GCSE Chemistry (AQA 8462)

Foundation Tier

Mark scheme

Introduction

The information provided for each question is intended to be a guide to the type of answers students may produce, but can be neither exhaustive nor prescriptive. Award marks according to your professional judgement for all appropriate responses.

Disclaimer

- These mark schemes and exemplar answer content are entirely the work of the question author and have not been produced by, reviewed by or endorsed by AQA.
- Where marks are suggested and levels mapped to particular styles or features of answers, these are intended for guidance only and cannot reflect the full examination marking process, which involves moderation and alignment of level boundaries across a full, national student cohort that cannot be determined from a standalone product such as this set of Practice Papers.
- Therefore, mark allocation, mark totals, suggested levels and overall assessments of performance as found in these Practice Papers and Mark Schemes represent only a limited guide to possible outcomes, and are not a reliable indicator of actual performance.

Information for teachers

1. General

The mark scheme for each question gives:

- the marks available for each part of the question
- the total marks available for the question
- the correct answer or, if multiple correct answers are possible, a typical correct answer with variations
- extra information to help with making decisions about how many marks to award
- the Assessment Objective(s) from the GCSE Specification that the part question is intended to cover.

The 'extra information' is aligned to the appropriate answer and is only intended for consideration with that particular part of the answer.

2. Marking of lists

For question parts where a set number of responses is requested, all possible correct answers are stated. Each correct response should be awarded a mark as indicated, up to a maximum for the question part as stated on the question paper and as written in this marks scheme.

If a student has provided more than the set number of responses requested, the principle to be followed is that 'right + wrong = wrong'. Each error or contradictory response negates each correct response. If the number of errors and contradictions equals or exceeds the number of correct responses, no marks can be awarded for that part of the question.

3. Use of symbols and formulae

If an accepted scientific symbol or formula is written instead of a required chemical name or unit, award full marks if the symbol or formula is correct and if, in the context of the question, the response is appropriate.

4. Calculations

Award marks for each correctly completed stage of a calculation, as students are instructed to show their working.

Full marks can be given for a correct numerical answer (including units), even though no working is shown.

5. Interpretation of 'it' and 'them'

Answers using the word 'it' or 'them' should be awarded marks only if it is clear that the 'it' or 'them' refers to the correct subject.

6. Errors carried forward

An error in the answers to a structured question should be penalised once only.

Allowances for errors carried forward are usually restricted to calculation questions. Where such allowances are permissible, the mark scheme includes a statement such as 'allow ecf'.

7. Phonetic spelling

The phonetic spelling of correct scientific terminology should be awarded marks unless there is a possible confusion with another technical term.

8. Brackets

(……) in this marks scheme indicates information that is not essential for a mark to be awarded, but is included to help you identify the sense of the required answer.

9. Ignore / insufficient / do not allow

'Ignore' or 'insufficient' are used in this marks scheme to indicate information that is irrelevant to the question or not enough to gain the mark. Further correct amplification could gain the mark.

'Do not allow' indicates that this is a wrong answer which, even if the correct answer is also given, still means that the mark should not be awarded.

'Level of response' marking instructions

'Level of response' mark schemes are broken down into levels, each of which is given a descriptor. The descriptor for a level shows the average performance for that level. There are marks allocated to each level.

Before applying the mark scheme to a student's answer, read through the answer and annotate it to show the qualities that are being looked for. 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 qualities given in the descriptor for that level. If the answer meets the lowest level, move up to the next level and repeat the assessment until you find a match between the descriptors and the answer.

When assigning a level, you should look at the overall quality of the answer and not be distracted by small details of the answer where the student may not have performed quite as well as their overall performance. If an answer covers different aspects of different levels of the mark scheme, use a 'best fit' approach: for example, if a response is predominantly level 2 with a small amount of level 3 material, place it in level 2 but award a mark near the top of the level because of the level 3 content.

Step 2 Determine a mark

The descriptors within each level can help with this, along with the exemplar answers or extra information given. Indicative content is provided as a guide. It is not exhaustive and you should credit other valid points in the answer. Students do not have to cover all of the points mentioned in the indicative content to reach the highest level of the mark scheme.

Ignore any responses that are irrelevant. However, only award full marks if there are no incorrect or contradictory responses.

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

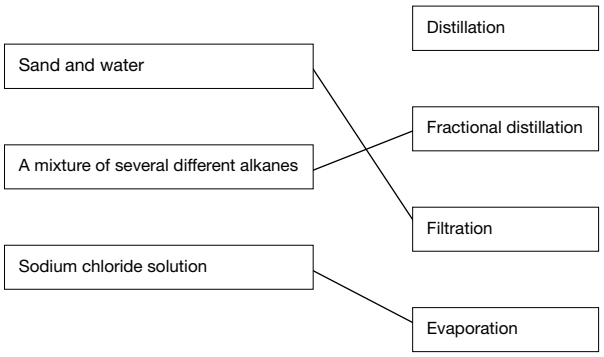
Read back through the full answer as you apply the mark scheme, so as to clarify points and assure yourself that the level and the mark are appropriate.

Paper 1

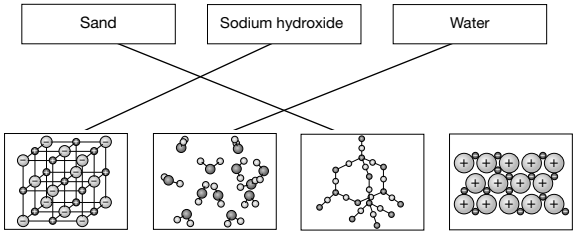
Question 01

QUESTION	ANSWERS	EXTRA INFORMATION	MARK	AO / SPEC. REF.
01.1	Newlands		1	AO1/4.1.2.2
01.2	Neon		1	AO1/4.1.2.2
01.3	Transition		1	AO1/4.1.3.2
	High		1	
	Mercury		1	
	Low		1	
	Coloured		1	
TOTAL			**7**	

Question 02

02.1		Accept a line drawn from sodium chloride solution to distillation 1 mark per line If a box on the left has two or more lines coming from it, ignore all lines	3	AO1/4.1.1.2
TOTAL			**3**	

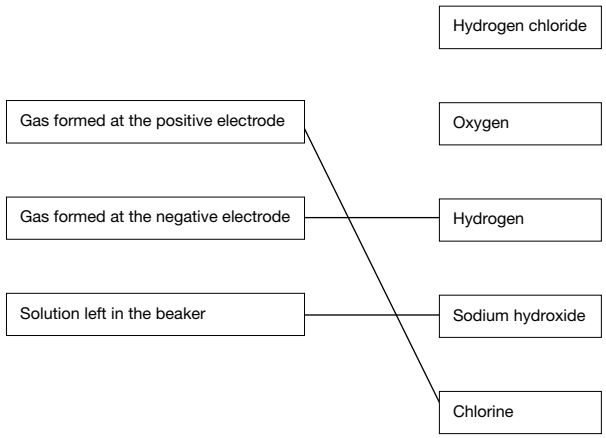
Question 03

QUESTION	ANSWERS	EXTRA INFORMATION	MARK	AO / SPEC. REF.
03.1	Sodium hydroxide		1	AO1/4.1.1.2
03.2	$2Na + 2H_2O \rightarrow 2NaOH + H_2$		1	AO1/4.1.1.1
03.3	A		1	AO1/4.1.1.7
03.4	+		1	AO1/4.1.2.5
03.5	Electron		1	AO1/4.1.1.3
03.6		1 mark per line If a box on the left has two or more lines coming from it, ignore all lines	3	AO1/4.2.1.3 AO1/4.2.1.4 AO1/4.2.1.5
TOTAL			**8**	

Question 04

04.1	A or B	1 mark if both A and B given. No marks if any of C, D or E given	1	AO1/4.1.2.3
04.2	C, D or E	1 mark if more than one of C, D or E given. No marks if either A or B given	1	AO1/4.1.2.3
04.3	D		1	AO1/4.1.2.6
04.4	E It has a full outer shell of electrons		1 1	AO1/4.1.2.4 AO2/4.1.2.4
TOTAL			**5**	

Question 05

QUESTION	ANSWERS	EXTRA INFORMATION	MARK	AO / SPEC. REF.
05.1		1 mark per line If there is more than one line coming from a box on the left-hand side, ignore both lines	3	AO1/4.4.3.4
TOTAL			**3**	

Question 06

06.1	C		1	AO1/4.4.2.2
06.2	A		1	AO1/4.4.2.1
06.3	D		1	AO1/4.4.2.2
06.4	B		1	AO1/4.4.2.2
TOTAL			**4**	

Question 07

07.1	7 + 16 + 1 = 24		1	AO2/4.3.1.2 MS 1c
07.2	60 ÷ 5 = 12 g/dm^3		1	AO2/4.3.2.5
TOTAL			**2**	

Question 08

QUESTION	ANSWERS	EXTRA INFORMATION	MARK	AO / SPEC. REF.
08.1	Protons = 26 Neutrons = 31 Electrons = 26		1 1 1	AO2/4.1.1.5
08.2	55.9	Just $\frac{(54 \times 6) + (56 \times 92) + (57 \times 2)}{100}$ gets 1 mark 55.9 without the working gets 2 marks 56 gets 1 mark	2	AO2/4.1.1.6
TOTAL			**5**	

Question 09

QUESTION	ANSWERS	EXTRA INFORMATION	MARK	AO / SPEC. REF.
09.1	250 times larger		1	AO2/4.2.4.1 MS 2h
09.2	$(2 \times 10^{-9} \times 1 \times 10^{-9}) \times 2 = 4 \times 10^{-18}$ m^2 $(6 \times 10^{-9} \times 2 \times 10^{-9}) \times 2 = 24 \times 10^{-18}$ m^2 $(6 \times 10^{-9} \times 1 \times 10^{-9}) \times 2 = 12 \times 10^{-18}$ m^2 total is 4×10^{-17} m^2		1	AO2/4.2.4.1
09.3	$2 \times 10^{-9} \times 1 \times 10^{-9} \times 6 \times 10^{-9}$ $= 12 \times 10^{-27}$ m^3 $= 1.2 \times 10^{-26}$ m^3		1	AO2/4.2.4.1
09.4	$4 \times 10^{-17} / 1.2 \times 10^{-26} = 3.3 \times 10^{9}$	Accept 3×10^{9} or 3.33×10^{9} Accept error carried forward for either number	2	AO2/4.2.4.1
09.5	Smaller quantities are needed They react faster due to a high(er) surface area to volume ratio		1 1	AO1/4.2.4.1
TOTAL			**7**	

Question 10

QUESTION	ANSWERS	EXTRA INFORMATION	MARK	AO / SPEC. REF.
10.1	Any **five** from: • Put the acid in the burette • Use a pipette to measure out a fixed volume of alkali • Use a white tile • Add indicator (to the alkali) • Add dropwise towards the end point/swirl the mixture • The titration is complete upon the colour change	Do not accept universal indicator. Accept a named indicator such as litmus, phenolphthalein or methyl orange. Accept changes from pink to colourless (for phenolphthalein) Accept yellow to red (for methyl orange) Accept blue to red (for litmus)	5	AO2/4.4.2.5 WS2.6
TOTAL			**5**	

Question 11

QUESTION	ANSWERS	EXTRA INFORMATION	MARK	AO / SPEC. REF.
11.1	Any **one** from: • Saucepans • Overhead power cables • Aeroplanes • Cooking foil • Drink cans • Window and door frames • Bicycle frames • Car bodies		1	AO1/4.4.3.3
11.2	Cryolite reduces the melting point of aluminium oxide It saves energy (which saves money)		1 1	AO1/4.4.3.3
11.3	Oxygen		1	AO1/4.4.3.3
11.4	The oxygen reacts with the carbon forming (carbon dioxide) gas	Accept the gas mentioned in 11.3	1 1	AO1/4.4.3.3
TOTAL			**6**	

Question 12

QUESTION	ANSWERS	EXTRA INFORMATION	MARK	AO / SPEC. REF.
12.1	total mass of reactants or products = 180 mass of ethanol = 2 × 46 = 92 atom economy = $\frac{\text{mass of wanted product}}{\text{total mass of reactants}} \times 100$ $= \frac{92}{180} \times 100$ = 51.1%		1 1 1 1	AO2/4.3.3.2
12.2	There is only one product		1	AO2/4.3.3.2
TOTAL			**5**	

Question 13

13.1	percentage yield $= \frac{\text{actual yield}}{\text{expected yield}} \times 100$ $= \frac{1750}{2000}$ = 87.5%	Accept 87.5% with no working for 2 marks	1 1	AO2/4.3.3.1
13.2	Any **one** from: • some of the product may be lost when it is separated from the reaction mixture • some of the reactants may react in ways different to the expected reaction	Do not accept any reference to reversible reactions as the equation shows that the reaction is not reversible	1	AO1/4.3.3.1
TOTAL			**3**	

Question 14

QUESTION	ANSWERS	EXTRA INFORMATION	MARK	AO / SPEC. REF.
14.1	Any **one** from: • Wear safety goggles • Do not boil the acid		1	AO3/4.4.2.3
14.2	Filtration		1	AO3/4.4.2.3
14.3	Let the water evaporate slowly		1	AO3/4.4.2.3
TOTAL			**3**	

Question 15

15.1	The (positively charged) nucleus attracts the (negatively charged) electrons		1	AO3/4.1.2.6
	The outer electrons in fluorine are closest to the nucleus		1	
	As you go down the group, there is more shielding between the nucleus and the outer shell electrons	Accept distance from the nucleus increases down the group or its converse	1	
	As you go down group 7, it is harder for an element to gain an electron and achieve a full outer shell	Accept converse	1	
15.2	Any number between –8 and –219	The actual melting point of chlorine is –101 °C	1	AO3/4.1.2.6
TOTAL			**5**	

Question 16

QUESTION	ANSWERS	EXTRA INFORMATION	MARK	AO / SPEC. REF.
16.1	**Level 3:** There is an explanation for three states.	5–6 marks		AO2/4.2.2.1
	Level 2: There is an explanation for two states.	3–4 marks		
	Level 1: There is an explanation for one state.	1–2 marks		
	No relevant content	0		
	Examples of points that could be made include: • In solids, the particles cannot move. • In solids, the distance between the particles is very small. • In liquids, particle can move. The particles move in a random arrangement. • In liquids, the distance between the particles is very small. • In gases, the particles can move. • In gases, the particles spread out as far as possible so that take up as much space as possible.		1 1 1 1 1 1	
TOTAL			**6**	

Question 17

17.1	0 or 0.00		1	AO2/4.5.2.1
17.2	Magnesium and copper They have the largest difference in reactivity		1 1	AO3/4.5.2.1
TOTAL			**3**	

Question 18

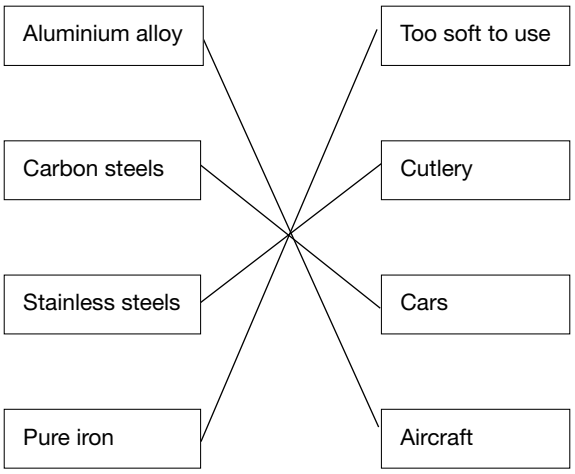
QUESTION	ANSWERS	EXTRA INFORMATION	MARK	AO / SPEC. REF.
18.1	Any **four** from: • Metals have high melting points • Because there are many (electrostatic attractions) • There are electrostatic attractions between positive metal ions and negative electrons • The electrostatic attractions require a lot of energy to break • Metals conduct heat well • Because they have free electrons		4	AO2/4.2.2.7
18.2	Wood does not conduct heat		1	AO1/4.2.2.6
18.3	A		1	AO1/4.2.2.5
18.4	There are weak forces between the molecules They require little energy to break Water has a low boiling point	Do not accept weak bonds Accept weak intermolecular forces	1 1 1	AO2/4.2.2.5
TOTAL			**9**	

Question 19

QUESTION	ANSWERS	EXTRA INFORMATION	MARK	AO / SPEC. REF.
19.1	Any **one** from: • Use a polystyrene cup/ insulate the beaker • Stir the mixture		1	AO3/4.5.1.1
19.2	7.1 (°C)	Correct answer gains 2 marks 7.13 gains 1 mark due to an incorrect number of significant figures (7.2 + 7.2 + 7.0)/3 gains 1 mark	2	AO2/2a AO2/2b
19.3	It is an anomaly/it does not fit the pattern		1	AO2/2b
19.4	All points correct Best fit line correct	½ a small square Allow ecf for the mean result of 2g Allow 1 mark for 3–4 points correct	2 1	AO2/4c AO3/4a
19.5	Any number below 6.1 (°C) Lead is less reactive than zinc	 Accept converse	1 1	AO3/4.4.1.2
19.6	The products line is lower than the reactants line There is a hump between the reactants and products line to show the activation energy		1 1	AO2/4.5.1.2
TOTAL			**11**	

Paper 2

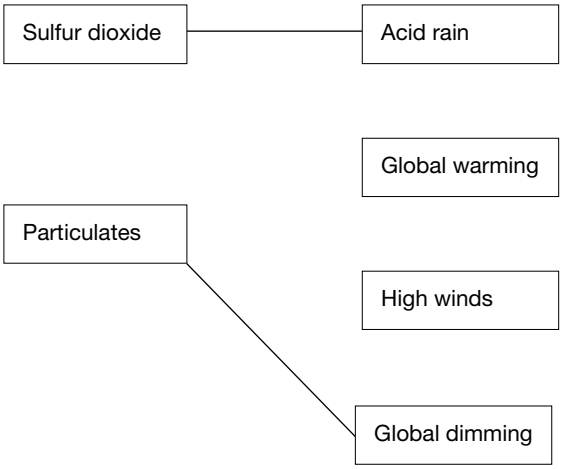
Question 01

QUESTION	ANSWERS	EXTRA INFORMATION	MARK	AO / SPEC. REF.
01.1		1 mark per line Ignore any boxes that have two or more lines drawn from them	4	AO1/4. 10.3.2
TOTAL			**4**	

Question 02

02.1	A		1	AO1/4.6.1.1
02.2	Use more concentrated acid Use smaller pieces of sodium carbonate		1 1	AO1/4.6.1.2
02.3	They collide They have enough energy to react		1 1	AO1/4.6.1.3
02.4	Endothermic		1	AO1/4.5.1.1
02.5	The energy required to start the reaction		1	AO1/4.5.1.2
02.6	Use a catalyst		1	AO1/4.6.1.2
TOTAL			**8**	

Question 03

QUESTION	ANSWERS	EXTRA INFORMATION	MARK	AO / SPEC. REF.
03.1	Combustion is a reaction where a substance reacts with **oxygen**. Carbon monoxide and particulates are formed when the alkanes in the petrol undergo **incomplete** combustion. Nitrogen reacts with oxygen to form nitrogen oxides in an engine because of the high **temperature** there. There is an impurity in some fuels called **sulfur**. When it reacts with oxygen and forms an oxide, it forms acid rain.	1 mark per correct term	4	AO1/4.9.3.1
03.2		1 mark per line Award no marks if there is more than one line from a box.	2	AO1/4.9.3.2
03.3	Severe storms Rising sea levels		1 1	AO1/4.9.2.3
03.4	Any **four** from: • People disagree over the causes of global climate change. • People disagree over the consequences of global climate change. • Developing countries might have their development restricted by restrictions on carbon dioxide production. • Manufacturing and transport industries will face increased costs. • People may feel that their contributions will have no effect.		4	AO3/4.9.2.4
TOTAL			**12**	

Question 04

QUESTION	ANSWERS	EXTRA INFORMATION	MARK	AO / SPEC. REF.
04.1	Polymers have covalent bonds Covalent substances do not conduct heat		1 1	AO2/4.2.2.5
04.2	Thermosetting polymers have higher melting points because there are strong cross-links between the chains. The cross-links require a lot of energy to break.		1 1 1	AO2/ 4.10.3.3 WS 1.4, 3.5. 3.8
TOTAL			**5**	

Question 05

QUESTION	ANSWERS	EXTRA INFORMATION	MARK	AO / SPEC. REF.
05.1	1×10^{-1} cm^3		1	AO1/4.9.3.1
05.2	Working is $\frac{26.4 + 26.3}{2}$ Answer is 26.35 cm^3 Answer given to 3 sf (26.4 cm^3)	26.7 cm^3 gains 2 marks (27.5 cm^3 used in the average) 26.73 cm^3 gains 1 mark (27.5 cm^3 used in the average and did not use the correct number of significant figures) 26.35 cm^3 gains 2 marks (did not use the correct number of significant figures)	1 1 1	AO1/4.9.3.2
05.3	Crystallisation		1	AO1/4.1.1.2
05.4	Phosphoric acid, H_3PO_4		1	AO1/ 4.10.4.2
05.5	Any **one** from: • The reactants are concentrated • There are more reactants so more heat is released		1	AO2/ 4.10.4.2
05.6	It is a continuous process		1	AO2/ 4.10.4.2
TOTAL			**8**	

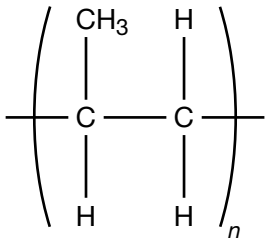
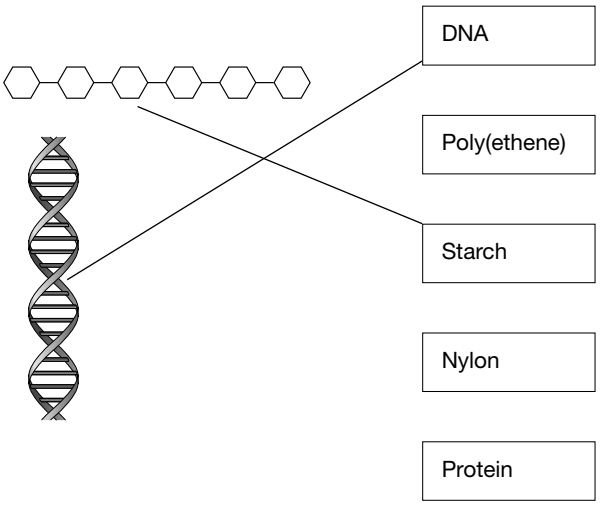
Question 06

QUESTION	ANSWERS	EXTRA INFORMATION	MARK	AO / SPEC. REF.
06.1	26 000 000 000		1	AO1/4.9.3.1
06.2	$2.6 \times 10^{10} - 2 \times 10^{9} = 2.4 \times 10^{10}$	Accept 24 000 000 000	1	AO1/4.9.3.2
	Evidence of $\frac{2.4 \times 10^{10}}{2.6 \times 10^{10}} \times 100$	Accept $\frac{24\,000\,000\,000}{26\,000\,000\,000} \times 100$	1	
	92%	Accept 92.3%	1	
TOTAL			**4**	

Question 07

QUESTION	ANSWERS	EXTRA INFORMATION	MARK	AO / SPEC. REF.
07.1	carbon		1	AO1/4.9.3.1
	water		1	AO1/4.7.1.3
	carbon dioxide		1	AO1/4.7.1.3
07.2	Catalyst	allow named catalyst, e.g. zeolite, Al_2O_3, silica, ceramic, porous pot	1	AO2/4.7.1.4
	(Very) high temperature	Allow temperatures of 500 °C or more	1	
07.3	C_3H_6		1	AO2/4.7.1.4
07.4	Any **two** from: • It produces small alkanes that can be used as fuels. • It produces alkenes that can be used to make polymers. • Large alkanes do not make good fuels.		2	AO2/4.7.1.4
TOTAL			**8**	

Question 08

QUESTION	ANSWERS	EXTRA INFORMATION	MARK	AO / SPEC. REF.
08.1		two single trailing bonds extending from the carbons (through the brackets) five single bonds (1 C–C bond, 1 C–CH_3 bond and 3 C–H bonds) structure in bracket and *n* at the bottom right corner only	1 1 1	AO2/4.7.3.1
08.2	Poly(propene)	Accept polypropylene	1	AO2/4.7.3.1
08.3		Ignore if any box has more than one line drawn from it	2	AO1/4.7.3.4
TOTAL			**6**	

Question 09

QUESTION	ANSWERS	EXTRA INFORMATION	MARK	AO / SPEC. REF.
09.1	Points plotted correctly Best fit line drawn correctly		2 1	AO2/4.6.2.1 AO3/4.6.2.1 4a
09.2	1 – 0.22 = 0.78 0.78 ÷ 15 = 0.052 mol/minute		1 1 1	AO2/4.6.2.1 2b
09.3	There are more particles of reactant		1	AO2/4.6.2.1
09.4	11 minutes		1	AO2/4.6.2.1
TOTAL			**8**	

Question 10

QUESTION	ANSWERS	EXTRA INFORMATION	MARK	AO / SPEC. REF.
10.1	Substance D moves 4 cm		1	AO2/4.8.1.3
	The distance between the start line and the solvent front is 7 cm		1	
	4 ÷ 7		1	
	= 0.5714		1	
	Answer to 2 sf is 0.57		1	
10.2	Dyes A and C		1	AO2/4.10.3.3
	All the dots for both dyes are at the same height		1	WS 1.4, 3.5. 3.8
10.3	D		1	AO2/4.8.1.3
	It is made up of a single substance/there is only one spot on the chromatogram.		1	
TOTAL			**7**	

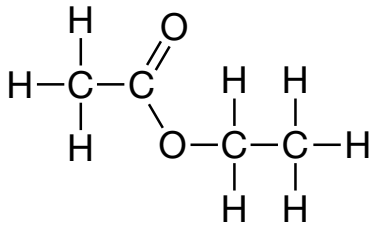
Question 11

11.1	Compound 1 is sodium chloride.		1	AO3 4.8.3.1, 3, 4 WS 2.2
	Yellow flame, so there are sodium ions present.		1	
	It makes a white precipitate when added to acidified silver nitrate, so there are chloride ions present.		1	
	Compound 2 is calcium carbonate.		1	
	Orange flame, so there are calcium ions present.		1	
	When it reacts with acid, a gas is produced which makes limewater cloudy, so carbon dioxide is present.		1	
11.2	barium	accept Ba	1	AO1/4.8.3.7
TOTAL			**7**	

Question 12

QUESTION	ANSWERS	EXTRA INFORMATION	MARK	AO / SPEC. REF.
12.1	oxygen water	accept O/O_2 accept H_2O	1 1	AO1/4.6.1.4 WS 2.2, 7, 3.5
12.2	The iron would not be rusty The magnesium would have a white solid on it		1 1	AO2/4.6.1.4 WS 2.2, 7, 3.5
12.3	Magnesium is more reactive (than iron) Magnesium reacts with the oxygen and water instead of the iron	must be a comparative	1 1	AO2/4.6.1.4
TOTAL			**6**	

Question 13

QUESTION	ANSWERS	EXTRA INFORMATION	MARK	AO / SPEC. REF.
13.1	$C_2H_5OH + 3O_2 \rightarrow 3H_2O + 2CO_2$	1 mark for correct reactants (order not important) accept C_2H_6O for ethanol 1 mark for correct products (order not important) 1 mark for the correct stoichiometry	3	AO3/4.7.2.3
13.2	ethanoic acid	accept acetic acid	1	AO1/4.7.2.3
13.3			1	AO1/4.7.2.4
13.4	bubbles/fizzing the piece of sodium gets smaller		1 1	AO1/4.7.2.3
13.5	Advantages: • renewable raw materials • carbon neutral Disadvantages: • batch reaction • the ethanol is not pure • it requires land to grow the plants	accept all converses when compared to reacting ethene with steam	1 1	AO1/4.7.2.3
TOTAL			**9**	

Question 14

QUESTION	ANSWERS	EXTRA INFORMATION	MARK	AO / SPEC. REF.
14.1	**Level 3:** A detailed and coherent argument is provided which considers a range of issues and comes to a conclusion consistent with the reasoning.	5–6 marks		AO3 4.7.1.2 4.7.1.4 4.10.2.1
	Level 2: An attempt to describe the advantages and disadvantages of the production and uses is made, which comes to a conclusion. The logic may be inconsistent at times but builds towards a coherent argument.	3–4 marks		
	Level 1: Simple statements made. The logic may be unclear and the conclusion, if present, may not be consistent with the reasoning.	1–2 marks		
	No relevant content.	0 marks		
	Advantages of paper bags: • made from renewable materials • they break down in landfill • can be recycled		1	
	Disadvantages of paper bags: • requires lots of water to make • bleach and acid will pollute water		1	
	Advantages of plastic bags: • they don't break down so they can be reused more		1	
	Disadvantages of plastic bags: • made from non-renewable materials • the energy required for the high temperature and pressure releases lots of CO_2 • they do not break down in landfill		1	
	Conclusion (with reason)		2	
TOTAL			**6**	

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Author Stuart Lloyd

Editorial Team Aidan Gill, Turnstone Solutions Limited, Tim Jackson

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