling point		1 1	AO2 4.8.1.1 4.10.1.2
01.4		an extra line from an ion to a compound needed negates that mark	1 1	AO1 4.8.3.2 4.8.3.5
01.5	distillation		1	AO1 4.10.1.2
Total			**9**	

Question 2

<table>
<tr><th>Question</th><th>Answers</th><th>Extra information</th><th>Mark</th><th>AO / Spec. Ref.</th></tr>
<tr><td>02.1</td><td>colourless

odourless

toxic

if more than three answers are given, apply the list principle as follows:

<table>
<tr><th>Number of answers</th><th>Number correct</th><th>Number incorrect</th><th>Mark awarded</th></tr>
<tr><td rowspan="3">4</td><td>3</td><td>1</td><td>2</td></tr>
<tr><td>2</td><td>2</td><td>1</td></tr>
<tr><td>1</td><td>3</td><td>0</td></tr>
<tr><td rowspan="3">5</td><td>3</td><td>2</td><td>1</td></tr>
<tr><td>2</td><td>3</td><td>0</td></tr>
<tr><td>1</td><td>4</td><td>0</td></tr>
</table>
</td><td>any order</td><td>1

1

1</td><td>AO1
4.9.3.2</td></tr>
<tr><td>02.2</td><td>oxygen</td><td>allow air / O_2</td><td>1</td><td>AO2
4.9.3.1</td></tr>
<tr><td>02.3</td><td>

$\frac{36}{12} \times 8$

= 24 (g)</td><td>an answer of 24 (g) scores 2 marks</td><td>

1

1</td><td>AO2
4.9.2.2</td></tr>
<tr><td>02.4</td><td>animal waste

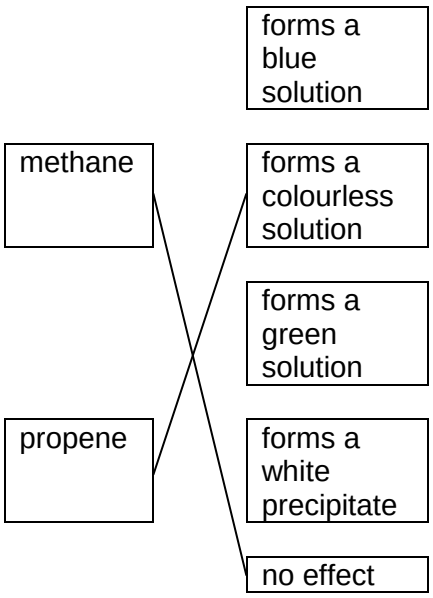
food in landfill</td><td></td><td>1

1</td><td>AO1
4.9.2.2
4.10.1.1</td></tr>
<tr><td>Total</td><td></td><td></td><td>8</td><td></td></tr>
</table>

Question 3

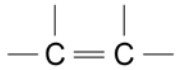
Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	(equation contains a) ⇌ (symbol)	allow description of arrow / symbol	1	AO1 4.6.2.1
03.2	exothermic		1	AO1 4.6.2.2
03.3	to reduce costs to use less energy		1 1	AO3 4.6.1.4
03.4	(the world production of ammonia) increased (the increase was) not steady / linear	 do **not** accept decreases ignore levels off	1 1	AO2 4.10.4.1
03.5	the demand for food changed the world population changed		1 1	AO2 AO3 4.10.4.2
03.6	**C** and **D**		1	AO3 4.10.4.2
03.7	**D**		1	AO3 4.10.4.2
Total			**10**	

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	nitrogen **and** methane	in either order, both required for mark allow phonetic spellings allow N_2 for nitrogen allow CH_4 for methane	1	AO2 4.9.1.1
04.2	nitrogen bar to 78% oxygen bar to 21%	ignore width of bars ignore additional bars	1 1	AO2 4.9.2.2
04.3	Titan's atmosphere contains too little carbon dioxide.		1	AO3 4.9.1.3
04.4	long wavelength radiation is reflected back to the surface of Titan.		1	AO1 4.9.2.1
04.5		an extra line from a gas to an effect on bromine water negates that mark	1 1	AO1 4.7.1.4

04.6	$\frac{7 \times 21}{3}$ = 49 (g)	an answer of 49 (g) scores **2** marks.	1 1	AO2 4.7.2.2
Total			**9**	

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	covalent		1	AO1 4.2.1.4
05.2			1	AO1 4.7.2.1 4.7.2.2
05.3	composite		1	AO2 4.10.3.3
05.4	limestone sand	either order	1 1	AO1 4.10.3.3
05.5	any **two** from: (makes the board) • strong • hard • tough • waterproof • durable • aesthetic reasons • rigid • less friction • protection	ignore corrosion / erosion / rotting / rusting allow long lasting allow streamlined / smooth allow prevents damage	2	AO3 4.10.3.3
05.6	(advantages of addition polymers) low(er) cost low(er) density (disadvantages of addition polymers) weak(er) hard(er) to dispose of	 allow cheap(er) allow light(er) allow (more) likely to break ignore references to recycling or use as a fuel	 1 1 1 1	AO3 4.10.1.1 4.10.2.1

05.7		an answer of 0.035 (m^3) scores **3** marks. allow **2** marks for an answer of 0.105 (m^3) (addition polymer)		AO2 4.10.1.1
	$150 = \frac{5.25}{\text{volume}}$		1	
	(volume =) $\frac{5.25}{150}$		1	
	(volume =) 0.035 (m^3)		1	
Total			**14**	

Question 6

Question	Answers		Mark	AO/ Spec. Ref
06.1	**Level 3**: The design/plan would lead to the production of a valid outcome. All key steps are identified and logically sequenced.		5–6	AO2
	Level 2: The design/plan would not necessarily lead to a valid outcome. Most steps are identified, but the plan is not fully logically sequenced.		3–4	AO1
	Level 1: The design/plan would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.		1–2	AO1 4.10.3.1
	No relevant content		0	
	Indicative content **Plan – allow diagrams to indicate content** • three test tubes containing nails • test tube 1 – open test tube with water • test tube 2 – stoppered test tube with drying agent • test tube 3 – test tube with boiled water • test tube 3 – sealed with oil • leave for several days • observe results **Results** • test tube 1 – nail rusts • test tube 2 – nail does not rust • test tube 3 – nail does not rust			
06.2	0.11 (g)		1	AO2 4.10.3.1
06.3	$\left(\frac{0.08 + \mathbf{X} + 0.09}{3}\right)$ = 0.09 (g)	 allow 0.09(3333….) allow ecf **from 06.2**	 1	AO2 4.10.3.1
Total			**9**	

Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	a glowing splint		1	AO1 4.8.2.2
07.2	student **A** should measure the mass of manganese dioxide.		1	AO3 4.6.1.1 4.6.1.2
07.3	calculate a mean but do not include any anomalous results.		1	AO3 4.6.1.1 4.6.1.2
07.4		an answer of 0.173 (cm^3/s) scores **4** marks		AO2 4.6.1.1
	(volume of oxygen formed =) (58 - 20 =) 38 (cm^3)	allow values between 36 (cm^3) and 40 (cm^3) inclusive	1	
	(time taken = 250 – 30 =) 220 (s)		1	
	$\frac{38}{220}$ **or** 0.1727 (cm^3/s)	allow a correct calculation using an incorrectly determined value for volume and / or time	1	
	= 0.173 (cm^3/s)	allow a correctly calculated answer given to 3 significant figures from an incorrect attempt at the rate equation	1	
07.5	line starts at the origin **and** steeper than existing line final volume same as existing line	 allow a tolerance of ± ½ a small square	1 1	AO2 4.6.1.1
07.6	fine manganese dioxide powder has a larger surface area		1	AO3 4.6.1.2 4.6.1.3
Total			**10**	

Question 8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.1	a temperature between 400 (°C) and 500 (°C) inclusive	allow a temperature range entirely within 400 (°C) and 500 (°C) inclusive	1	AO3 4.7.1.2
08.2	(diesel oil has a) lower boiling point / range than heavy fuel oil (but diesel oil has a) higher boiling point / range than kerosene	ignore quoted values for boiling points ignore references to melting points ignore references to intermolecular forces or chain length allow temperature of vaporisation / condensation for boiling points throughout allow the boiling range (of diesel oil) is between those of heavy fuel oil and kerosene for **2** marks.	1 1	AO2 4.7.1.2
08.3	any **two** from: • (too) viscous • not (very) flammable • boiling point (too) high	ignore references to cost allow references to difficulty of flow allow references to difficulty of ignition / burning do **not** accept bitumen takes more energy to burn allow not (very) volatile	2	AO2 4.7.1.3
08.4	C_6H_{14}		1	AO2 4.7.1.1

08.5	high temperature any **one** from: • steam • catalyst	ignore references to pressure allow a quoted temperature above 320 °C ignore hot / heat ignore name of catalyst allow alumina allow aluminium oxide allow porous pot allow zeolite	1 1	AO1 4.7.1.4
08.6	greater demand (for smaller molecules) any **one** from: (because smaller molecules are) • more useful • better fuels • used to make alkenes • used to make polymers	allow converse argument for larger molecules allow a named polymer ignore plastics	1 1	AO1 4.7.1.4
08.7	C_3H_6		1	AO2 4.1.1.1 4.7.1.4
Total			**11**	

Question 9

Question	Answers		Mark	AO/ Spec. Ref
09.1	**Level 3**: The design/plan would lead to the production of a valid outcome. All key steps are identified and logically sequenced.		5–6	AO1 4.8.2.3 4.8.3.1 4.8.3.3
	Level 2: The design/plan 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 design/plan 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 lithium: • crush tablets or dissolve tablet (in water or acid) • clean wire • place on wire • place in (roaring / blue / non-luminous) flame • observe flame colour • crimson flame carbonate: • add hydrochloric acid • effervescence / fizzing • bubble gas through limewater • limewater becomes cloudy			
09.2	formulation(s)		1	AO1 4.8.1.2

09.3		an answer of 58.3333333 (%) correctly rounded to at least 2 significant figures scores **3** marks		AO2 4.8.1.2
	1.20 g = 1200 mg **or** 700 mg = 0.700 g		1	
	$\frac{700}{1200} \times 100$ **or** $\frac{0.700}{1.20} \times 100$	allow correct use of incorrectly or not converted values from step 1	1	
	= 58.3 (%)	allow 58.3333333 (%) correctly rounded to at least 2 significant figures	1	
Total			**10**	

Question 10

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.1	(aq)	allow aqueous / aq	1	AO1 4.2.2.1 4.2.2.2
10.2	(gas) syringe	allow measuring cylinder (and water trough) allow balance	1	AO1 4.6.1.1
	stopclock / stopwatch	allow timer / clock / watch	1	
10.3	all points plotted correctly	allow a tolerance of ± ½ a small square allow at least 3 points plotted correctly for **1** mark.	2	AO2 4.6.1.1
	line of best fit	allow correctly drawn line of best fit for incorrectly plotted points	1	
10.4	(rate) decreases	allow slows down	1	AO3 4.6.1.1
	(rate decreases) more slowly as time increases	allow (rate decreases) at a non-linear rate	1	
	(rate) becomes zero at 60 s	allow the reaction stops at 60 s allow ecf from question **10.3**	1	
10.5	more bubbles were produced in the first 10 seconds		1	AO2 4.6.1.2
	the magnesium was used up more quickly		1	
Total			**11**	