

# **Chemistry B (Salters)**

Advanced Subsidiary GCE

Unit **F332**: Chemistry of Natural Resources

## **Mark Scheme for January 2011**

---

OCR (Oxford Cambridge and RSA) is a leading UK awarding body, providing a wide range of qualifications to meet the needs of pupils of all ages and abilities. OCR qualifications include AS/A Levels, Diplomas, GCSEs, OCR Nationals, 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 2011

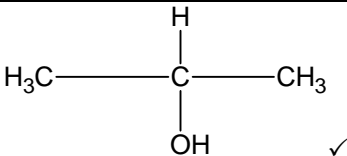
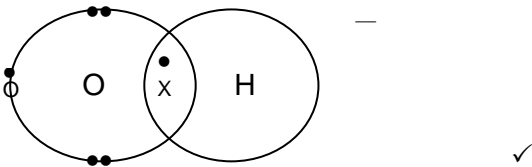
Any enquiries about publications should be addressed to:

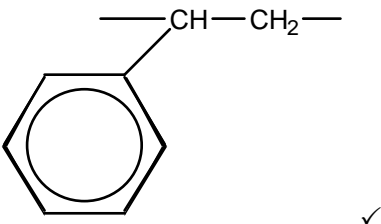
OCR Publications  
PO Box 5050  
Annesley  
NOTTINGHAM  
NG15 0DL

Telephone: 0870 770 6622  
Facsimile: 01223 552610  
E-mail: [publications@ocr.org.uk](mailto:publications@ocr.org.uk)

Question		Answer	Mark	Guidance
1	(a)	Alkene(s) ✓	1	<b>DO NOT ALLOW</b> C=C
1	(b)	(Processing of) crude oil / (dehydration of) propan-1-ol / propan-2-ol / propanol ✓	1	<b>IGNORE</b> cracking <b>NOT</b> 'oil', without 'crude' Hydrolysis of propanol <b>CONs</b> this mark
1	(c)	(Colour change) brown / orange / yellow to colourless ✓	1	Any combination of these colours but no others <b>DO NOT ALLOW</b> "clear" instead of "colourless" <b>IGNORE</b> red
1	(d)	Electrophilic ✓ Addition ✓	2	<b>ALLOW</b> answers indicated in other ways, such as circling Each additional underline <b>CONs</b> a mark
1	(e) (i)	Secondary ✓	1	
1	(e) (ii)	C to which OH / alcohol group / hydroxy(l) group is bonded is itself bonded to 2 other C / one H on C to which OH is bonded / 2 alkyl groups on C ✓	1	Can refer to R groups <b>IGNORE</b> 'OH in middle of chain' <b>NOT</b> 'it' for 'OH'
1	(e) (iii)	Water / steam ✓  Phosphoric acid ✓        High temperature and pressure ✓	3	<b>IGNORE</b> aqueous  <b>ALLOW</b> sulphuric acid instead of phosphoric acid or correct formulae Additional reagents <b>CON</b> acid mark <b>IGNORE</b> concentrations <b>IGNORE</b> inert catalyst supports such as alumina  <b>ALLOW</b> temps 200-400 °C and pressure above 1 atm <b>ALLOW</b> heat (but not warm) and pressure. Award the high temperature and pressure mark only if the water/steam mark has been gained

Question		Answer	Mark	Guidance
1	(f)		2	<b>ALLOW</b> any clear structure, e.g.: $\text{CH}_3\text{CHBrCH}_3$
1	(g)	<p>Chlorine ✓</p> <p><u>UV</u> radiation ✓</p>	2	<p><b>ALLOW</b> <math>\text{Cl}_2</math></p> <p><b>NOT</b> chlorine water</p> <p>Other reagents <b>CON</b> this mark</p> <p><b>ALLOW</b> UV light / UV</p> <p>Other conditions <b>CON</b> this mark</p>
1	(h)	(i) <p>Either:</p> <p><b>OR</b></p>	2	<p>One mark for each curly arrow</p> <p><b>DO NOT ALLOW</b> single headed arrows. However, if candidate draws two single headed arrows to the correct positions then award one mark</p> <p>Curly arrow must be drawn carefully starting from the lone pair or bond and ending on an atom or pointing to the line between C and O</p> <p><b>ALLOW</b> arrows starting at negative charges. Arrow must start within a radius of one lone pair width from either lone pair or minus. (i.e.: lower example is JUST OK)</p> <p>Mark separately</p>

Question			Answer	Mark	Guidance
1	(h)	(ii)		1	<b>ALLOW</b> any clear structure, e.g.: CH <sub>3</sub> CH(OH)CH <sub>3</sub> <b>NOT</b> ambiguous attachments of OH (i.e.: bond is in line with left-hand arm of the H or further right) Left-hand CH <sub>3</sub> can be drawn the other way round
1	(h)	(iii)		1	<b>ALLOW</b> negative charge in any position <b>IGNORE</b> circles <b>ALLOW</b> 'extra' electron shown as a dot <b>ALLOW</b> reversal of dots and crosses Must have correct total of electrons on appropriate atoms <b>ALLOW</b> diagram with no negative charge
1	(h)	(iv)	(It is a negative ion with a) lone <u>pair</u> / electron <u>pair</u> <b>AND</b> available to form a bond / can be donated.	1	
			<b>Total</b>	<b>19</b>	

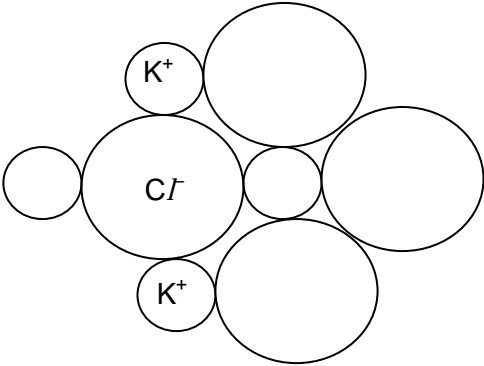
Question		Answer	Mark	Guidance
2	(a)	(Good thermal) insulator / low density ✓	1	<b>ALLOW</b> lightweight, but not light <b>IGNORE</b> one other irrelevant response If more than one other irrelevant response, this <b>CONs</b> the mark
2	(b)		1	The correct shape is not required for the mark More detailed structures can be drawn  <b>IGNORE</b> brackets and 'n'  <b>DO NOT ALLOW</b> ambiguous attachments to benzene ring, or benzene ring without circle
2	(c)	Softens / flows / melts / is deformed when <u>warmed / heated</u> ✓	1	<b>ALLOW</b> 'can be (re)moulded / <u>reshaped</u> when warm'
2	(d) (i)	Amount of phenylethene / product increases <b>OR</b> higher yield ✓  (increased temperature) moves (position of) equilibrium in the endothermic direction (ORA) ✓	2	Endothermic must be correctly spelled for the second mark to be awarded or 'exothermic' if reverse argument given  <b>ALLOW</b> 'reaction moves in / favours the endothermic direction' / forward reaction is endothermic / shifts towards the endothermic reaction <b>ALLOW</b> endothermic for QWC if written on equation 2.1.  Mark independently
2	(d) (ii)	Amount of phenylethene / product decreases / lower yield ✓  (increased pressure) moves (position of) <u>equilibrium</u> to the side with fewer molecules / moles / particles ✓	2	<b>NOT</b> just 'equilibrium moves to the left'. <b>NOT</b> atoms.  Mark independently

Question			Answer	Mark	Guidance
2	(e)	(i)	Larger / greater / more surface area of catalyst <b>OR</b> Higher surface area to volume ratio ✓  So more collisions per unit of time / more frequent collisions / collisions occur more often <b>OR</b> provides surface onto which reactants are adsorbed / can bond (AW) ✓	2	<b>NOT</b> higher surface area  <b>NOT</b> just more collisions  Mark independently
2	(e)	(ii)	(Catalyst) provides an alternative reaction path / route ✓  that has a lower activation enthalpy ✓	2	Answer must have the idea of a different path to gain the mark  Mark independently
2	(f)		Elimination ✓	1	Any clear indication scores the mark (e.g.: ringed) More than one indicated scores zero

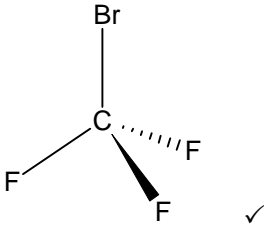
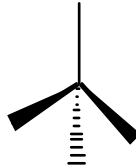




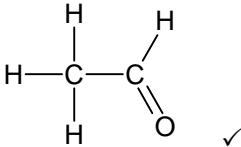
Question			Answer	Mark	Guidance
3	(a)		$M_r(\text{NaCl}) = 58.5$ and $M_r(\text{KCl}) = 74.6 / 74.5$ ✓  $2 / M_r(\text{NaCl}) : 1 / M_r(\text{KCl})$ and evaluate as 1: something (= 1 : 0.39) ✓	2	'moles Na : moles K = 1: 0.39' scores both marks <b>ALLOW</b> any number of s.f. for 2 <sup>nd</sup> mp ALLOW 2 <sup>nd</sup> mp if $A_r$ values of K and Na have been used instead of $M_r$ values (= 1: 0.29)
3	(b)	(i)	White ✓	1	<b>IGNORE</b> colour changes on standing
3	(b)	(ii)	Silver chloride ✓	1	
3	(b)	(iii)	$\text{Ag}^+ + \text{Cl}^- \rightarrow \text{AgCl}$ ✓	1	<b>ALLOW</b> with no state symbols <b>NOT</b> if state symbols are wrong
3	(c)	(i)	Green gas <b>OR</b> Green-yellow gas ✓	1	Both colour and 'gas' needed for mark <b>IGNORE</b> shades of colour, like dark or pale
3	(c)	(ii)	$[\text{Ne}] \quad 3s \quad \boxed{\uparrow\downarrow} \quad 3p \quad \boxed{\uparrow\downarrow} \quad \boxed{\uparrow\downarrow} \quad \boxed{\uparrow}$  ✓	1	<b>ALLOW</b> single arrow in any 3p atomic orbital pointing up or down  <b>ALLOW</b> use of other arrow symbols (such as 1, as long as – in each box that contains a pair– one points up and one down)
3	(d)	(i)	$1s^2 2s^2 2p^6 3s^2 3p^6 4s^1 / [\text{Ar}] 4s^1$ ✓	1	<b>ALLOW</b> capital letters. <b>ALLOW</b> $1s^2 2s^2 2p^6 3s^2 3p^6 3d^0 4s^1$ <b>NOT</b> subscripts
3	(d)	(ii)	$\text{K}(\text{g}) \rightarrow \text{K}^+(\text{g}) + \text{e}^-$  Equation ✓ K and $\text{K}^+$ both shown as (g) ✓	2	<b>ALLOW</b> e without a sign for the electron symbol <b>ALLOW</b> $\text{K}(\text{g}) - \text{e}^- \rightarrow \text{K}^+(\text{g})$ <b>IGNORE</b> state symbol on electron <b>NOT</b> capital 'G' for state symbol

Question			Answer	Mark	Guidance
3	(d)	(iii)	Outer shell / outermost electron(s) of K <b>AND</b> further from the nucleus (than Na) / shielded more (than Na) (ORA) ✓  Attraction / pull from the nucleus is weaker <u>and</u> less energy is needed to remove an electron (ORA) ✓	2	Must be a comparison. <b>IGNORE</b> 'molecule' <b>NOT</b> 'it' for potassium but second mark does not need element specified  Mark separately. <b>NOT</b> 'harder to remove'
3	(e)		 <p>Alternating K<sup>+</sup> and Cl<sup>-</sup> (at least 3 correct labels) ✓ At least one small circle surrounded by 4 large circles ✓</p>	2	<b>IGNORE</b> particles drawn in other layers  Any incorrect labels <b>CONs</b> the K <sup>+</sup> Cl <sup>-</sup> labels mark
3	(f)	(i)	$(25.00 \times 0.100 / 1000) = 0.00250$ ✓	1	<b>ALLOW</b> 0.0025 or standard form
3	(f)	(ii)	Burette ✓	1	<b>ALLOW</b> small spelling error (e.g.: 2 rs or one t). <b>NOT</b> biuret
3	(f)	(iii)	Answer to (f) (i) ✓	1	
3	(f)	(iv)	Answer to f(iii)/20.10 ✓ x 1000 and evaluated (= 0.1244) ✓  Correct evaluation of candidates calculation to 3 sf (=0.124) ✓	3	<b>ALLOW</b> sf mark for any 3 sig fig answer that follows from any calculation  <b>NB:</b> 0.124 does not score all three marks if (f)(iii) is incorrect

Question			Answer	Mark	Guidance
3	(g)	(i)	Method 1 / burning potassium in chlorine, as $KCl$ is the only product / all reacting atoms used / all products are useful (ORA) ✓	1	<b>ALLOW</b> 100% atom economy / only one product / no co-product / no other products / no by-products / no atoms lost / no waste / addition reaction. An incorrect statement about method 2 <b>CONs</b> the mark
3	(g)	(ii)	A lot of energy / high temperature is required <b>OR</b> reaction produces a low yield of $KCl$ ✓	1	<b>ALLOW</b> $K$ and $Cl_2$ / reagents of method 1 are expensive <b>ALLOW</b> reagents are dangerous <b>and</b> safety precautions / reaction conditions are expensive
3	(h)	(i)	(Mg is in) Group II and has a 2+ / +2 charge ✓	1	<b>ALLOW</b> 'second group'
3	(h)	(ii)	$MgCO_3$ ✓	1	
3	(h)	(iii)	<u>Giant</u> network / <u>giant</u> lattice ✓  With every C bonded to four other Cs / every C is tetrahedrally bonded ✓  Covalent ✓	3	<b>ALLOW</b> <u>giant</u> structure.  Answer must imply 'every' or 'all' carbons to score the mark.  References to ionic or intermolecular bonds <b>CON</b> 'covalent' mark
			<b>Total</b>	<b>27</b>	

Question		Answer	Mark	Guidance
4	(a)	Bromotrifluoromethane ✓	1	<b>IGNORE</b> 1s, commas, dashes and minor spelling errors (e.g.: 'fluro', 'flouro') <b>ALLOW</b> trifluorobromomethane
4	(b)	 <p>Bond angle <math>109^\circ</math> ✓</p>	2	Shape must be 3-dimensional <b>ACCEPT</b> $105 - 110^\circ$ Two bonds that are shown in the same plane <b>MUST</b> be next to each other  <b>ACCEPT</b>
4	(c)	C–Br ✓	1	<b>ALLOW</b> in words
4	(d) (i)	Homolytic (fission) / homolysis ✓	1	<b>IGNORE</b> 'photodissociation' and 'photolysis'
4	(d) (ii)	$8.67 \times 10^{14} \times 6.63 \times 10^{-34}$ ✓ $= 5.75 \times 10^{-19} \text{ (J)}$ ✓	2	A completely correct answer on its own scores both marks. <b>ALLOW</b> ecf only if the sole error is a mis-copy of one of the number values. <b>ALLOW</b> 2sf or more but rounding must be correct

Question			Answer	Mark	Guidance
4	(d)	(iii)	= answer to (d) (ii) $\times 6.02 \times 10^{23}$ ✓  /1000 (= + 346 KJ mol <sup>-1</sup> ) ✓	2	One mark for multiplying answer to (d)(ii) by $6.02 \times 10^{23}$ (Avogadro's constant)  Other mark for converting the answer from J to KJ, i.e.: dividing by 1000  Can be scored in either order, but must be correctly evaluated to score both marks  A completely correct answer on its own scores both marks ( <b>ALLOW</b> 2 or more sf but rounding must be correct)
4	(e)		Prediction / discovery (in the lab) that C/ can damage ozone layer ✓  Spectroscopic measurements showed ozone levels depleted/ lower than expected ✓  Results (initially) disregarded/ignored/overlooked/ thought to be an error/ thought to be anomalous as they were so low / depletion so high ✓	3	<b>IGNORE</b> 'hole in the ozone layer'. Must be lower, not different. Must mention 'spectroscopic' or one particular spectroscopic method (e.g.: ir)  Must imply 'very low' and not just 'anomalous' or different. Both parts needed for the mark.
4	(f)	(i)	(Greenhouse gas) <u>absorbs IR from Earth</u> ✓  More greenhouse gas means more IR absorbed ✓	2	Mark separately
4	(f)	(ii)	There is a relationship/ correlation between models of gas and models of <u>temperature</u> <b>OR</b> models of gas and measured <u>temperatures</u> <b>OR</b> gas levels and measured <u>temperatures</u>	1	<b>NOT</b> 'global warming' for 'temperature'
			<b>Total</b>	<b>15</b>	

Question			Answer	Mark	Guidance
5	(a)		<p><i>Explanation:</i></p> <p>1. A sequence / series / cycle of reactions OR several reactions ✓</p> <p>2. where a product of one reaction continues reacting / becomes a reactant in the next reaction OR a radical is used and a new one is regenerated which is then used in the next step ✓</p> <p><i>Example:</i></p> <p>At least two <b>consecutive</b> radical propagation steps, from the article, either as equations (not necessarily balanced) or words e.g.: 'OH• reacts with hydrocarbons to form RO<sub>2</sub>•, which then reacts further to give HO<sub>2</sub>• ✓</p>	3	<p><b>SCRIPT SHOWS A MARK OF 2 AND 1, BUT YOU WILL NEED TO ENTER A SINGLE SCORE OUT OF 3.</b></p> <p><b>NOT</b> continuous mp1 and mp2 must be stated clearly in the explanation, not gained by implication from the example</p> <p><b>ALLOW</b> 'radical produced in each step to continue the cycle' for 2 marks (mp 1 and 2)</p> <p><b>ALLOW</b> examples that are correct, but not from the article</p>
5	(b)	(i)	(A particle) with an unpaired electron ✓	1	<p><b>IGNORE</b> 'free' or 'lone' or single electron <b>NOT</b> 'is an unpaired electron'</p>
5	(b)	(ii)	$O + H_2O \rightarrow 2 \cdot OH$ / $O + H_2O \rightarrow \cdot OH + \cdot OH$ ✓	1	<p>Radicals do <b>NOT</b> need to have the • to show the unpaired electron <b>IGNORE</b> position of dot on radical</p>
5	(c)	(i)		1	

Question			Answer	Mark	Guidance
5	(c)	(ii)	<p>(The IR spectrum of the gas mixture would show) a peak / trough / absorption value in the range 1720 – 1740 (<math>\text{cm}^{-1}</math>) for the C=O ✓</p> <p>fingerprint (region) for ethanal / same as known spectrum of ethanal ✓</p>	2	<b>IGNORE</b> wavenumber for fingerprint region.
5	(d)		<p>The *OH removes the H atom / the *OH reacts to form water ✓</p> <p>This leaves an (alkyl) radical / molecule, which breaks down (in the atmosphere) ✓</p>	2	Can show first marking point using equation
5	(e)		<p><math>\text{NO}_2</math> concentration increases to 11 am, then decreases / peaks at 11 am ✓</p> <p>Increase caused by reaction of NO with oxygen / NO forms <math>\text{NO}_2</math> ✓</p> <p>Decrease caused by <u>UV</u> (radiation) breaking bonds in <math>\text{NO}_2</math> / Decrease caused by <u>UV</u> (radiation) breaking down <math>\text{NO}_2</math> ✓</p>	3	<p><b>IGNORE</b> references to 'rush-hour'</p> <p><b>ALLOW</b> times for maximum <math>\text{NO}_2</math> between 10.30 and 11.30</p> <p>Both increase and reaction required for the mark</p> <p>All three parts needed for the mark</p> <p><b>ALLOW</b> 'photolysis / photodissociation' for 'breaking bonds'</p> <p><b>NOT</b> <math>h\nu</math> for UV</p>





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

**OCR Customer Contact Centre**

**14 – 19 Qualifications (General)**

Telephone: 01223 553998

Facsimile: 01223 552627

Email: [general.qualifications@ocr.org.uk](mailto:general.qualifications@ocr.org.uk)

**[www.ocr.org.uk](http://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 2011