OCR
RECOGNISING ACHIEVEMENT

GCE

Chemistry A

Advanced Subsidiary GCE

Unit **F322:** Chains, Energy and Resources

Mark Scheme for June 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.

Any enquiries about publications should be addressed to:

OCR Publications
PO Box 5050
Annesley
NOTTINGHAM
NG15 0DL

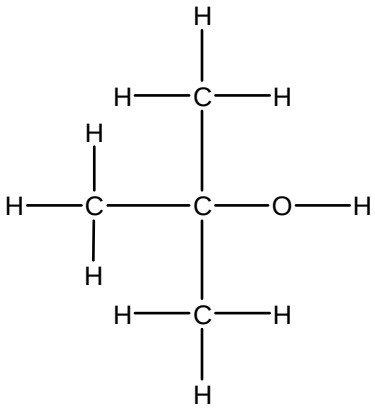
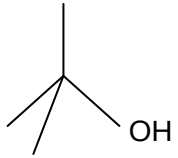
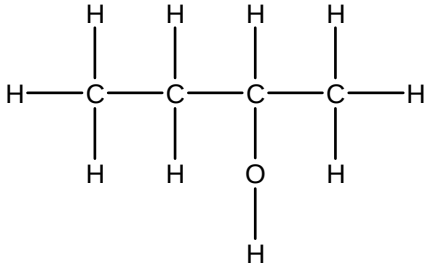
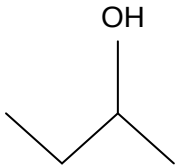
Telephone: 0870 770 6622
Facsimile: 01223 552610
E-mail: publications@ocr.org.uk

Question			Answer	Mark	Guidance
1	(a)	(i)	$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$ ✓	1	**IGNORE** state symbols
		(ii)	Bond breaking absorbs energy **AND** bond forming releases energy ✓ More energy released than absorbed ✓	2	**ALLOW** bond breaking is endothermic **AND** bond forming is exothermic **DO NOT ALLOW** bond forming requires energy The second marking point is **dependent** on the correct identification of the energy changes during bond breaking and bond making **ALLOW** exothermic change transfers more energy than endothermic change **OR** bond forming transfers more energy than bond breaking **OR** '(the sum of the) bond enthalpies in the products is greater than the (sum of the) bond enthalpies in the reactants' **OR** '(the sum of the) bond enthalpies of the bonds made is greater than (the sum of) the bond enthalpies of the bonds broken' **IGNORE** reference to strong and weak bonds **IGNORE** reference to number of bonds broken or made **IGNORE** enthalpy of products is less than enthalpy of reactants
	(b)	(i)	(Enthalpy change) when one mole of a substance ✓ is completely combusted **OR** burns in excess oxygen ✓	2	**ALLOW** energy released **DO NOT ALLOW** energy required **ALLOW** element **OR** compound **OR** molecule **DO NOT ALLOW** one mole of atoms **ALLOW** reacts fully with oxygen
		(ii)	Would make carbon dioxide and water instead **OR** activation energy (too) high **OR** rate is (too) slow **OR** do not react together ✓	1	**ALLOW** will make other compounds (containing carbon and hydrogen or carbon, oxygen and hydrogen) **ALLOW** reaction cannot be carried out experimentally **IGNORE** heat is lost to the surroundings

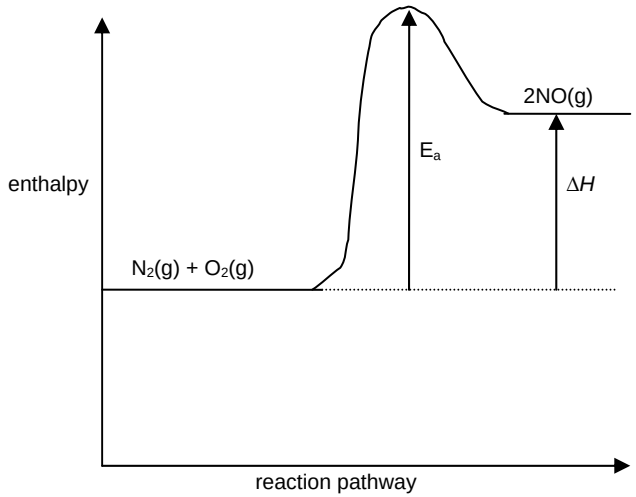
Question			Answer	Mark	Guidance
1	(b)	(iii)	(+)2801 ✓ + (−)394 × 6 + (−)286 × 6 **OR** (–)4080 ✓ −1279 ✓	3	**IGNORE** sign **IGNORE** sign **ALLOW** full marks for −1279 with no working out ✓✓✓ Unit **not** needed **ALLOW** ECF enthalpy change of combustion of carbon dioxide and water – enthalpy of combustion of glucose **ALLOW for 2 marks:** +1279 cycle wrong way around **OR** +151 **OR** +691 one value not × 6 **OR** –6881 **OR** +6881 wrong sign for 2801 or 4080 **OR** +2121 ✓✓correct cycle but not × 6 **ALLOW for 1 mark:** –151 **OR** –691 cycle wrong way around and one value not × 6 **OR** –2121 cycle wrong way around and not × 6 **OR** –3481 **OR** +3481 ✓ wrong sign and not × 6 **Note:** There may be other possibilities
			Total	9	

Question			Answer	Mark	Guidance
2	(a)	(i)	$C_nH_{2n+1}OH$ ✓	1	**ALLOW** $C_nH_{2n+2}O$
		(ii)	$C_{13}H_{28}O$ ✓	1	**ALLOW** $C_{13}H_{27}OH$
	(b)		group of atoms **OR** part of a molecule ✓ that give a compound its (characteristic set of) reactions ✓	2	**ALLOW** part of an alcohol **IGNORE** part of a compound **ALLOW** that determines its **chemical** properties **OR** that gives the compound its reaction **ALLOW** that determines its homologous series
	(c)	(i)	Alkanes have van der Waals' intermolecular forces ✓ Alcohols have hydrogen bonds (and van der Waals' forces) ✓ Hydrogen bonds are stronger (than van der Waals' forces) **OR** ORA ✓	3	**ANNOTATE ANSWER WITH TICKS AND CROSSES** **ALLOW** reference to specific compounds e.g. comparing methane and methanol vdW force is **not** sufficient here Third marking point is dependent on the correct intermolecular forces being described **BUT ALLOW** hydrogen bonds are stronger than intermolecular forces in alkanes
		(ii)	Methylpropan-1-ol has weaker van der Waals' forces (than butan-1-ol) **OR** ORA ✓ Methylpropan-1-ol has less surface contact (than butan-1-ol) **OR** ORA **OR** Methylpropan-1-ol has more branching (than butan-1-ol) **OR** ORA ✓	2	**ALLOW** methylpropan-1-ol has fewer van der Waals' forces (than butan-1-ol) **IGNORE** reference to more surface area / molecules are closer **ALLOW** methylpropan-1-ol is branched and butan-1-ol is not **IGNORE** 'methylpropan-1-ol is branched' with no comparison

Question			Answer	Mark	Guidance
2	(d)	(i)	$CH_3OH + 1½O_2 \rightarrow CO_2 + 2H_2O$ ✓ $CH_3OH + O_2 \rightarrow CO + 2H_2O$ ✓	2	**ALLOW** CH_4O for incomplete combustion **ALLOW** $CH_3OH + ½O_2 \rightarrow C + 2H_2O$ **ALLOW** $2CH_3OH + 1½O_2 \rightarrow C + CO + 4H_2O$ **ALLOW** correct multiples of these equations **IGNORE** state symbols
		(ii)	insufficient supply of oxygen **OR** limited amount of air **OR** poorly ventilated ✓	1	
		(iii)	Feedstock (in manufacture of organic compounds) **OR** manufacture of biodiesel **OR** manufacture of esters. ✓	1	**ALLOW** manufacture of a named organic compound that can be made from methanol **ALLOW** antifreeze, screenwash
	(e)		$CH_3CH_2CH_2COOH$ ✓ **BUT** $C_4H_9OH + 2[O] \rightarrow CH_3CH_2CH_2COOH + H_2O$ ✓✓	2	One mark is for the correct structure of the product One mark is for the equation **ALLOW** $CH_3CH_2CH_2CO_2H$ **DO NOT ALLOW** $C_4H_8O_2$, C_3H_7COOH, C_4H_7OOH for the structure mark but **ALLOW** for the equation mark Give credit for the correct structure in the equation e.g. $C_4H_9OH + 2[O] \rightarrow CH_3CH_2CH_2COOH + H_2O$ scores two marks **but** $C_4H_9OH + [O] \rightarrow CH_3CH_2CH_2COOH + H_2$ scores one mark $C_4H_{10}O + 2[O] \rightarrow C_4H_8O_2 + H_2O$ scores one mark **ALLOW** one mark for: $C_4H_9OH + [O] \rightarrow CH_3CH_2CH_2CHO + H_2O$

Question			Answer	Mark	Guidance
2	(f)	(i)	methylpropan-2-ol **OR** 2-methylpropan-2-ol ✓  ✓	2	**DO NOT ALLOW** methylprop-2-ol **ALLOW** $(CH_3)_3COH$ **ALLOW** vertical 'bond' to any part of the OH group **DO NOT ALLOW** horizontal –HO in the formula **ALLOW** 
		(ii)	 ✓	1	**ALLOW** $CH_3CHOHCH_2CH_3$ **ALLOW**  **ALLOW** vertical 'bond' to any part of the OH group **DO NOT ALLOW** horizontal –HO in the formula **IGNORE** an incorrect name
			Total	18	

Question			Answer	Mark	Guidance
3	(a)	(i)	Reaction in which energy enters the system (from the surroundings) ✓	1	**ALLOW** reaction that absorbs energy **ALLOW** takes energy in (from the surroundings) **ALLOW** enthalpy of products have higher enthalpy than enthalpy of reactants **ALLOW** heat instead of energy **ALLOW** correct reference in terms of bond breaking and bond making **IGNORE** incorrect reference to bond breaking or bond making
		(ii)	+33 ✓	1	+ sign is **not** required **DO NOT ALLOW** –33

Question			Answer	Mark	Guidance
3	(b)	(i)	2NO added for product ✓ Δ*H* labelled with product above reactant **AND** arrow upwards ✓ E_a labelled correctly **AND** above products ✓  	3	**ANNOTATE ANSWER WITH TICKS AND CROSSES** **IGNORE** State symbol **ALLOW** product line above or below reactants line **ALLOW** (+)66 **ALLOW** line that has a small gap at the top and bottom **IGNORE** arrows at both ends of activation energy line The E_a line must go to maximum (or near to the maximum) on the curve **ALLOW** if the line clearly shows an activation energy and is not an enthalpy change **ALLOW** line that has a small gap at the top and bottom
		(ii)	Activation energy is the **minimum** amount of energy needed for the reactants to react ✓	1	**ALLOW** compounds **OR** elements **OR** molecules **OR** chemicals instead of reactants **ALLOW** minimum energy needed to start a reaction

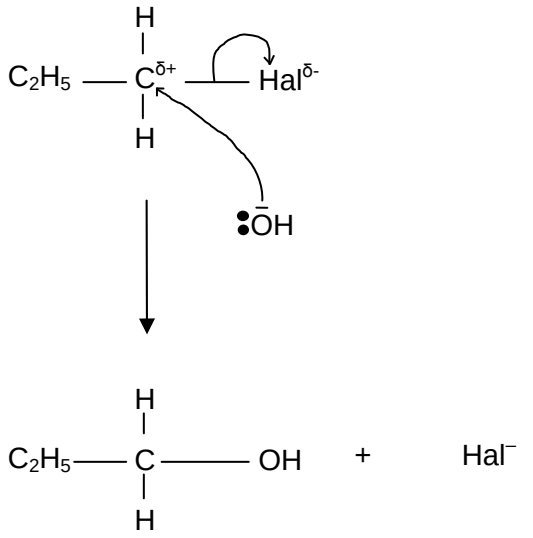
Question			Answer	Mark	Guidance
3	(c)	(i)	Rate of forward reaction slows down and rate of backward reaction speeds up ✓ (Until) rate of forward reaction is the same as the rate of the backward reaction ✓	2	**ALLOW** at start rate of forward reaction is fast but rate of backward reaction is slow **DO NOT ALLOW** forward reaction is the same as backward reaction
		(ii)	 Reaction is faster ✓ Increasing pressure mean more particles per unit volume **OR** increasing pressure gives more crowded particles **OR** increasing pressure gives more concentrated (particles) ✓ So more collisions per second **OR** higher collision frequency **OR** collisions more often ✓ (Changes of pressure) do not change the (position of) equilibrium ✓ Both sides of equation have same number of moles (of gas) ✓	5	**ANNOTATE ANSWER WITH TICKS AND CROSSES** **ALLOW** particles are closer together **DO NOT ALLOW** 'area' instead of 'volume' **ALLOW** increased rate of collision **OR** collisions are more likely **OR** there is a greater chance of collisions 'More collisions' or 'more successful collision' are **not** sufficient **DO NOT ALLOW** composition of equilibrium is the same (in question) **ALLOW** both sides of equation have same number of molecules (of gas)
		(iii)	Not a closed system ✓	1	**ALLOW** gases can escape **OR** gases are continuously entering **OR** it is an open system
	(d)		has an unpaired electron ✓	1	**ALLOW** plural: unpaired electrons has a lone electron is **not** sufficient
	(e)	(i)	$2NO + O_2 \rightarrow 2NO_2$ ✓	1	**ALLOW** any correct multiple including fractions **IGNORE** state symbols

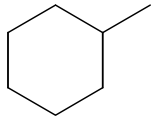
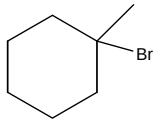
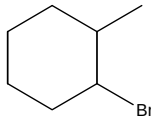
Question			Answer	Mark	Guidance
3	(e)	(ii)	NO is not consumed **OR** overall reaction is $O_3 + O \rightarrow 2O_2$ ✓ $NO + O_3 \rightarrow NO_2 + O_2$ ✓ $NO_2 + O \rightarrow NO + O_2$ ✓	3	**ANNOTATE ANSWER WITH TICKS AND CROSSES** **ALLOW** $2O_3 \rightarrow 3O_2$ **OR** It is a chain reaction **OR** NO is reformed **OR** mechanism of ozone depletion is changed **OR** NO made can react with more ozone **IGNORE dots** **ALLOW** $NO_2 + O_3 \rightarrow NO + 2O_2$
		(iii)	**ANY TWO FROM:** To identify the functional groups (in pollutants) **OR** to identify the bonds (in pollutants) ✓ Match spectrum to known pollutants **OR** each pollutant will have a different spectrum ✓ Idea that you can measure the concentration or abundance of pollutant ✓	2	 **ALLOW** a named bond **IGNORE** any specific wavenumber or range of wavenumbers **ALLOW** match spectrum to database or datasheet
			Total	21	

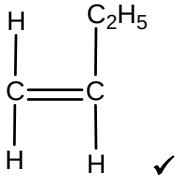
Question			Answer	Mark	Guidance
4	(a)		Atom economy = $\frac{\text{sum of (all) } M_r \text{ of desired product(s)}}{\text{sum of (all) } M_r \text{ of (all) products}}$ ✓	1	**ALLOW** Atom economy = $\frac{\text{sum of (all) } M_r \text{ of desired product(s)}}{\text{sum of (all) } M_r \text{ of (all) reactants}}$ **ALLOW** for the numerator: 'sum of' to be crossed out and replaced by 'molecular mass of the desired product(s)' **ALLOW** for the denominator: 'sum of molecular masses of all products'
	(b)	(i)	Process **5** ✓	1	**ALLOW** $C_8H_{18} \rightarrow C_2H_4 + C_6H_{14}$
		(ii)	Process **1** ✓	1	**ALLOW** $CH_3CH_2CH_2CH_2CH_2CH_2CH_2CH_3 \rightarrow (CH_3)_2CHCH_2CH_2CH(CH_3)_2$
		(iii)	Process **2** ✓ water is a waste product ✓	2	**ALLOW** $CH_3CH_2OH + CH_3COOH \rightarrow CH_3COOCH_2CH_3 + H_2O$ **ALLOW** it is a condensation reaction **ALLOW** water is a by-product / water is a non-desirable product **ALLOW** process 2 has an 83% atom economy **IGNORE** it forms more than one product / it forms a waste product
	(c)	(i)	Less waste products **OR** better sustainability **OR** get 100% atom economy ✓ (Stops) greenhouse gas emitted **OR** (stops) gas that (may) cause global warming ✓	2	**ALLOW** no waste products / there is no longer a waste product **ALLOW** increase atom economy

Question			Answer	Mark	Guidance
4	(c)	(ii)	High percentage yield with a simple reason e.g. because the aim is to manufacture ethanol; to reduce waste; increases sustainability ✓ **BUT** High percentage yield because there is very efficient conversion from **reactant** to product **OR** to reduce the waste of **starting** materials ✓✓ **OR** High atom economy with a simple reason e.g. because it is cheaper or makes less harmful products; to reduces waste; increases sustainability ✓ **BUT** High atom economy to reduce the amount of waste **products** **OR** less **by products** **OR** more desired **product** ✓✓	**2**	No marks for just percentage yield or for atom economy. Marks are for the quality of the explanation Marks are awarded as follows **One** mark – a simple reason that is not fully correct whether a choice has been made or not **Two** marks – a choice must be made and the reason must be correct
			Total	**9**	

Question			Answer	Mark	Guidance
5	(a)		Compound of hydrogen and carbon only ✓	1	**ALLOW** contains hydrogen and carbon only **DO NOT ALLOW** 'it contains hydrogen and carbon' **DO NOT ALLOW** a mixture of hydrogen and carbon only
	(b)		**F** ✓	1	**ALLOW** cyclobutane
	(c)		$C_5H_{10}O$ ✓	1	**ALLOW** any order **IGNORE** structural or displayed formula
	(d)		**D** and **E** **OR** **F** and **G** ✓	1	**ALLOW** pentanal and pentan(-3-)one **ALLOW** cyclobutane and but(-2-)ene Award mark if both pairs are given
	(e)	(i)	Tetrahedral ✓ Four (single) bonds (around carbon atom) **OR** four (single) bond pairs (around carbon atom) **OR** (carbon) bonded to four groups ✓	2	**IGNORE** incorrect bond angle If shape is not given, explanation mark **can** be credited If shape is incorrect, explanation mark **cannot** be credited
		(ii)	Trigonal planar ✓	1	**ALLOW** planar triangle **IGNORE** if incorrect bond angle is stated
	(f)	(i)	**G** ✓	1	**ALLOW** but-2-ene
		(ii)	Non rotating (carbon–carbon) double bond ✓ Each carbon atom of the double bond attached to (two) different groups/atoms ✓	2	

Question	Answer	Mark	Guidance
5 (g)		10	**ANNOTATE ANSWER WITH TICKS AND CROSSES**
	Equation $C_3H_7X + KOH \rightarrow C_3H_7OH + KX$ **OR** $C_3H_7X + OH^- \rightarrow C_3H_7OH + X^-$ ✓		X = Br or C*l* **ALLOW** molecular, structural, displayed or skeletal formula in equation **ALLOW** $C_3H_7X + H_2O \rightarrow C_3H_7OH + HX$ **ALLOW** equation from the mechanism **IGNORE** incorrect equations
	Structure of product $CH_3CH_2CH_2OH$ ✓		**ALLOW** structural, displayed or skeletal formula of product if seen **ONCE** in equation, mechanism or drawn out
	Reaction mechanism QWC - nucleophilic substitution ✓		**If two mechanism shown award marks from the mechanism that gives the higher mark**
	dipole shown on C–Hal bond, $C^{\delta+}$ and $Hal^{\delta-}$ ✓ curly arrow from HO^- to carbon atom of C–Hal bond ✓ curly arrow from C–Hal bond to the halogen atom ✓		 The curly arrow must start from the oxygen lone pair or the negative charge on the oxygen of ^-OH ion No need to show lone pair on the oxygen atom

Question			Answer	Mark	Guidance
5	(g)		**Type of bond fission** QWC - heterolytic ✓ **Reasons for the difference in rate of hydrolysis** 1-bromopropane reacts faster (than 1-chloropropane) **OR B** reacts faster (than **C**) **OR** C–Br reacts faster ✓ Because the C–Br bond is weaker **OR** C–Br has a lower bond enthalpy **OR** C–Br bond is longer ✓ C–Br is more easy to break ✓		**ALLOW S_N1 mechanism** dipole shown on C–Hal bond, $C^{\delta+}$ and $Hal^{\delta-}$ ✓ curly arrow from C–Hal bond to the halogen atom ✓ curly arrow from OH^- to correct carbocation ✓ **IGNORE** bromine reacts faster than chlorine **ALLOW** ora **ALLOW** less energy to break C–Br **ALLOW** ora **ALLOW** ora
	(h)		With H_2  ✓ With HBr  ✓  ✓	**3**	**ALLOW** methylcyclohexane **ALLOW** 1-bromo-1-methylcyclohexane **ALLOW** 1-bromo-2-methylcyclohexane **ALLOW** 2-bromo-1-methylcyclohexane
			Total	**23**	

Question			Answer	Mark	Guidance
6	(a)	(i)	But-1-ene ✓  ✓	2	**ALLOW** displayed formula **ALLOW** $C_2H_5CH=CH_2$
		(ii)	Poly(ethenol) has (many) O–H group(s) ✓ Poly(ethenol) forms hydrogen bonds with water ✓	2	**ALLOW** poly(ethenol) has hydroxyl group **OR** hydroxy group **OR** is an alcohol **DO NOT ALLOW** hydroxide **DO NOT ALLOW** 'it forms hydrogen bonds'
	(b)		CO is a poisonous gas ✓ HC*l* is acidic/forms acid rain **OR** corrosive **OR** HC*l* will react with metalwork **OR** HC*l* will react with marble/limestone buildings ✓ **ANY TWO METHODS FROM:** **Method 1** Remove HC*l* by reacting with a base **OR** remove HC*l* by use of a gas scrubber ✓ **Method 2** Develop ways of ensuring all CO is oxidised to CO_2 **OR** ensure complete combustion to avoid making CO ✓ **Method 3** Remove CO_2 by CCS ✓ **Method 4** (Use methods to remove the need for incineration such as) separation **AND** recycling of the plastics/polymers ✓ **Method 5** (Use methods to remove the need for incineration such as) developing biodegradable/compostable plastics/polymers ✓	4	**ANNOTATE ANSWER WITH TICKS AND CROSSES** **ALLOW** CO reduces amount of oxygen transported in blood Forming carboxyhaemoglobin/binds with haemoglobin is **not** sufficient **IGNORE** HC*l* is toxic **IGNORE** references to ozone layer and greenhouse effect **Methods 1 to 3 must be linked to a gas** **IGNORE** reference to catalytic converter **ALLOW** specific examples of CCS e.g. CO_2 stored as a metal carbonate / CO_2 stored deep under sea / CO_2 stored in rock **ALLOW** (Use methods to remove the need for incineration such as) use of plastics/polymers as a feedstock for making other chemicals

Question			Answer	Mark	Guidance
6	(c)		**ANY TWO FROM:** Idea that all countries contribute towards pollution ✓ Idea that atmospheric pollution (from incineration travels) across borders **OR** waste plastics travel across borders / waste plastics travel across the sea ✓ Cooperation means that scientists can share ideas **OR** scientists can warn governments of risk **OR** world-wide legislation can be introduced **OR** allows monitoring of pollution in different countries **OR** richer countries can help poorer countries introduce pollution controls ✓ One country cannot control pollution unless all countries do ✓	**2**	**ALLOW** some countries produce more pollution than others. **ALLOW** reference to protocols
			Total	**10**	

Question			Answer	Mark	Guidance
7				7	**ANNOTATE ANSWER WITH TICKS AND CROSSES** PLEASE ENSURE YOU LOOK AT THE DATA AND SPECTRA ON PAGE 20 IN CASE THEY INCLUDE COMMENTS THAT ARE WORTHY OF CREDIT. MARK THIS PAGE WITH AN OMISSION MARK, ^ , IF BLANK QWC: mark is integrated into the chemistry marks. These marks need to link evidence with an explanation
			ANY SEVEN FROM: **Compound X** QWC: **X** contains C=O because of absorption at 1720 cm^{-1} **AND** contains O–H because of (broad) absorption between 2500 to 3300 cm^{-1} ✓ So **X** is a carboxylic acid ✓ Molar ratio (C:H:O) of **X** is 4.05 : 8.1 : 2.7 **OR** $\frac{48.65}{12.0} : \frac{8.11}{1.0} : \frac{43.24}{16.0}$ ✓ (Empirical formula) is $C_3H_6O_2$ ✓ M_r is 74.0 so **X** is $C_3H_6O_2$ ✓		**ALLOW X** contains C=O and O–H because of absorptions at 1720 cm^{-1} and 2500 to 3300 cm^{-1} **ALLOW X** contains carboxylic acid/COOH because of absorption at 1720 cm^{-1} and (broad) absorption between 2500 to 3300 cm^{-1} ✓✓ **ALLOW** alternative approach to molecular formula M_r is 74.0 ✓ $74 \times \frac{48.65}{100} : 74 \times \frac{8.11}{100} : 74 \times \frac{43.24}{100}$ = 36 : 6 : 32 ✓ $C_3H_6O_2$ ✓ This mark is for some evidence of using M_r to deduce the molecular or structural formula **ALLOW** M_r is 74.0 so **X** is CH_3CH_2COOH ✓ **DO NOT ALLOW** ECF from the empirical formula with the wrong molar ratio

Question			Answer	Mark	Guidance
7			**Compound Y** QWC **Y** contains O–H because of absorption between 3100 and 3500 cm^{-1} ✓ QWC Mass spec of **Y** has molecular ion, *m*/*z* = 46 so M_r is 46 ✓ Correct identification of one fragment from a *m*/*z* value e.g. *m/z* = 31 is CH_2OH^+; *m/z* = 29 is $C_2H_5^+$; *m/z* = 15 is CH_3^+ ✓		**ANNOTATE ANSWER WITH TICKS AND CROSSES** **ALLOW Y** is an alcohol (or phenol) because of absorption between 3200 and 3550 cm^{-1} **ALLOW Y** contains C–O, C–H and O–H bonds because of absorptions at approximately 1030, 2950 and 3350 cm^{-1} **ALLOW** *m/z* = 46 so M_r is 46 **OR** mass spectrum has a peak at 46 which is the M_r **OR** M_r is 46 because of *m/z* peak shown on the actual spectra M_r = 46 on its own is **not** sufficient *m*/*z* = 46 on its own is not sufficient **ALLOW** *m/z* = 31 shows CH_2OH (fragment); *m/z* = 29 shows C_2H_5 (fragment); *m/z* = 15 is CH_3 (fragment)
			Identification of compounds So **X** must be CH_3CH_2COOH **OR** propanoic acid ✓ So **Y** is ethanol **OR** C_2H_5OH **OR** CH_3CH_2OH ✓ **Z** is $CH_3CH_2COOC_2H_5$ **OR** ethyl propanoate ✓	**3**	**Note**: an incorrect name CONs a correct structure **ALLOW** skeletal **OR** displayed formula throughout **DO NOT ALLOW** propanoic acid with wrong structure or incorrect molecular formula **DO NOT ALLOW** ethanol with wrong structure or incorrect molecular formula **DO NOT ALLOW** ethyl propanoate with wrong structure or incorrect molecular formula **ALLOW** ECF for identification of **Z** from incorrect **X** and **Y**. **DO NOT ALLOW** this ECF if name and structures of **X** or **Y** do **not** match
			Total	**10**	

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

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