WJEC
CBAC

GCE MARKING SCHEME

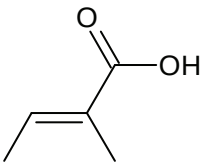
CHEMISTRY (NEW)
AS/Advanced

JANUARY 2010

CH4

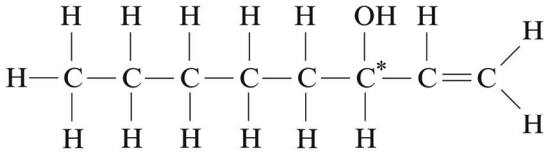
SECTION A

1. (a) (i) Isomers whose atoms / groups take up different positions in space. [1]

(ii) 

[1]

(iii) Ethanol (1) in the presence of (concentrated) sulfuric acid / hydrogen chloride (acting as a catalyst). (1) [2]

(b) (i) 

[1]

A carbon atoms that has four different groups / atoms bonded to it [1]

(ii) They rotate the plane of polarised light (in opposite directions) [1]

(iii) An equimolar / equal masses of the two enantiomers (1)

No (apparent) effect on the plane of polarised light (1) [2]

(c) (i) I Groups / atoms that are responsible for the absorption of (visible) light / giving colour [1]

II It absorbs 'blue' light / all other colours of the visible spectrum /transmits orange [1]

(ii) The CH_2 protons 'see' three protons on the adjacent CH_3 group and by the n+1 rule are split into a quartet. (1)
The CH_3 protons 'see' two protons on the adjacent CH_2 group and by the n+1 rule are split into a triplet. (1) [2]

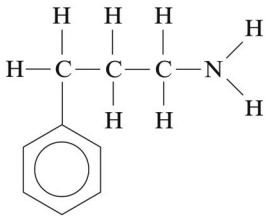
Total [13]

2. (a) (i) (Aqueous) sodium hydroxide – do not allow 'OH⁻' [1]

(ii) Potassium / sodium cyanide – do not allow 'CN⁻' [1]

(iii) Elimination / dehydration [1]

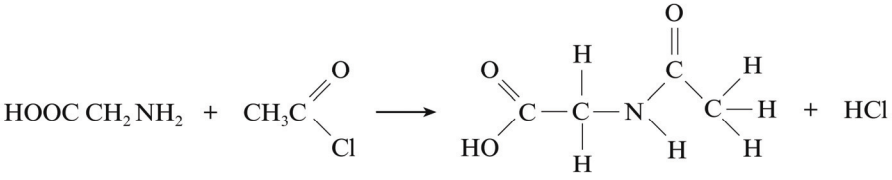
(iv)



[1]

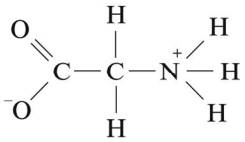
(b) Compound **T** (1); this has protons in only 'two' environments, ∴ 2 peaks (1) [2]

(c) (i)



balanced (1) correct displayed structure of ethanoyl derivative (1) [2]

(ii)



[1]

(d) The secondary structure results from hydrogen bonding (1). This occurs between the N – H and C = O groups of the polypeptide chain(s) (1) [2]

QWC Legibility of text; accuracy of spelling, punctuation and grammar; clarity of meaning. [1]

Total [12]

3. (a) (i) e.g. (Thorough) mixing of the solution [1]

(ii) Number of moles of

$$NaOH = \frac{26.25 \times 0.100}{1000} = 0.002625 / 2.625 \times 10^{-3}$$ (1)

Number of moles of CH_3COOH is also 0.002625 (1)

Concentration of the diluted solution

$$= \frac{1000 \times 0.002625}{25.00} = 0.105 \text{ mol dm}^{-3}$$ (1)

Concentration of the undiluted solution

$$= 10 \times 0.105 = 1.05(0) \text{ mol dm}^{-3}$$ (1) [4]

(b) Conditions although the temperatures are the same / moderate, method 2 needs higher pressures (1) (or vice versa)

Yield / Products Method 1 gives a higher yield / Method 2 gives a lower yield (1)
Method 1 gives few or no co-products / Method 2 gives a number of co-products (1)
The atom economy of the naphtha method is low (1)
There will be problems of the separation of products if method 2 is used (1)

- maximum 4 marks [4]

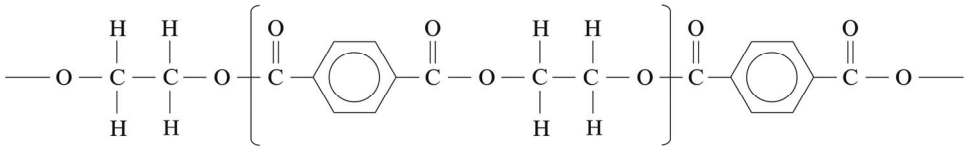
QWC Information organised clearly and coherently, using specialist vocabulary when appropriate [1]

(c) $CH_3(CH_2)_{10}COOCH_2$
|
$CH_3(CH_2)_{10}COOCH$
|
$CH_3(CH_2)_{10}COOCH_2$ [1]

(d) ethyl palmitate is **c** (1)

because $R_f = \frac{3.6}{6.0} = 0.60$ (1) [2]

(e)



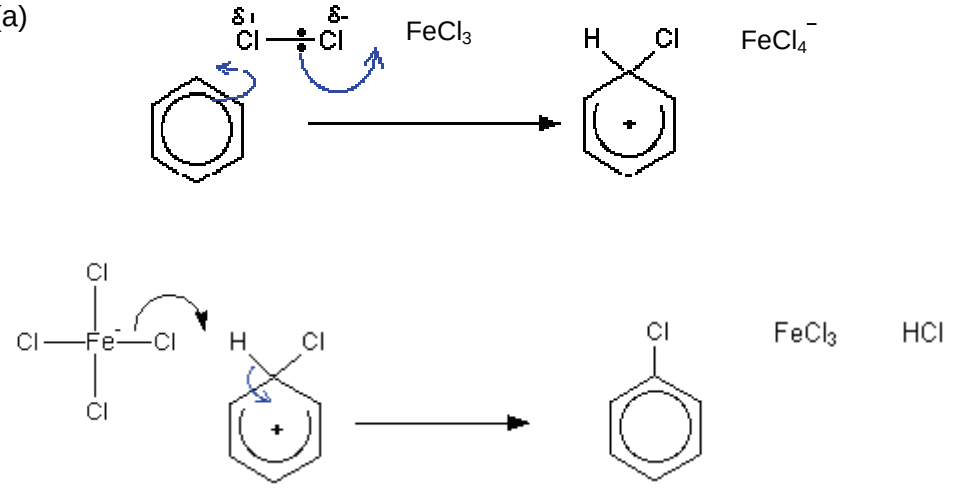
repeating unit (1) structure (1) [2]

Total [15]

Section A Total [40]

SECTION B

4. (a)



correct use of curly arrows (1)
polarisation of chlorine (1)
Wheland intermediate (1)
mechanism shows loss of H^+ or HCl (1)

[4]

(b) The chlorine lone pairs interact with the ring electrons (1)
strengthening the C – Cl bond / decreasing the C – Cl bond polarity (1)
making it less susceptible to nucleophilic attack (1) [3]

(c) (i) 2-propylbenzene / 2-phenylpropane / cumene [1]

(ii) Apart from phenol there is another product (1), the M_r of phenol and propanone are similar / OWTTE (1) [2]

(iii) Propanone would give a peak at ~ 1650 –1750 cm^{-1} (1)
due to the C = O bond (1) [2]

(iv) Purple colour / solution (1)
Ethanol does not react with $FeCl_3$ solution / ethanol is a polar solvent and will dissolve phenol / ethanol does not react with phenol (1) [2]

(v) An orange / red precipitate produced (1)
Melting temperature taken (1) and compared with literature value (1) [3]

(vi) $CH_3CH_2COCH_2CH_3$ M_r 86 (1)

$CH_3CH_2^+$ m/e 29 (1)

$CH_3CH_2CO^+$ m/e 57 (1)

Total [20]

5. (a) (i)

e.g. $CH_3CH_2CH_2CH_2Br + 2NH_3 \longrightarrow CH_3CH_2CH_2CH_2NH_2 + NH_4Br$ [1]

accept one mole of ammonia as a reactant and one mole of HX as a product

(ii) In the liquid phase butylamine molecules are attracted to each other (mainly) by hydrogen bonding (1). This is because the $-NH_2$ group is polar / correct mention of electronegativity / polarity shown in a diagram (1).
Attraction occurs between the nitrogen (lone pair) / (atom) of one molecule and the $\delta+$ hydrogen atom of another molecule (could be seen in a diagram) (1).
$\therefore$ stronger forces between molecules / more energy needed to separate molecules (and hence a higher boiling temperature). (1) [4]

(iii) The indicator turns blue / purple (1). This is because butylamine / amines are basic (1), as the lone pair on the nitrogen atom is a proton acceptor / or nitrogen is an electron pair donor (could be seen on a diagram) (1). [3]

(b) (i) 105 kg of ammonium butanoate gives 87 kg of butanamide
$\therefore$ 1 kg of ammonium butanoate gives $\frac{87}{105}$ kg of butanamide

$\therefore$ 50.0 kg of ammonium butanoate gives $\frac{87 \times 50.0}{105}$ kg of butanamide = 41.4 kg (1)

$$\% \text{ yield} = \frac{26.9 \times 100}{41.4} \quad (1) = 65 \ (1)$$ [3]

(ii) I To see if the results are reproducible. [1]

II See if the reaction time can be reduced. [1]

(c) (i) The (orange) mixture turns green (1) as the ethanol has reduced the acidified dichromate (to green Cr^{3+} (aq)). (1) [2]

(ii) Ethanol gives a mixture of ethanal (1) and ethanoic acid (1).
The ethanal present will give a silver mirror with Tollens' reagent (1)
The ethanoic acid present will fizz / effervesce / produce CO_2 when sodium hydrogencarbonate or carbonate is added (1) [4]
(Accept responses based on Fehlings' / Benedict's reagents, acidified dichromate, 2,4-dinitrophenylhydrazine and iodoform test.)

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

Total [20]

Section B Total [40]