OCR
RECOGNISING ACHIEVEMENT

GCE

Chemistry

Advanced GCE **2815/03**

Environmental Chemistry

Mark Scheme for June 2010

Oxford Cambridge and RSA Examinations

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by Examiners. It does not indicate the details of the discussions which took place at an Examiners' meeting before marking commenced.

All Examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the Report on the Examination.

OCR will not enter into any discussion or correspondence in connection with this mark scheme.

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ADVICE TO EXAMINERS ON THE ANNOTATION OF SCRIPTS

1 Please ensure that you use the **final** version of the Mark Scheme.
You are advised to destroy all draft versions.

2 Please mark all post-standardisation scripts in red ink. A tick (□) should be used for each answer judged worthy of a mark. Ticks should be placed as close as possible to the point in the answer where the mark has been awarded. The number of ticks should be the same as the number of marks awarded. If two (or more) responses are required for one mark, use only one tick. Half marks ($\frac{1}{2}$) should never be used.

3 The following annotations may be used when marking. No comments should be written on scripts unless they relate directly to the mark scheme.

x = incorrect response (errors may also be underlined)
^ = omission mark
bod = benefit of the doubt (where professional judgement has been used)
ecf = error carried forward (in consequential marking)
con = contradiction (in cases where candidates contradict themselves in the same response)
sf = error in the number of significant figures

4 The marks awarded for each part question should be indicated in the margin provided on the right hand side of the page. The mark total for each question should be ringed at the end of the question, on the right hand side. These totals should be added up to give the final total on the front of the paper.

5 In cases where candidates are required to give a specific number of answers, (e.g. 'give three reasons'), mark the first answer(s) given up to the total number required. Strike through the remainder. In specific cases where this rule cannot be applied, the exact procedure to be used is given in the mark scheme.

6 Correct answers to calculations should gain full credit even if no working is shown, unless otherwise indicated in the mark scheme. (An instruction on the paper to 'Show your working' is to help candidates, who may then gain partial credit even if their final answer is not correct.)

7 Strike through all blank spaces and/or pages in order to give a clear indication that the whole of the script has been considered.

8 An element of professional judgement is required in the marking of any written paper, and candidates may not use the exact words that appear in the mark scheme. If the science is correct and answers the question, then the mark(s) should normally be credited. If you are in doubt about the validity of any answer, contact your Team Leader/Principal Examiner for guidance.

9 Abbreviations, annotations and conventions used in the Mark Scheme

Abbreviations, annotations and conventions used in the Mark Scheme	/	= alternative and acceptable answers for the same marking point
	;	= separates marking points
	NOT	= answers which are not worthy of credit
	( )	= words which are not essential to gain credit
	____	= (underlining) key words which **must** be used to gain credit
	ecf	= error carried forward
	AW	= alternative wording
	ora	= or reverse argument

Question	Expected Answers	Marks
1 (a)	Standard conditions are 298 K and 100 kPa / 1 atm ✓ Temperature/pressure are lower than these **OR** varies with height ✓	**2**
(b)(i)	4 ✓	**1**
(b)(ii)	Steps 2 and 3 ✓ The chlorine radical/atom is regenerated in step 3 ✓	**2**
(b)(iii)	Diagram of oxygen radical with 6 electrons in outer shell ✓ Diagram of oxygen ion with 8 electrons in outer shell with 2- charge ✓	**2**
(c)(i)	It absorbs harmful UV	**1**
(c)(ii)	It causes photochemical smog/it is toxic ✓	**1**
(c)(iii)	Long residence time ✓ Caused by lack of reactivity/slow diffusion ✓	**2**
(c)(iv)	**Two** from: Non-toxic Volatility Non-flammable Reactive in troposphere Low residence time Not greenhouse effect	**2**
	Total	**13**

Question	Expected Answers	Marks
2 (a)(i)	Clear diagram ✓ Tetrahedral shape stated ✓	2
(a)(ii)	$Si_2O_7^{6-}$ formula ✓ and charge ✓ (ecf)	2
(a)(iii)	$Ca_3Si_2O_7$ ✓ (ecf)	1
(b)	1:1 means that there is 1 silicate layer and 1 aluminate layer ✓ 2:1 means 2 silicate layers for every 1 aluminate layer ✓ Not octahedral/tetrahedral	2
(c)(i)	**A** is a 1:1 clay and **B** is a 2:1 clay ✓ Layers in 1:1 clays are hydrogen bonded so less surface area for cations to be held and hence a smaller CEC. ✓ 2:1 clays expand between layers allowing more ions to be held and hence a greater CEC ✓	3
(c)(ii)	One named nutrient ion or formula with charge ✓ Held at cation exchange sites and taken up by plant roots ✓	2
(c)(iii)	Hydrogen ions displace ions from cation exchange sites ✓ which are then washed away ✓	2
	Total	**12**

Question	Expected Answers	Marks
3 (a)	Absence of air/oxygen ✓	1
(b)	H_2S (name or formula) ✓ Toxic/foul smelling ✓	2
(c)	Advantages - **two** from Avoids landfill ✓ Gets rid of non-biodegradable plastics ✓ Can be used to supply energy ✓ Disadvantages – **two** from Some plastics produce toxic products ✓ Gases released may contribute to greenhouse✓ effect (gas must be named) ✓ QWC – give mark for QoWC unless more than 3 mistakes ✓	4 1
	Total	8

Question	Expected Answers	Marks
4 (a)(i)	Magnesium carbonate reacts with CO_2 and water to form aqueous magnesium hydrogencarbonate ✓ $MgCO_3(s) + H_2O(l) + CO_2(g) \rightarrow Mg(HCO_3)_2(aq)$ Equation (Ignore state symbols) ✓	2
(a)(ii)	Any 2 from: % of $MgCO_3$ in the rock ✓ speed of water flow ✓ temperature of the water ✓ pH of the water ✓ concentration of carbon dioxide in the water ✓	2
(b)	The hydrogencarbonate present decomposes when heated ✓ To form an insoluble carbonate ✓	2
(c)	Aluminium ions attract fine particles/neutralises negative charges on particles ✓ which cause the particles to coagulate and sink (AW) ✓ Chlorine destroys bacteria ✓ And provides protection from further contamination/prevents disease ✓	4
	Total	12

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