



GCE MARKING SCHEME

**CHEMISTRY
AS/Advanced**

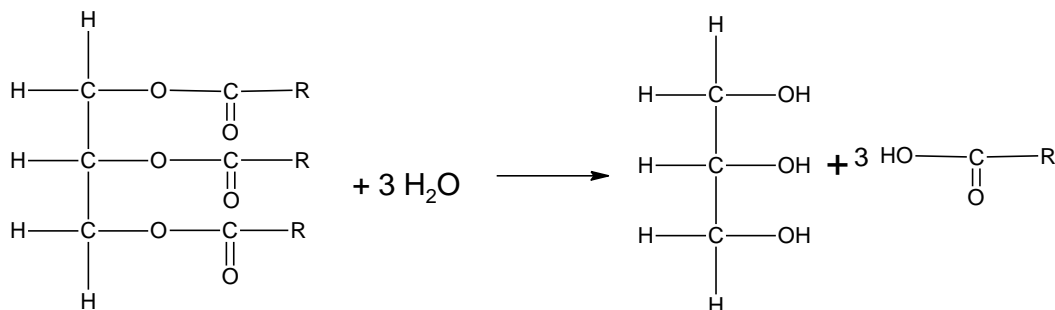
JANUARY 2014

CH4

Section A

Q.1 (a) Reagent(s): (aqueous) sodium hydroxide followed by acid (1)

Condition(s): Heat (to reflux) (1)



[IF NO ACID LISTED IN REAGENT, THEN EQUATION SHOULD CONTAIN SODIUM SALTS] (1) [3]

(b) (i) Reagent(s): (aqueous) bromine (1) [2]
 Observation(s): Changes from orange to colourless (1)

(ii) Nickel / Platinum / Palladium [1]

(iii) Moles of hydrogen gas = $1.15 \div 24.0 = 4.79 \times 10^{-2}$ mol (1)
 Moles of stearic acid produced = $4.79 \times 10^{-2} \div 2 = 2.40 \times 10^{-2}$ mol (1)
 Mass of stearic acid = $2.40 \times 10^{-2} \times 284 = 6.80$ g (1) [3]

(c) (i) **C** $69.7 \div 12 = 5.808$ **H** $11.7 \div 1.01 = 11.584$ **O** $18.6 \div 16 = 1.163$ (1)
 Empirical formula = $\text{C}_5\text{H}_{10}\text{O}$ (1) [2]

(ii) $\text{C}_{10}\text{H}_{20}\text{O}_2$ [1]

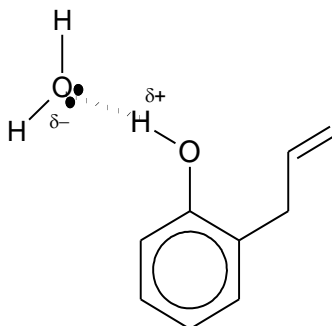
(d) e.g. biodiesel is renewable/won't run out / carbon neutral
 do not accept 'produces less carbon dioxide' [1]

Total [13]

- Q.2 (a) Chromophore [1]
- (b) (i) Melting temperature **lower** than literature value / melting occurs over a temperature range [1]
- (ii) Identify percentage or amount of impurities (1)
Identify the number of compounds present or number of impurities (1) [2]
- (c) (i) Acidified potassium dichromate (1)
Heat and distil (1) do not accept 'reflux' [2]
- (ii) M_r of phenylmethanol = 108.08 M_r of benzenecarbaldehyde = 106.06 (1)
100% conversion would be $10.0 \div 108.08 \times 106.06 = 9.815\text{g}$ (1)
86% yield = $9.815 \times 86 \div 100 = 8.44\text{g}$ (1) [3]
- (iii) Two resonances in the range 5.8-7.0 ppm (1)
These are doublets (1)
One **singlet** at around 11.0 ppm (1)
All resonances have the same area (1) [4]

Total [13]

- Q.3 (a) Isomers [1]
- (b) (i) Peak at 2500-3550 cm^{-1} present in product but not reactant [1]
- (ii) Add FeCl_3 (1)
Forms a purple solution (1) do not accept 'precipitate' [2]
- (iii) 1 mark for correct location of hydrogen bond; 1 mark for dipole OR lone pair e.g.



[2]

- (c) Aromatic Claisen product is more acidic / better proton donor than product of 1,2-Wittig rearrangement (1)

The 1,2-Wittig rearrangement product is an alcohol, so the charge on the **anion** formed is localised / the **anion** is unstable (1)

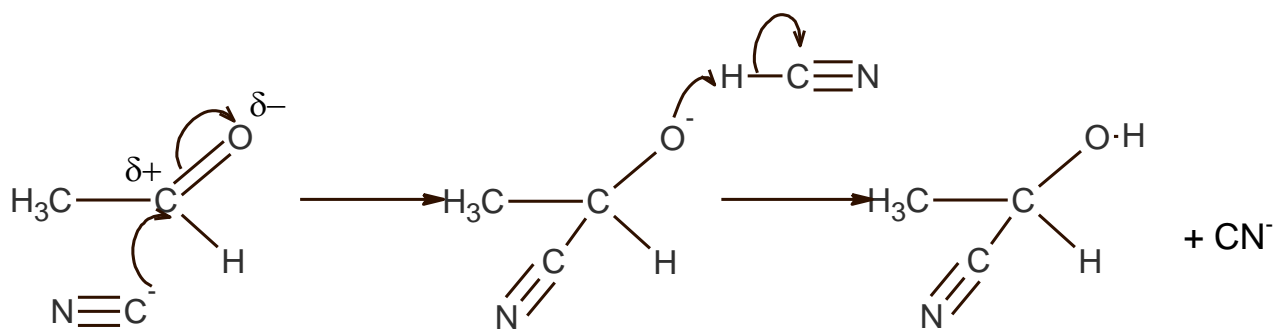
The product of the aromatic Claisen rearrangement is a phenol, so the charge on the anion can be delocalised which stabilises it (1)

(Must be reference to 'anions'; (1) mark awarded for 'stability of anions' if no reference to delocalisation)

[3]

QWC: organisation of information clearly and coherently; use of specialist vocabulary where appropriate [1]

- (d) 1 mark for arrows in first stage; 1 mark for correct intermediate; 1 mark for arrow giving gain of proton in second stage (from HCN or from H^+); 1 mark for bond polarity – max 3 marks; lose 1 if incorrect final structure



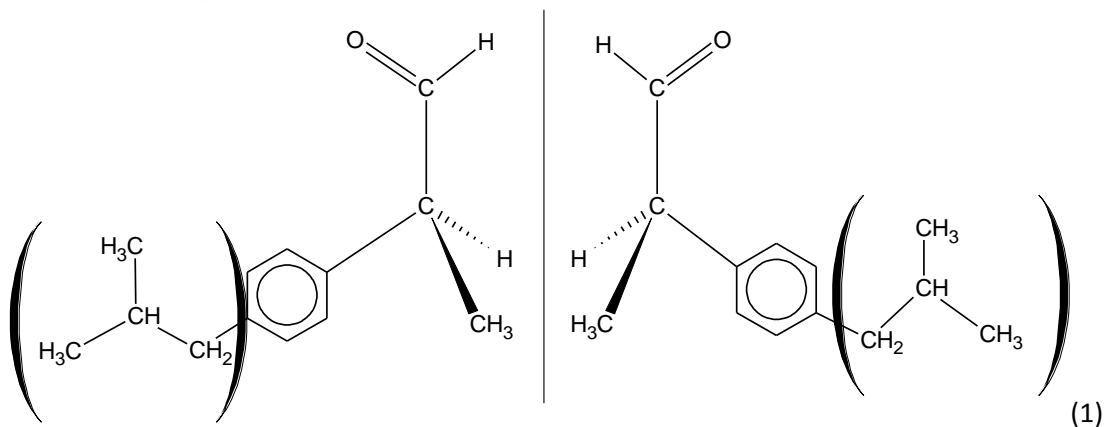
Mechanism: Nucleophilic addition (1)

[4]

Total [14]

Total Section A [40]

- Q.4 (a) $\text{CH}_3\text{CH}(\text{CH}_3)\text{CH}_2\text{Cl}$ (1) $\text{AlCl}_3 / \text{FeCl}_3$ (1) Room temperature / in the dark (1) [3]
- (b) (i) 2,4-DNP (1) Orange precipitate (1) [2]
- (ii) Tollen's reagent (1) Silver mirror with **C**, no reaction with **B** (1) [2]
- (c) Optical isomerism is where a molecule and its mirror image are different / non-superimposable (1)
Compound **C** has a chiral centre / 4 different groups attached to one carbon atom (1)



The two isomers rotate the plane of polarised light in opposite directions (1) [4]

QWC: organisation of information clearly and coherently; use of specialist vocabulary where appropriate (1) [1]

- (d) Dilute acid (1) heat (1) hydrolysis (1) [3]
- (e) Acidified potassium dichromate (VI) (1) / heat (1)

One step reactions are generally better as they have a better yield / there is waste in each stage (1)

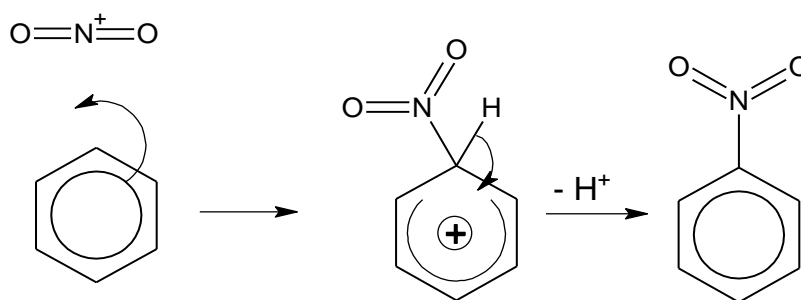
Two step process may be cheaper / use more sustainable reagents/ may give a better yield in this case / produce less harmful waste materials / potassium dichromate may react with other parts of the molecule as well / may be easier to separate product (1)

Do not credit same idea twice e.g. if 'better yield' gains first mark, a different point is required to gain second mark [4]

QWC: selection of a form and style of writing appropriate to purpose and to complexity of subject matter [1]

Total [20]

- Q.5 (a) (i) Both molecules have lone pairs on nitrogen (1)
 The lone pairs can form (coordinate) bonds with H^+ ions (1) [2]
- (ii) Lone pair on N in phenylamine is delocalised over benzene ring (1) therefore less able to accept H^+ (1) [2]
- (iii) I Arrow in first step (1)
 Cation structure in second step (1)
 Arrow in second step (1)

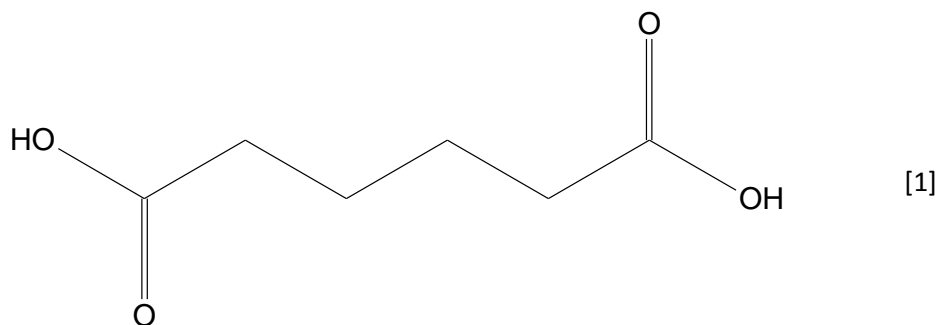


[3]

II (fractional) distillation / steam distillation [1]

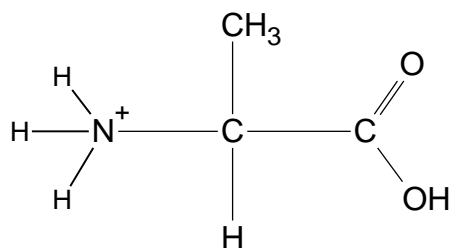
III Sn and conc. HCl (1) followed by NaOH (1) [2]

- (b) (i)

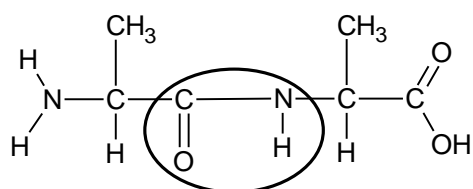


- (ii) Addition polymerisation makes one product only /
 Condensation produces one product plus a small molecule like water (1)
- Addition polymerisation uses one starting material /
 Condensation polymerisation has two different starting materials (1)
- Addition polymerisation involves monomer with one functional group /
 Condensation polymerisation involves monomer with two functional groups
 (1)
- (max 2) [2]

(c) (i)



(ii)



(iii) Alanine has strong (electrostatic) forces between the zwitterions (1)

Butanoic acid has hydrogen bonding between molecules /
electrostatic forces in alanine are stronger than forces in butanoic acid

(1)

[2]

(iv) Soda lime (1) $\text{CH}_3\text{CH}_2\text{NH}_2$ (1)

[2]

Total [20]

Total Section B [40]