

GCE

Chemistry B (Salters)

Unit **F332**: Chemistry of Natural Resources

Advanced Subsidiary GCE

Mark Scheme for June 2017

OCR (Oxford Cambridge and RSA) is a leading UK awarding body, providing a wide range of qualifications to meet the needs of candidates of all ages and abilities. OCR qualifications include AS/A Levels, Diplomas, GCSEs, Cambridge Nationals, Cambridge Technicals, Functional Skills, Key Skills, Entry Level qualifications, NVQs and vocational qualifications in areas such as IT, business, languages, teaching/training, administration and secretarial skills.

It is also responsible for developing new specifications to meet national requirements and the needs of students and teachers. OCR is a not-for-profit organisation; any surplus made is invested back into the establishment to help towards the development of qualifications and support, which keep pace with the changing needs of today's society.

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.

© OCR 2017

Annotations

Annotation	Meaning
DO NOT ALLOW	Answers which are not worthy of credit
IGNORE	Statements which are irrelevant
ALLOW	Answers that can be accepted
()	Words which are not essential to gain credit
—	Underlined words must be present in answer to score a mark
ECF	Error carried forward
AW	Alternative wording
ORA	Or reverse argument

Subject-specific Marking Instructions**INTRODUCTION**

Your first task as an Examiner is to become thoroughly familiar with the material on which the examination depends. This material includes:

- the specification, especially the assessment objectives
- the question paper
- the mark scheme.

You should ensure that you have copies of these materials.

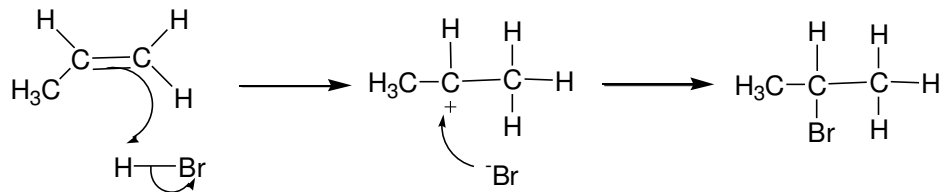
You should ensure also that you are familiar with the administrative procedures related to the marking process. These are set out in the OCR booklet **Instructions for Examiners**. If you are examining for the first time, please read carefully **Appendix 5 Introduction to Script Marking: Notes for New Examiners**.

Please ask for help or guidance whenever you need it. Your first point of contact is your Team Leader.

Question	Answer	Marks	Guidance
1ai	UV/ultraviolet	1	ALLOW visible
1aia	Infrared/IR (radiation)	1	IGNORE wavelength or frequency
1aiii	change in vibrational energy state/their bonds vibrate (more)	1	
1aiv	EITHER energy is transferred to other molecules by <u>collisions</u> , \checkmark thus increasing their <u>kinetic</u> energy (and raising the temperature) \checkmark OR molecules also (re-)emit (some of the absorbed) <u>IR</u> (in all directions) \checkmark (some of which) heats up the Earth \checkmark	2	ALLOW for 1 mark Increase in vibrational energy increases kinetic energy (of molecules) AW ALLOW a mixed answer here – eg molecules emit IR increasing kinetic energy of (surrounding) molecules (and raising temp) Last marking point must be in context of IR
1av	Energy/heat is lost/emitted \checkmark This balances (AW) the greenhouse effect/ heat gain \checkmark	2	ALLOW for one mark, amount of IR absorbed is constant/concentration of greenhouse gas is constant
1b	<i>one from:</i> \checkmark burn/use less fossil fuels scrub (AW) CO ₂ from chimneys	1	answers must be ways of <i>reducing emissions</i> , not of reducing the amount of CO ₂ present.
1c	double <u>covalent</u> bonds (in simple molecule) \checkmark polarised C δ^+ –O δ^- \checkmark no overall dipole/dipoles cancel out/ partial charges cancel out/ non polar/centres positive and negative charges co-incide \checkmark instantaneous dipole–induced dipole \checkmark	4	For mp1 allow C=O in diagram if covalent also stated Polar bond can be shown in diagram or described QWC ‘instantaneous dipole-induced dipole’ must be spelled correctly to score 4 th marking point.
1di	homolytic	1	
1dii	FIRST CHECK ANSWER ON ANSWER LINE If answer = 706 award 4 marks $E = 6.63 \times 10^{-34} \times 1.77 \times 10^{15} \checkmark$ $\times 6.02 \times 10^{23}$ and divide by 1000 \checkmark $= 706(.453\dots) \checkmark$ 706 (3 sf) \checkmark	4	allow ecf throughout mp1 can be scored later in calculation Award mp4 for any correctly evaluated calculation using at least 2 of the terms in the question that has been correctly rounded to 3 sf
1diii	+4 \checkmark +6, +6 \checkmark	2	Award 1 mark if all correct but + sign omitted or placed after the number

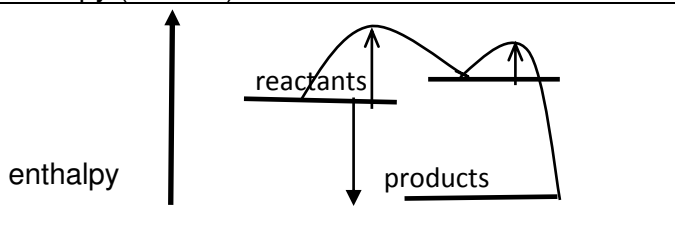
		19	
2ai	yellow precipitate ✓ $\text{Ag}^+(\text{aq}) + \text{I}^-(\text{aq}) \rightarrow \text{AgI}(\text{s})$ equation ✓ state symbols ✓	3	Both words required for the mark. ALLOW ppt ALLOW (aq) (aq) (s) for state symbol mark even if equation wrong
2aii	(large surplus of) white ppt will mask <u>yellow</u> AW ✓	1	
2b	Add chlorine (solution) ✓ Brown colour AND purple in hexane/ organic solvent ✓	2	ALLOW add bromine (solution) solution gets browner ALLOW add <u>conc.</u> NH_3 to 2ai ✓ AbBr and AgCl dissolve to leave yellow ppt (of AgI) ✓
2c	<u>Brown</u> colour	1	DO NOT ALLOW other colours IGNORE precipitate
2di	$(19.6 \times 1.5 \times 10^{-4} / 1000) \sqrt{} \times 0.5 \sqrt{} = 1.47 \times 10^{-6} \text{ mol}$	2	Second mark needs correct evaluation
2dii	mol iodate in 25 = $1.47 \times 10^{-6} / 3$ or 4.9×10^{-7} ✓ mol in 1000 = $(4.9 \times 10^{-7} \times 40) = 1.96 \times 10^{-5}$ ✓	2	ALLOW ecf from 2di ALLOW ecf for mp2 1.96×10^{-5} on answer line scores 2
2diii	mass = $1.96 \times 10^{-5} \times 214$ or $4.19(44) \times 10^{-3} \text{ g}$ ✓ ppm = 41.9 ppm ✓	2	ALLOW ecf from 2dii For mp2 ALLOW ecf for incorrect RFM ALLOW 42 ppm/two or more sf
2e	the iodide is oxidised by oxygen (in the air) ✓ <u>iodine</u> is volatile/vaporises/evaporates ✓	2	ALLOW iodide reacts to form iodine ALLOW "It" for iodide
2fi	(primary) amine ✓ carboxyl/carboxylic acid ✓ ether ✓	3	

2fii	109 ✓ four pairs/groups of electrons or areas of electron density ✓ (electrons) repel ✓ get as far away as possible ✓	4	ALLOW 104 – 110 QWC first marking point depends on second being correct IGNORE descriptions of shape ALLOW 4 regions of <u>negative</u> charge must be in the context of 'electrons repel' IGNORE 'repel as much as possible' 'minimise repulsion' scores last two marks
		22	

3ai	Δ \checkmark cyclopropane \checkmark	2	Mark independently ALLOW any unambiguous formula
3aii	one end of double bond (AW) has two hydrogens/two of same group \checkmark	1	DO NOT ALLOW functional group ALLOW Does not have 2 different groups on <u>each</u> C of C=C
3bi	C=C 1620 – 1680 (cm^{-1}) OR C–H 3000 – 3100 (cm^{-1})	1	
3bii	The fingerprint region/ region below 1500/1000 \checkmark can be compared with a database AW \checkmark	2	
3ci	$\text{C}_3\text{H}_8\text{O} \rightarrow \text{C}_3\text{H}_6 + \text{H}_2\text{O} \checkmark$	1	must be molecular formula for the alcohol
3cii	elimination	1	
3di	1 2 3 addition condensation substitution oxidation all three $\checkmark\checkmark$ two \checkmark	2	
3dii	$\text{CH}_3\text{CHBrCH}_3$ AND 2-bromopropane \checkmark	1	ALLOW any unambiguous formula
3diii	Bromine must be on centre carbon since C=O on centre carbon/ Bromine must be on centre carbon since OH on centre carbon (of alcohol / ketone is produced from secondary alcohol (AW) \checkmark	1	
3div	 <p>curly arrow on HBr and from C=C to H \checkmark secondary carbocation \checkmark attack by Br^- to form product \checkmark</p>	3	curly arrows must start (when extended back) to a bond or negative charge (or lone pair) on Br. They must end pointing to atom or (where appropriate) the bond between atoms. Mp1 and mp3 can still be awarded if mechanism is for 1-bromopropane
3dv	propan-2-ol	1	ALLOW propan-1-ol as ecf if 1-bromopropane given as answer to 3dii
3dvi	secondary \checkmark	1	ALLOW primary as ecf if 1-bromopropane given as answer to 3dii
3dvii	ketone	1	
3ei	addition	1	DO NOT ALLOW additional

3eii	$\begin{array}{c} \text{CH}_3 \quad \text{H} \\ \quad \\ \text{---C---C---} \\ \quad \\ \text{H} \quad \text{H} \end{array}$	1	ALLOW any unambiguous representation. IGNORE brackets and 'n' but 'continuation bonds must be shown.
3eiii	Softens/melts when heated/warmed	1	ALLOW can be remoulded/deformed when heated/warmed
		21	
4a	<p>rate faster ✓</p> <p>more frequent <u>collisions</u> with energy greater than activation enthalpy ✓</p> <p>Lower yield (AW) ✓</p> <p>(Forward reaction is) exothermic ORA ✓</p>	4	QWC second mark cannot be scored without first. ALLOW more frequent successful (particle) <u>collisions</u> / more successful (particle) <u>collisions</u> per unit time
4bi	<p>Increased pressure more yield (ORA)✓</p> <p>Fewer moles/molecules/particles on the right/fewer product molecules ✓</p>	2	Mark independently Must include a statement of higher or lower (AW) pressure
4bii	cost and danger AW ✓	1	
4ci	<p>ethanal – distillation ✓</p> <p>ethanoic acid – (heat under) reflux (then distil) ✓</p>	2	For mp1 DO NOT ALLOW references to reflux
4cii	$\begin{array}{ccc} \begin{array}{c} \text{H} \quad \text{H} \\ \quad \\ \text{H}-\text{C}-\text{C}-\text{O}-\text{H} \\ \quad \\ \text{H} \quad \text{H} \end{array} & \begin{array}{c} \text{H} \\ \\ \text{H}-\text{C}-\text{C}=\text{O} \\ \quad \\ \text{H} \quad \text{H} \end{array} & \begin{array}{c} \text{H} \\ \\ \text{H}-\text{C}-\text{C}=\text{O} \\ \quad \\ \text{H} \quad \text{OH} \end{array} \\ \text{ethanol} & \text{ethanal} & \text{ethanoic acid} \end{array}$ <p>✓✓ for all three; ✓ for two correct</p>	2	ALLOW 1 mark for three correct structures that are not full structural Must show O-H bond in ethanol and ethanoic acid
4ciii	<p>instantaneous dipole-induced dipole ✓</p> <p>hydrogen bonds ✓</p> <p>$\text{O}^{\delta-}-\text{H}^{\delta+} \text{---} \text{:O}$ ✓</p>	4	IGNORE permanent dipole-permanent dipole Lone pair on O must be in line with hydrogen bond ALLOW ecf for incorrect structure of ethanol from 4cii

4civ	Ethanol and ethanoic acid have hydrogen bonds ✓ permanent dipole-permanent dipole bonds in ethanal ✓ so more energy is required to break hydrogen bonds (than other intermolecular bonds) ORA ✓	3	Mark independently IGNORE hydrogen bonds are stronger
		18	

5a	chlorine atoms catalysing the breakdown of ozone AW	1	ALLOW equation
5b	$2\text{Co}^{2+} + \text{H}_2\text{O}_2 + 2\text{H}^+ \text{-----} > 2\text{Co}^{3+} + 2\text{H}_2\text{O} \checkmark$ $\text{C}_4\text{H}_4\text{O}_6^{2-} + 6\text{Co}^{3+} + 2\text{H}_2\text{O} \text{-----} > 6\text{H}^+ + 6\text{Co}^{2+} + 2\text{CO}_2 + 2\text{HCOO}^- \checkmark$ $3\text{H}_2\text{O}_2 + \text{C}_4\text{H}_4\text{O}_6^{2-} \text{-----} > 4\text{H}_2\text{O} + 2\text{CO}_2 + 2\text{HCOO}^- \checkmark$	3	DO NOT ALLOW CO for Co
5ci	Two negative ions repel AND require a large activation enthalpy (to react) \checkmark	1	
5cii	 <p>enthalpy arrow and reactants and prods \checkmark downward arrow labelled ΔH \checkmark intermediate and curves \checkmark upward arrows both labelled E_a \checkmark</p>	4	<p>ALLOW use of formulae/names of reactants and products</p> <p>For all three arrows: It must be clear from the diagram what the energy difference is that the arrows are marking. So, the arrows must start from (or close to) reactants line and end as closely as possible to the maximum height of the curves and for ΔH to the products line</p> <p>For mp3 second curve needs to have lower peak than first. Not necessary to show horizontal line but intermediate must be labelled</p> <p>Mark independently.</p> <p>If endothermic enthalpy profile drawn, can only score mp3 and mp4</p>
5ciii	$1s^2 2s^2 2p^6 3s^2 3p^6 3d^5$	1	ALLOW including $4s^0$
5civ	Fe^{3+} oxidises I^- then Fe^{2+} reduces $\text{S}_2\text{O}_8^{2-}$ \checkmark	1	<p>ALLOW in words or by equations</p> <p>ALLOW 'reacts with' for oxidises/reduces</p>

5d	(ozone) screens /filters/ removes/ absorbs/ blocks/ shields (AW) <u>high energy/high frequency</u> uv/ uvB/uvC OR prevents <u>high energy/high frequency</u> uv/ uvB/uvC getting through OR protects us from <u>high energy/high frequency</u> uv/ uvB/uvC ✓ that causes skin cancer/mutations/damage ✓	2	ALLOW damage to DNA in plants and/or animals ALLOW damages immune system/damage to eyes
5ei	hydrofluorocarbon ✓	1	ALLOW gaps and minor spelling errors
5eii	C–F bonds do not break (in stratosphere) OR (HFCs) do not release F atoms (in stratosphere) ✓ (HFCs) break down in the troposphere ✓	2	
5eiii	(HFCs) are greenhouse gases	1	IGNORE photochemical smog / breakdown to produce greenhouse gases
5fi	$\begin{array}{c} \text{X X} \\ \text{N} \\ \text{X X} \end{array} \begin{array}{c} \text{X} \\ \text{O} \\ \text{O} \\ \text{O} \end{array} \begin{array}{c} \text{O} \\ \text{O} \end{array} \quad \text{or} \quad \begin{array}{c} \text{X} \\ \text{N} \\ \text{X X} \end{array} \begin{array}{c} \text{X} \\ \text{O} \\ \text{X} \\ \text{O} \end{array} \begin{array}{c} \text{O O} \\ \text{O} \\ \text{O O} \end{array}$ ✓ unpaired electron (s) ✓	2	IGNORE 'lone'/'single'
5fii	$\text{NO} + \text{O}_3 \rightarrow \text{NO}_2 + \text{O}_2$ $\text{NO}_2 + \text{O} \rightarrow \text{NO} + \text{O}_2 \quad \checkmark$	1	
		20	

OCR (Oxford Cambridge and RSA Examinations)
1 Hills Road
Cambridge
CB1 2EU

OCR Customer Contact Centre

Education and Learning

Telephone: 01223 553998

Facsimile: 01223 552627

Email: general.qualifications@ocr.org.uk

www.ocr.org.uk

For staff training purposes and as part of our quality assurance programme your call may be recorded or monitored

Oxford Cambridge and RSA Examinations
is a Company Limited by Guarantee
Registered in England
Registered Office; 1 Hills Road, Cambridge, CB1 2EU
Registered Company Number: 3484466
OCR is an exempt Charity

OCR (Oxford Cambridge and RSA Examinations)
Head office
Telephone: 01223 552552
Facsimile: 01223 552553

© OCR 2017

