



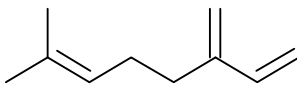
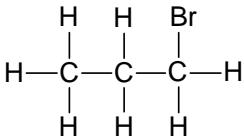
# **GCE MARKING SCHEME**

**CHEMISTRY  
AS/Advanced**

**SUMMER 2010**

## CH4

## SECTION A

1. (a) (i)  $C_{10}H_{16}$  (not shortened structural formula) [1]
- (ii)  [1]
- (iii) I Compound that contains no double bonds / single bonds only [1]  
(Accept contains maximum number of hydrogens)
- II  $C_{10}H_{16} + 3H_2 \longrightarrow C_{10}H_{22}$  [1]  
(accept structural formulae, consequential from (a)(i))
- (iv) Moles  $H_2 = \frac{8.96}{22.4} = 0.4$  [1]  
4 double bonds [1]
- (b) (i) Ethane (accept formula) [1]
- (ii)  $LiAlH_4$  [1]
- (iii)  [1]
- (iv) (1-)Propyl ethanoate [1]

**Total [10]**

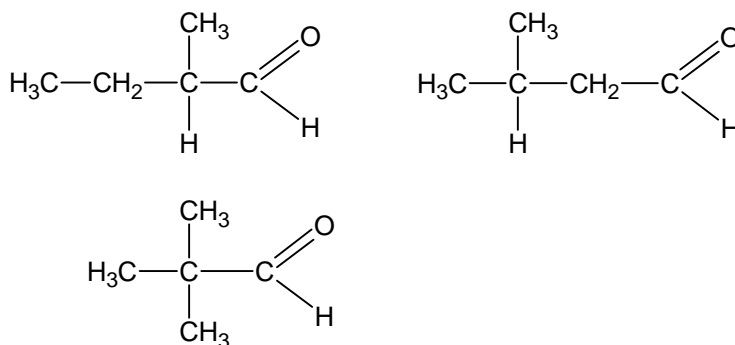
2. (a) In primary alcohols the –OH group is joined to a carbon atom bonded to two hydrogen atoms, in secondary alcohols the carbon atom is bonded to only one hydrogen. [1]

(b)	$\frac{C}{68.1}$	$\frac{H}{13.7}$	$\frac{O}{18.2}$	
	$\frac{12}{12}$	$\frac{1.01}{1.01}$	$\frac{16}{16}$	
	5.675	13.56	1.1375	[1]
	4.99	11.92	1	

Empirical formula = C<sub>5</sub>H<sub>12</sub>O [1]

Formula mass, 88.1(2), is same as *M<sub>r</sub>*, therefore molecular formula is C<sub>5</sub>H<sub>12</sub>O [1]

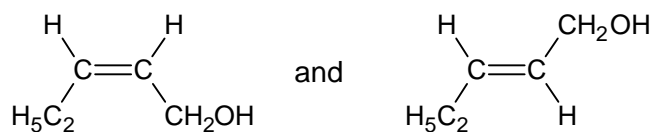
- (c) (i) [1]



any one of three isomers

- (ii) I C [1]

- II [1]



- (iii) Add Tollens' reagent / Fehling's solution [1]

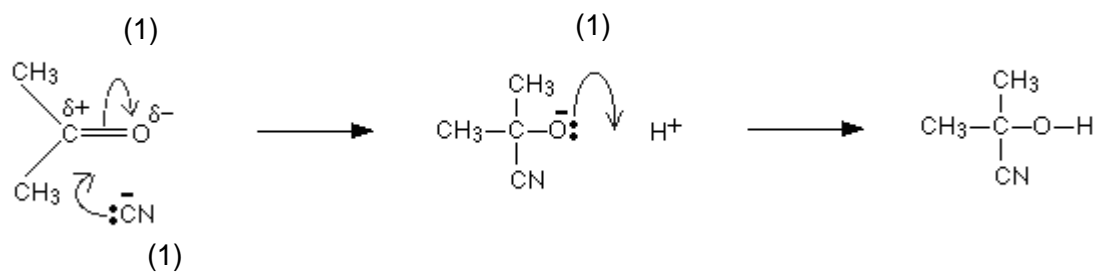
**A** no reaction, **B** gives silver mirror / red ppt. [1]

- (iv) Add iodine in aqueous sodium hydroxide / KI and NaOCl [1]

**C** no reaction, **D** gives pale yellow ppt. [1]

(d) (i) Nucleophilic addition [1]

(ii) [3]



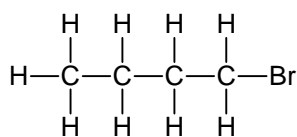
**Total [15]**

3. (a) Iron(III) chloride / bromine water [1]  
Purple solution / white precipitate [1]
- (b) In phenol anion formed is stabilised by delocalisation of the negative charge over the benzene ring (1)  
In alcohol anion formed is not stabilised by delocalisation (1)  
In carboxylic acids anion formed is stabilised by delocalisation of the negative charge over the two oxygen atoms (1)  
Delocalisation is stronger in acid than in phenol (1)  
Phenol loses H<sup>+</sup> more easily than alcohol and carboxylic acid does so more easily than phenol (1)  
(Accept diagrams)  
max 4 marks [4]
- (c) 4-chloro-3,5-dimethylphenol [1]
- (d) Atom economy =  $\frac{94.06 \times 100}{122.07}$  [1]  
= 77% [1]
- (e) [1]
- $$\begin{array}{ccccccccc} & & \text{O} & & \text{H} & \text{H} & \text{H} & \text{H} & & \text{O} & & \\ & & // & & | & | & | & | & & // & & \\ \text{H} & - & \text{O} & - & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} & - & \text{O} & - & \text{H} \\ & & & & | & | & | & | & & & & & | & & & & \\ & & & & \text{H} & \text{H} & \text{H} & \text{H} & & & & & \text{H} & & & & \end{array}$$
- (f) Hexane-1,6-diamine / 1,6-diaminohexane [1]
- (g) [1]
- $$\left[ \begin{array}{c} \text{N} - (\text{CH}_2)_6 - \text{N} - \text{C}(=\text{O}) - (\text{CH}_2)_4 - \text{C}(=\text{O}) \\ | \qquad \qquad | \\ \text{H} \qquad \qquad \text{H} \end{array} \right]$$
- (h) In addition polymerisation only the polymer is formed [1]  
(Accept description e.g. monomers join together with no water loss)  
In condensation polymerisation the polymer and a small molecule are formed [1]  
(Accept description e.g. water molecule lost as monomers join together)  
(Accept for 1 mark only water is eliminated during condensation polymerisation but not during addition polymerisation)
- (i) Making aspirin / cellulose acetate / as an acylating agent [1]

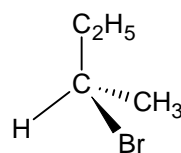
**Total [15]****Total Section A [40]**

## SECTION B

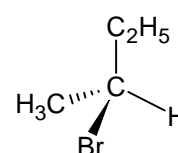
4. (a) (i) [3]



(1)



(1)



(1)

- (ii) Use a polarimeter to differentiate between isomers (1)  
 One will rotate plane of plane polarised light to the right and one to the left / opposite directions (1)  
 1-bromobutane will have no effect on plane polarised light (1) [3]

Accept use mass spectrometer / nmr spectroscopy to identify

1-bromobutane (1)

Answer gives peak present in 1-bromobutane that is not in other isomers (1)

(Accept converting to alcohols and carrying out iodoform test)

QWC The information is organised clearly and coherently, using specialist vocabulary where appropriate [1]

(b) (i) I  $\text{C}_2\text{H}_5\text{Cl} + \text{NH}_3 \longrightarrow \text{C}_2\text{H}_5\text{NH}_2 + \text{HCl}$  [1]

II Nucleophilic substitution [1]

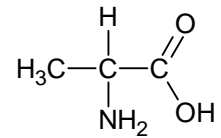
(ii) Nitrobenzene (1)  
 Tin and concentrated hydrochloric acid (1) [2]

(iii) Sodium nitrite and hydrochloric acid, (1)  
 under 5 °C (1)  
 No change phenylamine, bubbles (of nitrogen) with ethylamine (1)

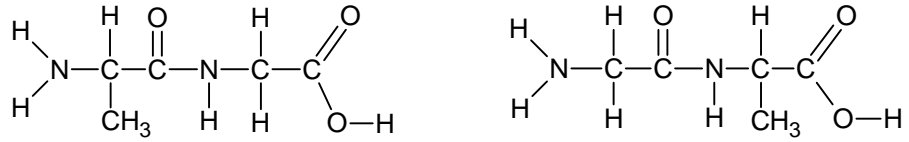
Accept alternative – bromine (1), aqueous (1), white ppt with phenylamine, no change with ethylamine (1)

[3]

(c) (i) [1]



(ii) [2]



(iii) Primary structure is the amino acid sequence (1)  
 Secondary structure is the folding / coiling / twisting of the primary structure (held by hydrogen bonding) (1)  
 Tertiary structure is the overall folding of the chain held by interactions (e.g. disulphide bridges, ionic bonding) between more distant amino acids / 3D structures (1) [3]

**Total [20]**

5. (a) Planar molecule (1)  
 each carbon bonded covalently to 2 other carbons and 1 hydrogen.(1)  
 Sideways overlap of p-orbitals. (1)  
 Leading to delocalised  $\pi$  – bonds. (1)  
 above and below plane of molecule (1)  
 (Maximum 4 marks for bonding)
- Alkenes have localised double bond /greater electron density /  
 attract electrophiles more readily (1)  
 In benzene stable delocalised system would be disturbed / has extra  
 delocalisation energy / reacts by substitution (1) [6]
- QWC* Legibility of text; accuracy of spelling, punctuation and grammar,  
 clarity of meaning (1)  
 Selection of a form and style of writing appropriate to purpose and to  
 complexity of subject matter (1) [2]
- (b) (i) Benzene is too hazardous / methylbenzoate is less toxic [1]
- (ii) The product is crude / impure [1]
- (iii) Add crystals to minimum amount of hot ethanol (1)  
 Filter if necessary and leave to cool (1)  
 Filter and dry (in air) (1) [3]
- (iv) Take a melting point and compare it with a book value [1]
- (v)  $\frac{2.75}{1.1} = 2.5 \text{ cm}^3$  [1]
- (vi) Moles methylbenzoate =  $\frac{2.75}{136} = 0.0202$  (1)
- Moles methyl 3-nitrobenzoate =  $\frac{270}{181} = 0.0149$  (1)  
 % yield = 73.8 % (1) [3]
- (vii) I Electrophilic substitution [1]
- II  $\text{NO}_2^+$  [1]

**Total [20]**

**Total Section B [40]**