OCR
Oxford Cambridge and RSA

GCE

Chemistry B (Salters)

Unit **F332:** Chemistry of Natural Resources

Advanced Subsidiary GCE

Mark Scheme for June 2017

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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.

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.

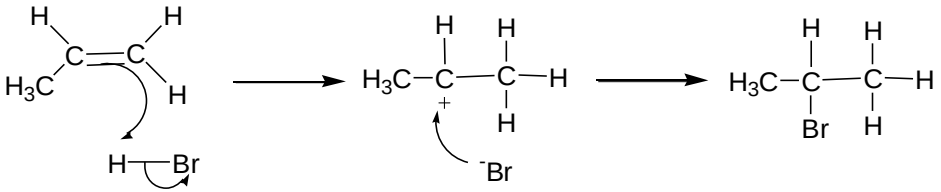
You should ensure also that you are familiar with the administrative procedures related to the marking process. These are set out in the OCR booklet **Instructions for Examiners**. If you are examining for the first time, please read carefully **Appendix 5 Introduction to Script Marking: Notes for New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

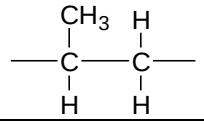
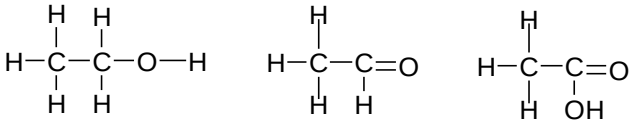
Please ask for help or guidance whenever you need it. Your first point of contact is your Team Leader.

Question	Answer	Marks	Guidance
1ai	UV/ultraviolet	**1**	**ALLOW** visible
1aii	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 collisions, √ thus increasing their kinetic energy (and raising the temperature) √ **OR** molecules also (re-)emit (some of the absorbed) IR (in all directions)√ (some of which) heats up the Earth √	**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 √ This balances (AW) the greenhouse effect/ heat gain √	**2**	**ALLOW** for one mark, amount of IR absorbed is constant/concentration of greenhouse gas is constant
1b	*one from:* √ burn/use less fossil fuels scrub (AW) CO_2 from chimneys	**1**	answers must be ways of *reducing emissions*, not of reducing the amount of CO_2 present.
1c	double covalent bonds (in simple molecule) √ polarised $C\delta+–O\delta–$ √ no overall dipole/dipoles cancel out/ partial charges cancel out/ non polar/centres positive and negative charges co-incide √ instantaneous dipole–induced dipole √	**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 4th marking point.
1di	homolytic	**1**	
1dii	**FIRST CHECK ANSWER ON ANSWER LINE** **If answer = 706 award 4 marks** $E = 6.63 \times 10^{-34} \times 1.77. \times 10^{15}$ √ $\times 6.02 \times 10^{23}$ and divide by 1000 √ = 706(.453...) √ 706 (3 sf) √	**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 √ +6, +6 √	**2**	Award 1 mark if all correct but + sign omitted or placed after the number

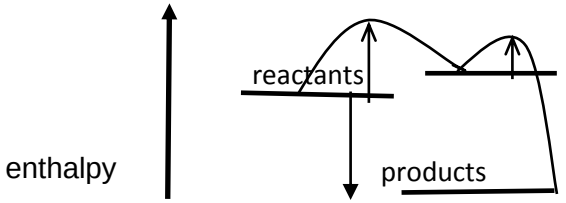
		19	
2ai	yellow precipitate √ $Ag^+(aq) + I^-(aq) \dashrightarrow AgI(s)$ equation √ state symbols √	**3**	Both words required for the mark. ALLOW ppt **ALLOW** (aq) (aq) (s) for state symbol mark even if equation wrong
2aii	(large surplus of) white ppt will mask <u>yellow</u> AW √	**1**	
2b	Add chlorine (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	$(19.6 \times 1.5 \times 10^{-4} / 1000)$√ x 0.5√ = 1.47×10^{-6} 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** $4.19(44) \times 10^{-3}$ 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**	

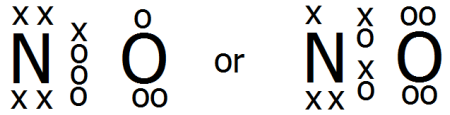
2fii	109 √ four pairs/groups of electrons **or** areas of electron density √ (electrons) repel √ get as far away as possible √	**4**	**ALLOW** 104 – 110 **QWC** first marking point depends on second being correct **IGNORE** descriptions of shape **ALLOW** 4 regions of <u>negative</u> charge must be in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

3ai	Δ √ cyclopropane √	**2**	Mark independently **ALLOW** any unambiguous formula
3aii	one end of double bond (AW) has two hydrogens/two of same group √	**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 √ can be compared with a database AW √	**2**	
3ci	$C_3H_8O \rightarrow C_3H_6 + H_2O$ √	**1**	must be molecular formula for the alcohol
3cii	elimination	**1**	
3di	**1** **2** **3** addition condensation substitution oxidation all three √√ two √	**2**	
3dii	$CH_3CHBrCH_3$ **AND** 2-bromopropane √	**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) √	**1**	
3div	 curly arrow on HBr and from C=C to H √ secondary carbocation √ attack by Br^- to form product √	**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 √	**1**	**ALLOW** primary as ecf if 1-bromopropane given as answer to 3dii
3dvii	ketone	**1**	
3ei	addition	**1**	**DO NOT ALLOW** additional

3eii		**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	rate faster √ more frequent <u>collisions</u> with energy greater than activation enthalpy √ Lower yield (AW) √ (Forward reaction is) exothermic ORA √	**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	Increased pressure more yield (ORA)√ Fewer moles/molecules/particles on the right/fewer product molecules √	**2**	Mark independently Must include a statement of higher or lower (AW) pressure
4bii	cost **and** danger AW √	**1**	
4ci	ethanal – distillation √ ethanoic acid – (heat under) reflux (then distil) √	**2**	For mp1 **DO NOT ALLOW** references to reflux
4cii	 ethanol ethanal ethanoic acid √√ for all three; √ for two correct	**2**	**ALLOW** 1 mark for three correct structures that are not full structural Must show O-H bond in ethanol and ethanoic acid
4ciii	instantaneous dipole-induced dipole √ hydrogen bonds √ $O^{\delta-}$-$H^{\delta+}$ √------ :O √	**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	$2Co^{2+} + H_2O_2 + 2H^+ \text{ -----> } 2Co^{3+} + 2H_2O$ √ $C_4H_4O_6^{2-} + 6Co^{3+} + 2H_2O \text{ ----> } 6H^+ + 6Co^{2+} + 2CO_2 + 2HCOO^-$ √ $3H_2O_2 + C_4H_4O_6^{2-} \text{ ----> } 4H_2O + 2CO_2 + 2HCOO^-$ √	**3**	**DO NOT ALLOW** CO for Co
5ci	Two negative ions repel **AND** require a large activation enthalpy (to react) √	**1**	
5cii	 enthalpy arrow and reactants and prods √ downward arrow labelled ΔH √ intermediate and curves √ upward arrows both labelled E_a √	**4**	**ALLOW** use of formulae/names of reactants and products 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 For mp3 second curve needs to have lower peak than first. Not necessary to show horizontal line but intermediate must be labelled Mark independently. If endothermic enthalpy profile drawn, can only score mp3 and mp4
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 $S_2O_8^{2-}$ √	**1**	**ALLOW** in words or by equations **ALLOW** 'reacts with' for oxidises/reduces

5d	(ozone) screens /filters/ removes/ absorbs/ blocks/ shields (AW) high energy/high frequency uv/ uvB/uvC **OR** prevents high energy/high frequency uv/ uvB/uvC getting through **OR** protects us from high energy/high frequency 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	 or √ unpaired electron (s) √	**2**	**IGNORE** 'lone'/'single'
5fii	$NO + O_3 \rightarrow NO_2 + O_2$ $NO_2 + O \rightarrow NO + O_2$ √	**1**	
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