Rewarding Learning

General Certificate of Secondary Education

Double Award Science: Chemistry

Unit C2

Higher Tier

[GDW52]

Assessment

MARK SCHEME

General Marking Instructions

Introduction

Mark schemes are published to assist teachers and students in their preparation for examinations. Through the mark schemes teachers and students will be able to see what examiners are looking for in response to questions and exactly where the marks have been awarded. The publishing of the mark schemes may help to show that examiners are not concerned about finding out what a student does not know but rather with rewarding students for what they do know.

The Purpose of Mark Schemes

Examination papers are set and revised by teams of examiners and revisers appointed by the Council. The teams of examiners and revisers include experienced teachers who are familiar with the level and standards expected of students in schools and colleges.

The job of the examiners is to set the questions and the mark schemes; and the job of the revisers is to review the questions and mark schemes commenting on a large range of issues about which they must be satisfied before the question papers and mark schemes are finalised.

The questions and the mark schemes are developed in association with each other so that the issues of differentiation and positive achievement can be addressed right from the start. Mark schemes, therefore, are regarded as part of an integral process which begins with the setting of questions and ends with the marking of the examination.

The main purpose of the mark scheme is to provide a uniform basis for the marking process so that all the markers are following exactly the same instructions and making the same judgements in so far as this is possible. Before marking begins a standardising meeting is held where all the markers are briefed using the mark scheme and samples of the students' work in the form of scripts. Consideration is also given at this stage to any comments on the operational papers received from teachers and their organisations. During this meeting, and up to and including the end of the marking, there is provision for amendments to be made to the mark scheme. What is published represents this final form of the mark scheme.

It is important to recognise that in some cases there may well be other correct responses which are equally acceptable to those published: the mark scheme can only cover those responses which emerged in the examination. There may also be instances where certain judgements may have to be left to the experience of the examiner, for example, where there is no absolute correct response – all teachers will be familiar with making such judgements.

General marking guidance in applying mark schemes for GCSE DAS Chemistry

1. Alternative responses

- A solidus (/) used in mark schemes indicates alternative answers. Where a solidus may be confused with part of the answer (for example as a division sign or as part of units) "or" may be used to show alternatives.

Example: What is meant by the term element? [1]
MS: A substance which contains only one type of atom/substance which cannot be broken down into anything simpler by chemical means [1]

- Either answer as a response would be acceptable. If both are given this is accepted.

2. Brackets in a response

- Normal parentheses used in a mark scheme response means that the word(s) given in brackets **are not required** for the response to be marked correct.

Example: Name the chemical used to test for carbon dioxide. [1]
MS: limewater/calcium hydroxide (solution) [1]

Response	Candidate Response	Marks awarded	Notes
1	limewater	1	Correct response
2	calcium hydroxide	1	Correct response
3	calcium hydroxide solution	1	Correct response

- Calcium hydroxide on its own is an acceptable response to this question as the focus is on the chemical as opposed to solution.
- *Note that in a practical style question, solution may be expected if the candidate chooses to describe limewater as "calcium hydroxide solution".*

3. Words or phrases in bold in a response

- Words or phrases highlighted in bold in a mark scheme response mean that the word(s) or phrases or their equivalent, if applicable, **are required** for the response to be marked correct.

Example: Describe the test for ammonia gas. [3]
MS: Dip a **glass** rod [1] in **concentrated hydrochloric acid** [1] and then in a sample of the gas. Idea that **white** smoke/**white** fumes is/are formed [1]

Response	Candidate Response	Marks awarded	Notes
1	Dip a rod in hydrochloric acid and then in the gas. White smoke means it is ammonia.	1	"glass" and "concentrated" not stated
2	Put a glass rod into concentrated acid and then into ammonia. You will see white fumes.	2	"hydrochloric" not stated
3	Put a glass rod into concentrated hydrochloric acid and then into the ammonia. A white smoke is formed.	3	Correct response

4. Marking of lists

- Where candidates give extra responses, additional correct responses can be ignored.
- Additional neutral responses can also be ignored. A neutral response is one which does not have a bearing on the question but is not incorrect.
- Additional incorrect responses **cancel out** a correct response to the marking point to which they pertain.

Example: Name the ore from which iron is extracted. [1]
MS: haematite [1]

Response	Candidate Response	Marks awarded	Notes
1	haematite (bauxite)	0	Bauxite is incorrect
2	haematite (iron oxide)	1	Iron oxide is a neutral answer
3	iron oxide	0	Not the correct answer
4	iron(III) oxide	0	Not the correct answer
5	haematite (iron(III) oxide)	1	Iron(III) oxide is a neutral answer
6	Bauxite (iron(III) oxide)	0	Bauxite is incorrect

5. Marking values where a range is given

- Where a numerical range is given, correct responses are any value in the range, the range itself or any other range given which falls within the MS range.

Example: What is the pH of a solution of hydrochloric acid? [1]
MS: 0–2 [1]

Response	Candidate Response	Marks awarded	Notes
1	0	1	A single value within the accepted range
2	1.5	1	A single value within the accepted range
3	2	1	A single value within the accepted range
4	0–2	1	The accepted range
5	1–2	1	A range given within the accepted range
6	1–3	0	Range given outside the accepted range
7	2.5	0	A single value not within the accepted range

6. Names and chemical formulae

(a) Names, formulae and identification

- If a candidate writes a symbol for an element or chemical formula to **identify** an element or compound this can be marked correct **unless** a name is specifically required as detailed in the question.

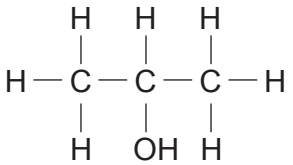
Example: Which substance undergoes catalytic decomposition in the laboratory preparation of oxygen? [1]
MS: hydrogen peroxide/H_2O_2 [1]
i.e. either the name or the formula can be given

- If the command word "*Identify*" is used, a candidate may provide either the name or symbol/formula. When the command word "***Name***" (in bold) is used, only the correct name will be awarded the mark.

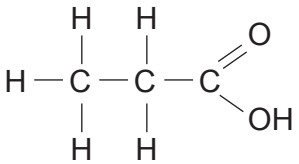
Example: **Name** the substance which undergoes catalytic decomposition in the laboratory preparation of oxygen? [1]
MS: hydrogen peroxide [1]

- There are examples where the command word "*Name*" is used but it is not in bold, but it should be obvious that a name is required.

Example: Name compounds E and F.



E



F [2]

MS: E = propan-2-ol [1]
F = propanoic acid [1] [2]

Chemical formulae for these compounds would **not** be accepted as the command word is "***name***". With names such as these the full name with number and dashes for propan-2-ol is required.

(b) Both name and formula provided by candidate

- If a name is required and a candidate gives both a name and a chemical formula, the formula can be ignored even if it is incorrect.
- If a name is required and a candidate gives an incorrect name and a correct chemical formula the answer must be marked wrong.
- If a formula is required and both the name and formula are given, the name can be ignored even if it is incorrect.

Example: **Name** the salt produced when sodium hydroxide reacts with hydrochloric acid. [1]
MS: sodium chloride [1]

Response	Candidate Response	Marks awarded	Notes
1	sodium chloride $NaCl_2$	1	Incorrect formula ignored
2	sodium chlorate NaCl	0	Name is incorrect

(c) Formula asked for but equation containing the correct formula given

- If a question asks for a formula and the candidate writes an equation on the answer line, then even if the formula in that equation is correct there is no credit because the candidate has not answered the question correctly.

Example: Give the formula of the salt formed when magnesium reacts with nitric acid. [1]
MS: $Mg(NO_3)_2$ [1]

- A response such as: $Mg + 2HNO_3 \rightarrow Mg(NO_3)_2 + H_2$
  gains no credit because the candidate has provided an equation (with four formulae).

(d) Oxidation states

- Where an element has variable oxidation states, the oxidation state should be given where this is indicated in the mark scheme. However, with copper(II) compounds, the (II) can be omitted in the name.
- Where an element has variable oxidation states and a name is required, the oxidation state should be given, e.g. hydrated iron(III) oxide.

Example: Which catalyst is used in the decomposition of hydrogen peroxide? [1]
MS: manganese(IV) oxide/manganese dioxide/MnO_2 [1]

- Manganese oxide would not be accepted.
- The (IV) is required unless manganese dioxide or MnO_2 is given.
- Manganese(IV) dioxide would also be incorrect.

7. Marking equations

Some general points about formulae and equations:

- A missing $\rightarrow$ in any equation is penalised by 1 mark.
- If only the left hand side(LHS) or only the right hand side(RHS) are given with no $\rightarrow$ then no credit can be given.
- If only one side is given and an arrow is shown then that side can be credited, e.g. $Na + H_2O \rightarrow$ can get the LHS mark.
- Mark the equation which has been written on the line or the equation closest to the line if several “answers” are given and not crossed out.
- Do **not** penalise a cursive A (for example for Al) or N (for example for N or Na).
- Do **not** penalise lower case single symbols such as S or O unless it is **extremely** clear that it is lower case.
- Penalise use of capital letter for second letter of element symbols: CL is incorrect if it is a clear right-angle capital; NA is incorrect even if the A is smaller.
- Only penalise letter errors once in an equation (or even in a paper) if a symbol is repeated so mark the equation as normal but penalise 1 mark if there is a very clear symbol error which would appear on both sides of the equation.
- Ignore state symbols, unless they are asked for in the question, even if incorrect.
- For standalone formulae of ionic compounds or when written in an equation, two charges are acceptable, e.g. Na^+Cl^- is acceptable but Na^+Cl is **not** acceptable.
- A bracket is acceptable around a molecular ion even if only one is required, Na(OH) is accepted but a bracket is **not** accepted around a single element so $(H)_2O$ is **not** correct.

(a) Balanced symbol equations and ionic equations

- A balanced symbol equation or ionic equation without state symbols is either worth 2 marks or 3 marks. State symbols are an additional mark.
- Multiple or fractional balancing numbers which are correct are accepted.

(i) A 3 mark balanced symbol equation requires balancing numbers.
[1] mark is awarded for the correct formula(e) of the reactants.
[1] mark is awarded for the correct formula(e) of the products.
The third mark, the balancing mark, is only available if all formulae are correct; if they are and balancing is correct, award [3] in total.

(ii) A 2 mark balanced symbol equation does not require balancing numbers.
[1] mark is awarded for the correct formula(e) of the reactants OR the correct formulae of the products
[1] mark is awarded for the correct formula(e) of the other side of the equation AND balancing.

Example: Write a balanced symbol equation for the reaction of magnesium with sulfuric acid.
MS: $Mg + H_2SO_4 \rightarrow MgSO_4 + H_2$ [2]
correct formulae of reactants (LHS) OR correct formulae of products (RHS) [1]
correct formula for other side of the equation AND balancing correct [1] [2]

- When considering the **first** mark only look at the formulae; ignore any balancing; if one side of the equation has the correct formula(e), the first mark is awarded.
- When considering the **second** mark look at the formulae on the other side of the equation (from that credited with the first mark) AND at the balancing – the second mark is only awarded if all the formula(e) are correct and the balancing is also correct.

Response	Candidate Response	Marks awarded	Notes
1	$Mg_2 + H_2SO_4 \rightarrow MgSO_4 + H_2O$	0	Neither LHS or RHS has correct formulae so no credit
2	$Mg_2 + H_2SO_4 \rightarrow 2MgSO_4 + H_2$	1	The RHS has both formulae correct so gets [1] the LHS has a wrong formula so no credit
3	$Mg + H_2SO_4 \rightarrow 2MgSO_4 + H_2$	1	The LHS has both formulae correct so gets [1]; the RHS has both formulae correct but balancing wrong overall so no credit
4	$2Mg + 2H_2SO_4 \rightarrow 2MgSO_4 + 2H_2$	2	All formulae correct; doubling up doesn't negate the balancing mark.

(iii) A 3 mark balanced symbol equation requires balancing numbers.
The mark for balancing numbers is **dependent** on all the formulae being correct.

Example: Write a balanced symbol equation for the reaction between copper(II) carbonate and hydrochloric acid. [3]
MS: $CuCO_3 + 2HCl \rightarrow CuCl_2 + CO_2 + H_2O$
correct formulae of reactants (LHS) [1]
correct formulae of products (RHS) [1]
correct balancing [1] [3]

Response	Candidate Response	Marks awarded	Notes
1	$CuCO_3 + HCl \rightarrow CuCl_2 + CO_2 + H_2O$	2	LHS and RHS marks awarded but balancing mark not awarded.
2	$Cu_2CO_3 + 2HCl \rightarrow CuCl_2 + CO_2 + H_2O$	1	LHS mark not awarded as formula incorrect so balancing mark cannot be awarded. RHS mark awarded.
3	$CaCO_3 + 2HCl \rightarrow CaCl_2 + CO_2 + H2O$	2	There is a symbol error in this equation so if Cu was correct on both sides it would be worth 3 marks but the single symbol error is penalised by 1 mark.
4	$CuCO_3 + HCl \quad CuCl_2 + H_2O + CO_2$	1	Equation is not balanced and the arrow is missing. 2 marks awarded for LHS and RHS but 1 error for missing arrow so worth 1 overall.

(b) Half equations

- Note that e is acceptable for e^-.
- Half equations marking details are provided within the mark schemes for each specific question and in general they are marked as follows:

  Where there are 3 species in the equation – e.g. ion, molecule and electron [2] marks are available
  - correct atom/ion/molecule on left, with arrow and correct atom/ion/molecule on right [1]
  - $+e^-$ on the correct side (or $-e^-$ on the other side) AND correct balancing [1]
  - Note that the second mark is dependent on the first

Example: Write a half equation for the reaction occurring at the anode during the extraction of aluminium by electrolysis. [2]

MS: $2O^{2-} \rightarrow O_2 + 4e^-$ OR $2O^{2-} - 4e^- \rightarrow O_2$

Correct ion on LHS with arrow and correct molecule on RHS [1]

+e on correct side (or –e on other side) AND correct balancing [1] [2]

Response	Candidate Response	Marks awarded	Notes
1	$2O^{2-} \rightarrow O_2 + 4e^-$	2	All marks awarded as correct with $+e^-$ on RHS.
2	$2O^{2-} \rightarrow O_2 - 4e^-$	1	First mark only awarded as $-e^-$ on RHS is incorrect.
3	$2O^- \rightarrow O_2 + 2e^-$	0	No marks awarded as formula of oxide ion is incorrect.
4	$O_2 + 4e^- \rightarrow 2O^{2-}$	0	No marks awarded as equation shows oxide being formed.

8. QWC

- Quality of written communication is marked using indicative content and a banded mark scheme.
- The initial marking is for the indicative content. The number of indicative content marks places a candidate in a specific band. The total marks awarded will be one of the two mark options in that band based on the standard of written communication.
- A typical banded grid from a mark scheme which would have 8 indicative content points is shown below:

Band	Response	Mark
A	Candidates must use appropriate specialist terms including a minimum of 7 points of indicative content. They use good spelling, punctuation and grammar and the form and style are of a high standard.	[5]–[6]
B	Candidates must use appropriate specialist terms including a minimum of 5 points of indicative content. They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3]–[4]
C	Candidates provide a brief and partial response including a minimum of 2 points of indicative content. They use limited spelling, punctuation and grammar and they have made little use of specialist terms. The form and style are of a limited standard.	[1]–[2]
D	Response not worthy of credit.	[0]

[6]

- A candidate who provides 5 indicative content points is placed in band B and can be awarded 3 or 4 overall marks out of 6 for their response.
- Responses would normally only be given the lower mark in the band if there were multiple spelling, punctuation and grammar errors.

9. Marking calculations

- Any errors in a single calculation or between parts of a multipart calculation may be carried forward. ECF may be used to indicate where an error is carried forward. For example, the incorrect use of the ratio/no ratio used in a reacting mass calculation could be awarded 2 out of the 3 marks available, provided all other steps are carried out correctly.
- Full marks can be awarded for a correct numerical answer to any calculation even if no working out is shown **apart** from degree of hydration and empirical formula calculations for which working out is required.
- Candidates should avoid excessive rounding such as to 1 decimal place unless appropriate or when it does not greatly affect the answer to the question. Any required number of decimal places will be asked for in the question.
- Units are required where they are not provided at the end of an answer line.

Example: Calculate the mass of aluminium oxide formed when a sample of 2.42 g of aluminium is heated to constant mass.
Relative atomic mass: Al = 27 Relative formula mass Al_2O_3 = 102

The equation for the reaction is:

$4Al + 3O_2 \rightarrow 2Al_2O_3$ [3]

MS: 4.57 g [3]

Up to 2 method marks may be awarded

e.g. moles of Al = $\frac{2.42}{27}$ = 0.0896 [1]

moles of Al_2O_3 = $\frac{0.0896}{2}$ = 0.0448 [1]

mass of Al_2O_3 = 0.0448 × 102 = 4.57 g [1] [3]

- Note that the space where the answer is to be written will have g at the end of the line so g is not required in the answer.
- The method marks are allocated for the numerical answers/computations as appropriate.
- Responses do not need to include "moles of Al" as it may be presented below the equation or just have "Al" or be clear from the layout of the answer.
- Essentially if a candidate has made 1 error and the work is clearly shown then 2 marks can be awarded.

Response	Candidate Response	Marks awarded	Notes
1	Al = $\frac{2.42}{27}$ = 0.1 Al_2O_3 = 0.05 Al_2O_3 = 0.05 × 102 = 5.1 g	2	The rounding in the first line has a significant effect on the answer so the first mark is not awarded. The second and third marks are awarded as this rounding error is carried forward.
2	Al = $\frac{2.42}{27}$ = 0.09 Al_2O_3 = 0.045 Al_2O_3 = 0.045 × 102 = 4.59 g	3	All marks are awarded as the rounding here does not have a significant effect on the answer.
3	moles of Al = 0.048 moles of Al_2O_3 = 0.024 mass of Al_2O_3 = 2.448 g	2	The first mark is not awarded but the second and third marks are awarded as the error is carried through.
4	4.57	3	All marks are awarded for the correct numerical answer. Units are not required as they would be provided at the end of the answer line in the question.
5	moles of Al = 0.0896 moles of Al_2O_3 = 0.1792 mass of Al_2O_3 = 18.3 g	2	The ratio is not applied correctly here so the second mark is not awarded but the first and third steps in the calculation are carried out correctly.

10. Colours and colour changes

- The colours and colour changes are given in the mark schemes. Shades (such as light and dark) are ignored except where they are clearly part of the mark scheme.
- Incorrect colours with the correct colour will lose the mark as this is an example of an inconsistent response.

11. Definitions

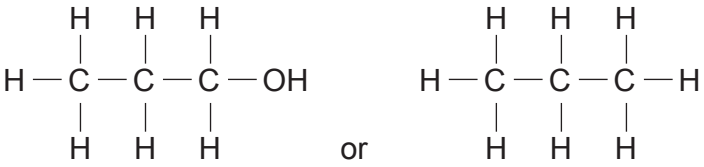
- Definitions are often worth 1 mark but those that have multiple parts are marked based on the distribution of marks detailed in the mark scheme.
- Minor errors with prepositions and conjunctions within the wording should not be penalised if they do not change the meaning of the answer given.

12. Organic structures

- Each organic structure is generally worth 1 mark.
- Any omission of a bond or an atom from the structure will lose the candidate the mark.
- Connectivity of atoms should only be penalised when it is very obviously wrong. This applies mostly to the OH group for alcohols.

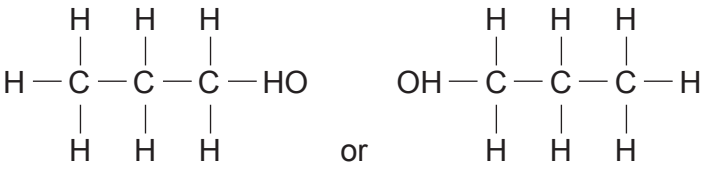
Example: Draw the structural formula of propan-1-ol. [1]

MS:



[1]

- The structures below would not be awarded the mark due to connectivity issues with the OH group.



[1]

- Note that the bond between the O and H is not required unless the question asks for all bonds to be shown.

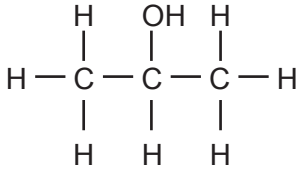
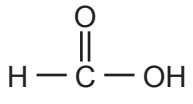
13. Marking diagrams

- Diagrams of assembled apparatus are expected to be two-dimensional cross-sectional diagrams of the apparatus where appropriate.
- The marks awarded for an apparatus diagram are usually based on 1 or 2 marks being awarded for labelling recognisable piece(s) of apparatus in an assembled diagram.
- NB apparatus needs to be assembled and to work in order to gain full credit e.g. if a labelled diagram for filtration is required then simply drawing, as separate pieces, a funnel, a conical flask and filter paper would not gain credit; If the diagram showed a labelled filter funnel above a labelled conical flask but the filter paper was missing the candidate could gain 2 out of 3 marks; if the diagram was correct but no labels then 2 out of 3 marks would be awarded.
- In some diagrams a combination of pieces of apparatus may be worth 1 mark such as a gauze on a tripod with a Bunsen burner/heat. All must be recognisable in a diagram of assembled apparatus and labelled correctly for the combined mark to be awarded.

				AVAILABLE MARKS
1	**(a)**	**(i)**	red-orange/red-brown/pink/brown solid formed [1] blue colour of solution fades/disappears **or** solution turns colourless [1] [2]	
		(ii)	$Mg + CuSO_4 \rightarrow MgSO_4 + Cu$ LHS or RHS correct [1] Both sides correct and no balancing error [1] [2]	
	(b)		B [1]	5
2	**(a)**		5 or 6 points correct [2], 3 or 4 points correct [1] Correct curve [1] [3]	
	(b)	**(i)**	76 ± 3 s (units needed) [1]	
		(ii)	4 seconds [1]	
	(c)		(Step 2:) Explicit idea that timing should commence as soon as the acid and the calcium carbonate are mixed together [1] (Step 3:) *explicit idea of what is going to be measured and how*: e.g. loss of mass [1] by placing the flask/container on a (top pan) balance [1] **or** volume of gas produced [1] by attaching the flask/container to a gas syringe [1] (Step 4:) explicit idea that readings/measurements need to be taken at known times [1] [4] *NB It is the marking points which are important – not the order of the Steps*	
	(d)		Particles given more energy/move faster [1] More (frequent) collisions [1] More successful collisions [1] [3]	12

3 **(a)** (A hydrocarbon is) a compound/molecule which consists of (OR contains only) carbon and hydrogen (atoms) [2]
one mark can be allowed if there is only one error, e.g. definition correct but compound/molecule not given OR definition correct but "contains" used and "only" not given OR definition correct but, e.g. "and oxygen" added
NB there is no credit unless carbon and hydrogen are both mentioned

(b)

Name	Molecular formula	Structural formula	Physical state at room temperature
Propan-2-ol	C_3H_8O/C_3H_7OH [1]		Liquid [1]
Methanoic acid	HCOOH	 [1]	Liquid

[3]

(c) A large saturated hydrocarbon/alkane [1]
It is broken down into smaller more useful hydrocarbons [1]
Some of which are unsaturated/alkenes [1]
Non generic answer, i.e. heptadecane, octane, ethene or propene mentioned in correct context [1] [4] 9

4 **(a)** Carbonic acid [1] H_2CO_3 [1] [2]

(b) decomposition [1] hydrogen peroxide [1] manganese dioxide [1] [3] 5

5 **(a)** electrolytes contain **ions** that are free to move [1]
and carry charge [1] [2]
For answer which refers to electrons rather than ions apply ecf

(b) anode:

$2Cl^- \longrightarrow Cl_2 + 2e^-$

Correct ion(Cl^-) on LHS with arrow and correct molecule (Cl_2) on RHS [1]

+e on correct side (or –e on other side) AND correct balancing [1]

cathode:

$Pb^{2+} + 2e^- \longrightarrow Pb$

Correct ion(Pb^{2+}) on LHS with arrow and correct element (Pb) on RHS [1]

+e on correct side (or –e on other side) AND correct balancing [1] [4] 6

NB if the anode answer is $Pb^{2+} + 2e^- \longrightarrow Pb$
even if wrongly balanced – apply ecf to cathode answer

AVAILABLE MARKS

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6 **(a)** Zn/zinc [1]
Cl_2/chlorine [1] [2]

(b) **(i)** O^{2-} or oxide ion **not** oxygen
Explicit idea that the substance being oxidised is losing electrons [1] [2]

(ii) explicit idea that oxidation and reduction are both happening [1]

(c) **Indicative points:**
The production of the reducing agent:
- carbon/coke reacts with hot air/oxygen
- (carbon/coke reacts) to give carbon dioxide
- carbon dioxide reacts with (more) carbon/coke
- carbon monoxide (produced) is the reducing agent

Equation for the reaction which produces iron:
$Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$
- LHS
- RHS
- balancing if LHS and RHS correct

Removal of acidic impurities:
- limestone/calcium carbonate reacts/decomposes
- calcium oxide is produced
- silicon dioxide reacts with calcium oxide
- slag/calcium silicate is formed **not** "slag is the acidic impurity"
- slag/calcium silicate is run off/tapped off

Response	Marks
Candidates must use specialist terms throughout, **10–12** indicative points required. They use good spelling, punctuation and grammar and the form and style are of a high standard.	[5]–[6]
Candidates use some specialist terms throughout, **6–9** indicative points required. They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3]–[4]
Candidates give **3–5** of the indicative points. They use limited spelling, punctuation and grammar and make little use of specialist terms.	[1]–[2]
Response not worthy of credit. Candidates make reference to less than 3 of the points above and offer no other suitable response.	[0]

[6] 11

					AVAILABLE MARKS
7	**(a)**	**(i)**	$CuSO_4.5H_2O \rightleftharpoons CuSO_4 + 5H_2O$ (proper reversible sign needed) Reversible sign [1] correct equation [1]	[2]	
		(ii)	C [1] E [1]	[2]	
	(b)	**(i)**	250	[1]	
		(ii)	45 g	[1]	
	(c)		Empirical formula: CH_3 [2] – allow method mark, if answer correct, for $\frac{\text{C}}{12}\ \frac{\text{H}}{1}$ $\frac{80}{}\ \frac{20}{}$ Possible molecular formula: C_2H_6 [1]	[3]	
	(d)	**(i)**	1.25	[1]	
		(ii)	0.6	[1]	11
8	**(a)**		carbon monoxide [1] carbon/soot [1]	[2]	
	(b)		$C_3H_6 + H_2 \rightarrow C_3H_8$ LHS or RHS correct [1] Both sides correct and no balancing error [1]	[2]	
	(c)		use bromine water/solution [1] (**not** bromine, **not** bromine liquid) idea that bromine water is orange [1] (accept colours in yellow-orange-brown range **not** any shade of red **not** idea of dark brown) ethene decolourises bromine water [1] no decolourisation with ethane [1] apply ecf i.e. if ethene and ethane in wrong order in last 2 marking points, allow 1 mark	[4]	
	(d)		$H_2C{=}CHBr$ with all bonds shown	[1]	
	(e)		–OH or –O–H	[1]	
	(f)		yeast is added [1] the temperature should be warm/not above 37 °C [1] (accept "warm" but not "hot" or "heat") Anaerobic conditions/absence of air [1]	[3]	13

			AVAILABLE MARKS
9	**(a)**	Bonds are broken in named reactants (ethene and oxygen) [1] Idea that energy is needed to break bonds/bond breaking is endothermic [1] Bonds are made in named products (carbon dioxide and water) [1] Idea that energy is given out when bonds are made/bond making is exothermic [1] **Clear** idea that the reaction is exothermic because **more** energy is released in bond making than is needed for bond breaking – **No** credit for simply stating the reaction is exothermic because heat/energy is given out [1] (5 × [1]) [5] *The first and third marking points require named reactants and products to be given.* *If answer is a generic one then maximum mark is [3].* *If only 2 of 4 chemicals are appropriately referred to, i.e. either both reactants or both products or only 1 of each, then award either marking point 1 or marking point 3 but not both.* *The maximum mark for a non-generic answer which only names 2 of the 4 chemicals is [4].* *For all [5] marks at least 3 of the 4 chemicals must be explicitly referred to.*	
	(b)	–1076 kJmol^{-1} [3] If answer incorrect up to two method marks can be awarded, e.g. Energy needed to break bonds in reactants = **3748** kJ mol^{-1} [1] Energy released when bonds form in products = **4824** kJ mol^{-1} [1] Energy change = 3748 – 4824 = **–1076 kJ mol^{-1}** (apply ECF) [1] Incorrect units or sign maximum is [2] If work shown and there is only one error then award [2]; if work shown and there are 2 errors award [1] [3]	8
		Total	**80**