



*Rewarding Learning*

**General Certificate of Secondary Education  
2016**

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**Double Award Science: Chemistry**

Unit C2

Higher Tier

**[GSD52]**

**WEDNESDAY 15 JUNE 2016, AFTERNOON**

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**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.

			AVAILABLE MARKS	
1	(a)	It speeds up the reaction/lowers the activation energy [1] Idea that it is not used up/does not react/does not take part in the reaction [1]	[2]	7
	(b)	(i) Accept answers in range 27–28 cm <sup>3</sup> But not, e.g. 28 or 28 gas/cm <sup>3</sup> correct units needed	[1]	
		(ii) 76 ± 1 s units not needed	[1]	
		(iii) Rate slows down/decreases	[1]	
	(c)	Steeper slope [1] double volume of gas [1]	[2]	
2	(a)	(i) carbon dioxide	[1]	
		(ii) $2\text{C} + \text{O}_2 \rightarrow 2\text{CO}$ LHS [1] RHS [1] balancing (if all formulae correct) [1]	[3]	
		(iii) toxic/poisonous/silent killer [1] <b>not</b> just 'kills' no colour/smell/taste <b>or</b> idea of it combining with haemoglobin/red blood cells [1] <b>or</b> (alternative answer) idea of it combining with haemoglobin/red blood cells [1] idea of this (combining) being in place of oxygen/reducing oxygen/being irreversible [1]	[2]	
	(b)	(i) $\text{CO}_2 + \text{H}_2\text{O} \rightarrow \text{H}_2\text{CO}_3$	[1]	
		(ii) Carbonic acid	[1]	
	(c)	(i) calcium carbonate	[1]	
		(ii) Explicit idea that calcium carbonate/the precipitate reacts [1] to give calcium hydrogen carbonate [1] i.e. temporary hardness is caused by calcium hydrogen carbonate Explicit that calcium hydrogen carbonate/the <b>product</b> from the reaction is soluble/has dissolved [1]	[3]	
		<b>Do not credit</b> idea that “the precipitate”/“calcium carbonate” dissolves, i.e. the final marking point is dependent on recognising that the precipitate has reacted.		12

### 3 Indicative points:

#### Effects of acid rain

- corrosion of (limestone) buildings/statues/metal (e.g. bridges/cars) **not** “destroys”, or “dissolves” **not** rocks
- kills fish/aquatic life (ignore ref. to animal habitats or animals)
- idea of defoliation/damages trees or plants/or crops/deforestation
- specific economic reason 1
- specific economic reason (2) – or idea of causing respiratory problems/asthma – not just health

**Not** any answer relating to increasing global warming

#### Preventing acid rain

- burn less fossil fuels/use alternative fuel/energy sources/limiting transportation
- idea of removing sulfur dioxide from industrial/vehicle emissions **NB not** removing sulfur
- idea of desulfurization i.e. removing sulfur from fuels
- idea of government legislation (clean air act)

Response	Marks
Candidates must use specialist terms throughout. (6–9 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 (4–5 indicative points required). They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3]–[4]
Candidates give 1–3 of the indicative points but not necessarily in a logical sequence. They use limited spelling, punctuation and grammar and they have made little use of specialist terms.	[1]–[2]
Response not worthy of credit. Candidates make no reference to the points above and offer no other suitable response.	[0]

[6]

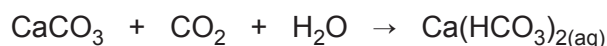
AVAILABLE  
MARKS

6

			AVAILABLE MARKS		
4	(a) (i)	17	[1]	11	
	(ii)	106	[1]		
	(iii)	58	[1]		
	(b)	The relative formula mass (RFM) [1] of the substance in grams [1] second mark dependant on first			
		Alternative answer 1: The mass of a substance which contains the same number of particles as there are in 12 g of the carbon-12 isotope [2]			
		Alternative answer 2: Idea that a mole contains $6 \times 10^{23}$ particles [2]	[2]		
	(c) (i)	38.4 (g)	[1]		
	(ii)	5	[1]		
	(d) (i)	0.025 (moles) [2] If answer incorrect then 1 method mark can be awarded for either a method that shows that 8.5g is 0.05 moles (of silver nitrate) or that the reactants are needed in a 2 : 1 ratio	[2]		
	(ii)	17 (g) [2] If answer incorrect then 1 method mark can be awarded for either a method that shows that 0.1 mole (of silver nitrate) is needed or that a 1 : 1 ratio is needed	[2]		
5	(a) (i)	white [1] to blue [1]	[2]	12	
	(ii)	exothermic	[1]		
	(b) (i)	$\text{CuCO}_3 \rightarrow \text{CuO} + \text{CO}_2$ LHS [1]                      RHS [1]	[2]		
	(ii)	colour change from green [1] to black [1]	[2]		
	(c)	Bonds are broken in named reactants (propane 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] <b>Clear</b> idea that the reaction is exothermic because <b>more</b> energy is released in bond making than is needed for bond breaking – <b>No</b> credit for simply stating that reaction is exothermic because heat/energy is given out [1] MAX = (5 × [1])	[5]		
		<i>The first and third marking points require named reactants and products to be given.</i>			
		<i>if answer is a generic one then maximum mark is [3]</i>			
		<i>if only 2 of the 4 chemicals are appropriately referred to i.e. either both reactants or both products or only 1 of each then award <b>either</b> marking point 1 or marking point 3 but not both.</i>			
		<i>i.e. maximum mark for a non generic answer which only names 2 of the 4 chemicals is [4]</i>			
		<i>for all [5] marks at least 3 of the 4 chemicals must be explicitly referred to.</i>			

- 6 (a) Any **three** of:  
 wastes soap (**not** doesn't lather with soap)  
 produces (lime)scale (or fur) in pipes/boilers/kettles (allow "blocks **hot** water pipes" but **not** "blocks pipes") **not** scale on its own  
 produces scum **with soap**  
 one clear, explicit economic disadvantage, e.g. the need to buy dishwasher salt **or** need to replace kettles or other correct, e.g. idea of not being good for washing clothes/hair or "stains clothes"  
 any 3 × [1] [3]

- (b) Any **three** of:  
 idea of water, limestone (calcium carbonate) and carbon dioxide all being needed [1]  
 water reacts with carbon dioxide to form carbonic acid [1]  
 carbonic acid (or water and carbon dioxide react with limestone to form a **soluble** calcium compound [1]  
 calcium hydrogen carbonate (is the chemical present in temporary hard water) [1]  
 max 3 × [1] a correct equation can gain all three marks [3]



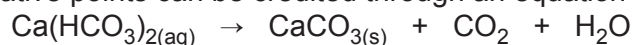
If role of carbon dioxide is completely missed but candidate has idea of calcium carbonate and water forming a soluble calcium compound/calcium hydrogen carbonate award [1]

(c) **Indicative points:**

Boiling

- clear idea of thermal decomposition
- calcium hydrogen carbonate is decomposed
- calcium carbonate is produced
- the product (calcium carbonate) is insoluble (in water)
- clear idea that calcium ions are removed from solution (making the water soft)

NB: indicative points can be credited through an equation



Ion exchange

- idea that there are sodium ions present (accept hydrogen ions) in the resin/ion exchanger
- the sodium/hydrogen ions replace the calcium ions
- calcium ions are removed from solution making the water soft/  
sodium ions do not cause hardness

Response	Marks
Candidates must use specialist terms throughout. (6–8 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 (4–5 indicative points required). They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3]–[4]
Candidates give 2–3 of the indicative points but not necessarily in a logical sequence. They use limited spelling, punctuation and grammar and they have made little use of specialist terms.	[1]–[2]
Response not worthy of credit. Candidates make reference to less than 2 of the points above and offer no other suitable response.	[0]

[6]

12

- 7 (a) Clear idea that crude oil is heated (to 400 °C) [1]  
 idea that it undergoes a series of evaporations and condensations/vapours  
 condense at different temperatures/idea that fractions condense/or collected  
 at different levels in the column [1]  
 fractions are separated due to differences in boiling point [1] [3]

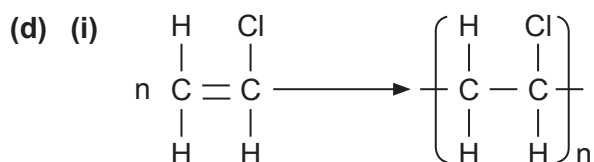
(b)

Name	Molecular Formula	Structural Formula
Ethanol	$C_2H_5OH$ [1]	$  \begin{array}{c}  H \quad H \\    \quad   \\  H - C - C - OH \\    \quad   \\  H \quad H  \end{array}  $ [1]
Ethene	$C_2H_4$ [1]	$  \begin{array}{c}  H \qquad \qquad H \\  \diagdown \quad \diagup \\  \quad C = C \\  \diagup \quad \diagdown \\  H \qquad \qquad H  \end{array}  $ [1]

\*1  $C_2H_6O$  and  $CH_3CH_2OH$  as alternatives to the  $C_2H_5OH$  molecular formula  
 for ethanol [4]

\*2  $CH_2 = CH_2$  and  $CH_2 - CH_2$  as alternatives to the  $C_2H_4$  molecular formula  
 for ethene

- (c) (i) alkene [1]
- (ii) Bubble each gas into bromine **water/solution** [1]  
 idea that bromine water is orange [1]  
 ethene decolorises (bromine water) [1]  
 there is no decolorisation with ethane [1] [4]



correct monomer structure [1]  
 correct polymer repeating unit [1]  
 n before chloroethene [1]  
 indicating repeating unit  
 (repeat can be brackets and n after or a min of 3 repeating units) [1]  
 must be equation if not 3 mark max. [4]

- (ii) Suitable use [1] and linked property [1]  
 e.g. electric cable [1] good (electrical insulator) [1]  
 guttering/drainpipes [1] waterproof/tough/durable/can be coloured [1] [2]

8 (a) (i) Idea that the calcium carbonate (thermally) decomposes [1] forming calcium oxide [1] and carbon dioxide [1]	[3]	<b>AVAILABLE MARKS</b>
(ii) Carbon/coke reacts with carbon dioxide [2] Carbon/coke reacts with oxygen [1]	[2]	
(b) $\text{Fe}_2\text{O}_3 + 3\text{CO} \rightarrow 2\text{Fe} + 3\text{CO}_2$ LHS [1]                      RHS [1] balancing, if all formulae correct [1]	[3]	
(c) It is a reduction [1] aluminium <b>ions</b> are gaining electrons [1]	[2]	
(d) (i) nitrogen	[1]	
(ii) the reaction is reversible	[1]	12
<b>Total</b>		<b>90</b>