

# Alcohols

## Mark Scheme 2

<b>Level</b>	International A Level
<b>Subject</b>	Chemistry
<b>Exam Board</b>	Edexcel
<b>Topic</b>	Application of Core Principles of Chemistry
<b>Sub Topic</b>	Alcohols
<b>Booklet</b>	Mark Scheme 2

**Time Allowed:** 54 minutes  
**Score:** /45  
**Percentage:** /100

**Grade Boundaries:**

A*	A	B	C	D	E	U
>85%	77.5%	70%	62.5%	57.5%	45%	<45%

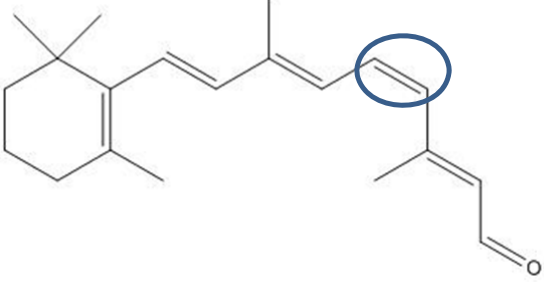
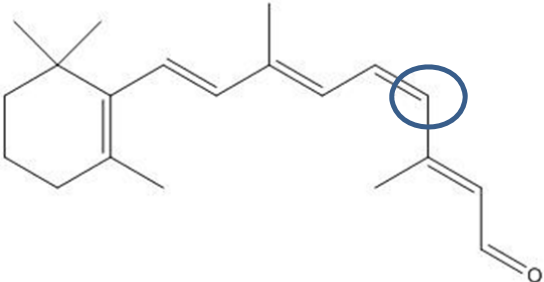
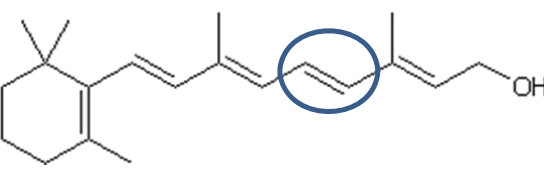
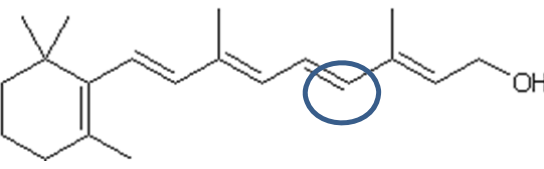
Question Number	Acceptable Answers	Reject	Mark
<b>1 (a)</b>	<p>Primary (1)</p> <p>Part of the molecule which determines how it will react / atom or group responsible for its reactions / group where chemical reactions occur/ part of the molecule responsible for its (chemical) properties</p> <p>ALLOW The part of the molecule which reacts / Group responsible for its characteristics (1)</p> <p>IGNORE Group which determines how the molecule behaves</p>	Molecule responsible for reactions	<b>2</b>

Question Number	Acceptable Answers	Reject	Mark
<b>1 (b)</b>	<p><math>C_{20}H_{30}O</math></p> <p>Correct number of carbons (1)</p> <p>Rest of formula correct (stand alone mark, even if C incorrect) (1)</p> <p>Note: <math>C_{20}H_{29}OH</math> scores first mark only</p> <p>Ignore working (structural formula) if shown as long as a molecular formula is given</p>	Just structural formula	<b>2</b>

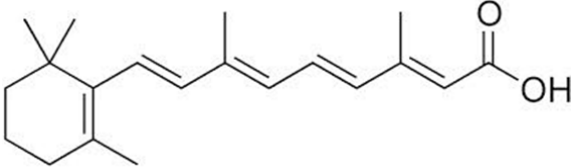
Question Number	Acceptable Answers	Reject	Mark
<b>1</b> <b>(c) (i)</b>	Reflux apparatus produces carboxylic/ retinoic acid OR completely oxidizes the alcohol (1)  Convert to distillation  ALLOW use condenser in horizontal position/ description of distillation/ sketch of distillation apparatus (1)  Oxidizing agent should be limiting/not in excess/remove aldehyde as it is formed/ remove before further oxidation (1)  ALLOW Use excess alcohol 'Product' for 'aldehyde'	Oxidizes to a ketone   Fractional distillation   Just 'the collection of aldehyde'	<b>3</b>

Question Number	Acceptable Answers	Reject	Mark
<b>1</b> <b>(c) (ii)</b>	$\text{Cr}_2\text{O}_7^{2-}(\text{aq}) + 14\text{H}^+(\text{aq}) + 6\text{e}^- \rightarrow 2\text{Cr}^{3+}(\text{aq}) + 7\text{H}_2\text{O}(\text{l})$ +6 Orange  +3 Green  One mark for the correct numbers of hydrogens (1)  One mark for the correct numbers of chromiums and electrons (1)  One mark for each oxidation number with sign. If sign is missing penalise once only ALLOW 6+ , 3+ (2)  One mark for both colours (1)	Any other colour with orange/ Green-blue	<b>5</b>

Question Number	Acceptable Answers	Reject	Mark
<b>1</b> <b>(c)(iii)</b>	<p>(Retinal) (strong) absorption at 1740-1720 (due to C=O bond)</p> <p>OR</p> <p>(Retinal) (weak) absorption at 2900-2820/ 2775-2700 (due to C-H bond)</p> <p>ALLOW</p> <p>Wavenumber/ peak/ stretch for "absorption" <b>(1)</b></p> <p>No absorption at 3750-3200 /absorption at 3750-3200 shows not all retinol converted <b>(1)</b></p> <p>Ignore comments on absorptions at 3300-2500</p>	<p>Absorption at 1725-1700 1700-1680</p>	2

Question Number	Acceptable Answers	Reject	Mark
<p><b>1</b> <b>(c) (iv)</b></p>	<p>Any one of the following:</p>   <p>ALLOW the following circles in retinol</p>  	<p>Any additional area circled</p> <p>Circles including any C atom other than those of the double bond circled on the mark scheme</p>	<p>1</p>

Question Number	Acceptable Answers	Reject	Mark
<b>1 (c) (v)</b>	<p>Round the carbon there are three areas with electrons / 3 regions of electron density/ 3 areas of electron density</p> <p>ALLOW Three bond pairs IF answer says that double bond can be treated as one bond (1)</p> <p>Electron pairs repel/ go to maximum separation/go to minimum repulsion (1)</p> <p>ALLOW Bonds repel</p> <p>The answer must clearly refer to electrons/ bonds/ bonding pairs at some point to score these marks.</p> <p>Trigonal planar</p> <p>ALLOW Triangular planar (1)</p>	<p>Round the carbon there are 3 bonds</p> <p>C with a lone pair</p> <p>atoms repel maximum repulsion/ minimum separation</p>	3

Question Number	Acceptable Answers	Reject	Mark
<b>1 (d)</b>	 <p>Accept any orientation of =O and -OH and length of bonds. Allow the OH displayed</p>	<p>COOH added to final single bond</p> <p>OOH added</p>	1

Question Number	Acceptable Answers	Reject	Mark
1 (e)	<p>Observation and precaution marks are dependent on correct reagent.</p> <p>EITHER</p> <p><b>Reagent</b>  <math>\text{PCl}_5</math> / phosphorus(V) chloride / phosphorus pentachloride                      ALLOW                      Phosphoric(V) chloride (1)</p> <p><b>Observation</b>                      Steamy/misty/white fumes (1)</p> <p>IGNORE                      Tests on steamy fumes eg litmus</p> <p><b>Precaution</b>                      Use of fume cupboard (1)</p> <p>IGNORE                      need for safety goggles and lab coats.                      Incorrect reasons given for use of fume cupboard.                      Need for dry equipment                      Use of gloves</p> <p><b>OR ALLOW</b></p> <p><b>Reagent</b>                      Sodium/ Na (1)</p> <p><b>Observation</b>                      Fizzing/Bubbles (1)</p> <p>IGNORE                      sodium dissolves</p> <p><b>Precaution</b>                      Handle with gloves/tweezers (1)</p> <p>IGNORE                      naked flames                      need for dry equipment                      need for safety goggles and lab coats.</p>	<p>White smoke/solid                      Dense white fumes</p> <p>Gas mask</p>	3

TOTAL FOR SECTION C (Question 1) = 22 MARKS

Question Number	Acceptable Answers	Reject	Mark
<b>2(a)</b>	C <sub>6</sub> H <sub>8</sub> O <sub>3</sub> Allow elements in any order.	Any other answers	<b>1</b>

Question Number	Acceptable Answers	Reject	Mark
<b>2(b)</b>	(Secondary) alcohol/Hydroxyl  OR Alkene/Carbon-Carbon double bond  OR Enol/ether	C-OH/ Just 'OH Group' Primary alcohol  C=C Just 'double bond'  Ester	<b>1</b>

Question Number	Acceptable Answers	Reject	Mark
<b>2(c)(i)</b>	ROH + Na → RO <sup>(-)</sup> Na <sup>(+)</sup> + ½H <sub>2</sub> <b>(1)</b> Allow multiples Ignore state symbols even if incorrect  Effervescence/Fizzing/Bubbles OR Sodium dissolves/disappears/ decreases in size OR White solid forms <b>(1)</b>  Stand alone marks	RNaO         White ppt	<b>2</b>

Question Number	Acceptable Answers	Reject	Mark
<b>2(c)(ii)</b>	ROH + PCl <sub>5</sub> → RCl + POCl <sub>3</sub> + HCl <b>(1)</b> Ignore state symbols even if incorrect  Steamy /misty / white <b>and</b> fumes/gas <b>(1)</b>  Stand alone marks  Allow PCl <sub>3</sub> O	White smoke	<b>2</b>



Question Number	Acceptable Answers	Reject	Mark
<b>2(c)(iii)</b>	<p>(HCl poses the greater risk – No credit but must be stated for the second mark)</p> <p>(because it is)toxic/corrosive/poisonous/reference damage to skin <b>(1)</b></p> <p>Not enough hydrogen produced/hydrogen produced only slowly (so won't catch fire) <b>(1)</b></p>	<p>Harmful/ ozone depletion/ Flammable Just 'acidic' Just 'dangerous'</p>	<b>2</b>

Question Number	Acceptable Answers	Reject	Mark
<b>2(d)(i)</b>	<p>Agent: sodium dichromate((VI)) / <math>\text{Na}_2\text{Cr}_2\text{O}_7</math> / potassium dichromate((VI)) / <math>\text{K}_2\text{Cr}_2\text{O}_7</math> <b>(1)</b></p> <p>sulfuric acid/<math>\text{H}_2\text{SO}_4</math> <b>(1)</b></p> <p>If name and formula are given, both must be correct.</p> <p>Conditions: Distillation <b>(1)</b> Allow 'Fractional distillation'</p> <p>Acidified dichromate/ <math>\text{H}^+</math> and <math>\text{Cr}_2\text{O}_7^{2-}</math> scores 1 mark Allow the acid as a reagent or as a condition. Acid can be conc. or dilute</p>	<p><math>\text{KMnO}_4</math></p> <p>Any other acids</p> <p>Reflux/ Just 'heat'</p>	<b>3</b>

Question Number	Acceptable Answers	Reject	Mark
* 2(d)(ii)	(infrared radiation causes) stretching/ bending/changes in bond polarity/bond vibration (1)  different bonds absorb different IR (frequencies/wavelength/wavenumber)/ different peaks for different groups (1)  compare absorption with database / data booklet (1)	Molecular vibration Bonds broken	3

Question Number	Acceptable Answers	Reject	Mark
*2(e)	<p>Point 1: (Alkanes) London Forces/ Dispersion forces/van der Waals' forces (1)</p> <p>Point 2: (Arises) – instantaneous dipole/momentary imbalance in electron density (1)</p> <p>Point 3: which <b>induces</b> dipole in adjacent molecule (and results in attraction) / description of <b>induction</b> (1)</p> <p>Ignore reference to atoms/molecules</p> <hr/> <p>Point 4: (Alcohols) Hydrogen bonds (1)</p> <p>Point 5: (Arises) – oxygen's higher electronegativity creates dipole/large difference in electronegativity (1)</p> <p>Point 6: Bond is attraction between (lone pair of electrons on) O of one molecule and H of <b>another</b> molecule (1)</p> <hr/> <p>Point 7: London forces are weaker than hydrogen bonds (1)</p> <p>Allow "alkanes intermolecular force weaker (than that of alcohols)" for point 7</p>	<p>Just 'Id-Id' Any other forces in combination</p> <p>Any reference to permanent dipoles loses points 2 &amp; 3</p> <p>London Forces</p>	<p>7</p>

Question Number	Acceptable Answers	Reject	Mark
<b>2 (f)</b>	Unique fragmentation/ different fragmentation/ different peak pattern	Just 'different masses'	<b>1</b>

Question Number	Acceptable Answers	Reject	Mark
<b>2 (g)</b>	Polymers have low volatility/ do not bind to receptors in nose/ Polymers do not have an aroma/ Polymer formation does not involve the 'aroma' molecules/ The chemicals causing the aroma are not affected (by the enzyme)		<b>1</b>

**TOTAL FOR Question 2 = 23 MARKS**