edexcel

GCE

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Chemistry (8080, 9080)

6245/01

Summer 2005

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Mark Scheme (Results)

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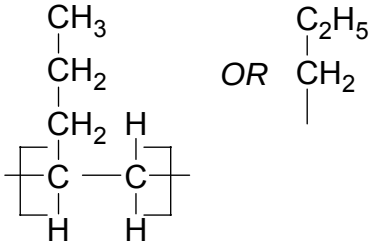
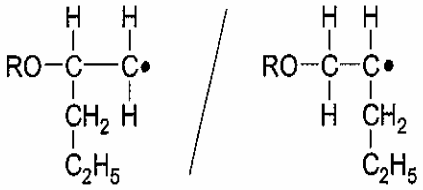
1 (a) (i)



Skeleton **(1)**
NOT C_3H_7
NOT just R for side chain unless specify R= $CH_3CH_2CH_2$
Brackets are not essential

Extension **(1) -** *conditional on first mark OR C_3H_7 / R* **(2 marks)**

(ii) nitiation
$ROOR \rightarrow 2RO^{\bullet}$ **(1)**

Propogation
$RO^{\bullet} + (C_2H_5)CH_2CH{=}CH_2 \rightarrow$  **(1)**

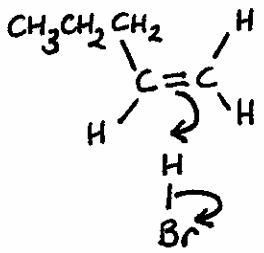
(1)

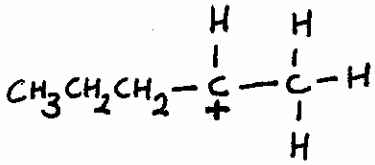
$ROCH(CH_2C_2H_5)CH_2^{\bullet} + C_2H_5CH_2CH{=}CH_2 \rightarrow$
$ROCH(CH_2C_2H_5)CH_2CH(CH_2C_2H_5)CH_2^{\bullet}$
Second propagation step consequential on first step
ALLOW C_3H_7 *OR* $CH_2C_2H_5$ **(1)**
ALLOW any representation of the alkene eg $RCH{=}CH_2$

A correct use of single headed curly arrow

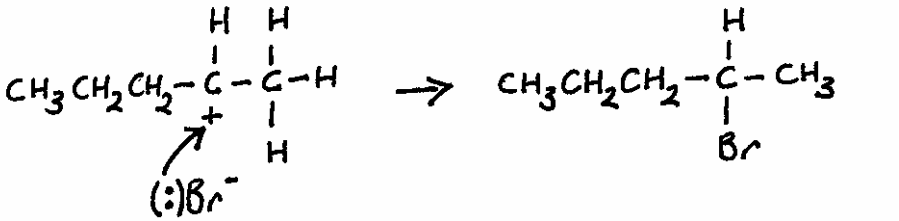
IGNORE additional incorrect arrows
IGNORE termination steps **(4 marks)**

(b) (i)





(1) for both arrows **(1)** for structure of intermediate



(1) Arrow

Lone pair not essential, but if it is shown the arrow must start from it
ALLOW arrow from negative charge
ALLOW arrow to + if written below the C
ALLOW C_3H_7*/R*
If ethene is used **MAX 2** *for curly arrows* **(3 marks)**

(ii) Structures of the **2** intermediate carbocations / intermediate cation giving 2-bromopentane is secondary **and** primary for 1-bromopentane **(1)**

Secondary cation is more stable than primary CONDITIONAL on reference to cations **(1)** **(2 marks)**

(c) (i) Sample in polarimeter / use of crossed polaroids / pass polarised light through sample **(1)**

Rotates the plane of (polarisation of plane)-polarised (monochromatic) light **(1)**

NOT deflection
NOT reflection **(2 marks)**

(ii) intermediate (carbocation) planar **(1)**

equal (probability of) attack from either side **(1)**

(leads to) racemic/ 50:50 / equimolar mixture **(1)** – *stand alone* **(3 marks)**

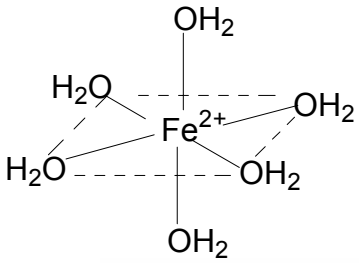
Total 16 marks

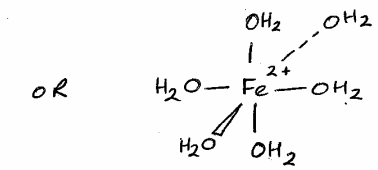
2 (a) (i) Fe [Ar]
$3d^6 4s^2$
or $3d_6 4s_2$
or 3d64s2
or $4s^2 3d^6$ **(1)**

Fe^{2+} [Ar]
$3d^6$
or $3d_6$
or $3d^6\ 4s^o$ **(1)**

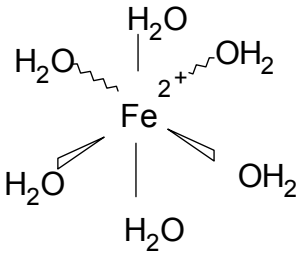
Letter d must be lower case
Any additional letters or numbers (0) **(2 marks)**

(ii) *The mark is for the shape*





OR



Instead of dotted line

ALLOW bond to H of H_2O (except on left side if OH_2 is given)
IGNORE charge unless incorrect

(1 mark)

(iii) $[Fe(H_2O)_6]^{2+} + 2OH^- \rightarrow [Fe(OH)_2(H_2O)_4] + 2H_2O$

OR
$[Fe(H_2O)_6]^{2+} + 2OH^- \rightarrow Fe(OH)_2 + 6H_2O$

OR equations with 2NaOH as reactant and $2Na^+$ as product

IGNORE state symbols **(1 mark)**

(iv) Green precipitate/solid → foxy-red / red-brown/brown/orange
Both colours and precipitate/solid needed
NOT darkens **(1 mark)**

(v) $N_2 + 3H_2 \rightarrow / \rightleftharpoons 2NH_3$
ALLOW  + Br_2 →  + HBr *OR* equation with Cl_2 **(1 mark)**

(b) (i) Emf of cell / potential difference of cell containing Fe^{2+} and Fe **(1)**

and standard hydrogen electrode/half cell *NOT* 'SHE'
OR hydrogen electrode and 1 mol dm^{-3} H^+ and 1 atm H_2 **(1)**

1 mol dm^{-3} Fe^{2+} **(1)**
IGNORE temperature **(3 marks)**

QWC * (ii) Emf of hydrogen electrode is zero – *stated or implied* (e.g. if calculate E_{cell} = +0.44 (V)) **(1)**

$Fe + 2H^+ \rightarrow Fe^{2+} + H_2$ **(1)** – *equation stand alone*

Potential for the reaction is positive so reaction is feasible **(1)**

OR
$H^+$and (½)H_2 has a more +ve electrode potential than $Fe^{2+}$and Fe **(1)**

H^+ will oxidise Fe / H^+ is an oxidising agent / Fe is a reducing agent for H^+ / other correct redox statement **(1)**

$Fe + 2H^+ \rightarrow Fe^{2+} + H_2$ **(1)** – *stand alone* **(3 marks)**

(iii) High E_a so slow reaction / reactants are kinetically stable
IGNORE any mention of non-standard conditions **(1 mark)**

(c) $2Fe^{3+} + 2I^- \rightarrow 2Fe^{2+} + I_2$ or words E^0 = (**+) 0.23** V **(1)**
So I^- would reduce Fe^{3+} / Fe^{3+} would oxidise I^- / E^0 positive so reaction L→ R **(1)**

OR reverse argument **(2)**

OR
Fe^{3+} and Fe^{2+} has a more positive electrode potential than I_2 and I^- **(1)**
I^- will reduce Fe^{3+} / Fe^{3+} will oxidise I^- **(1)** **(2 marks)**

Total 14 marks

ALLOW correct names or formulae. If both given, both must be correct.
Condition marks are dependent on correct or nearly correct reagents

3 (a) (i) aluminium chloride/$AlCl_3$/Al_2Cl_6 / iron(III) chloride/$FeCl_3$
OR the equivalent bromides **(1 mark)**

(ii) <u>First step</u>

Potassium dichromate +sulphuric acid
OR acidified dichromate
OR $H^+ + Cr_2O_7^{2-}$
OR (potassium) manganate(VII)/permanganate + acid/alkali/neutral **(1)**

heat / reflux **(1)**

Intermediate: CH_3COOH/CH_3CO_2H **(1)**

<u>Second step</u>

PCl_5 / PCl_3 / $SOCl_2$ **(1)** **(4 marks)**

(b) (i) $LiAlH_4$ **(1)**
dry ether / ethoxyethane (followed by hydrolysis). **(1)**

OR
$NaBH_4$ **(1)**
aqueous ethanol/water **(1)**

OR
Na **(1)**
ethanol **(1)**

OR
H_2 **(1)**
Pt *OR* Ni+heat *OR* Ni + specified temperature **(1)** **(2 marks)**

(ii) $KMnO_4$ **(1)**

sodium hydroxide / alkali **(1)**
ALLOW KOH
Heat **(1)**
} Both conditions dependent on $KMnO_4$

OR
I_2 **(1)**
NaOH **(1)**
warm **(1)**

(3 marks)

(c) (i) **A** spectrum shows bond due to C=O at 1680-1700 (cm^{-1}) **(1)**
Can be given as a range or number within this range
NOT 1750
NOT 1680 -1750

QWC
*

B spectrum shows bond due to OH at 3230-3550 (cm^{-1}) **(1)**

A has no OH / no bond at 3230-3550
OR B has no C=O bond / no bond at 1680-1700 **(1)**
Can be given as a range or number within this range
ALLOW 1750 if already penalised in first marking point **(3 marks)**

(ii) IR spectra due to **bonds** present **(1)**
Same bonds/functional groups in both isomers **(1)** **(2 marks)**

(d) (i) Iodine/I_2/sodium iodate(I) / NaOI /NaIO/iodate(I)/ OI^- /IO^- **(1 mark)**

(ii) $C_6H_5COCH_3 + 3I_2 + 4OH^- \rightarrow C_6H_5COO^- + CHI_3 + 3I^- + 3H_2O$

OR
$C_6H_5COCH_3 + 3I_2 + 4NaOH \rightarrow C_6H_5COONa + CHI_3 + 3NaI + 3H_2O$

CHI_3 *on RHS***(1)**
NOT CH_3I

All remaining species correct **(1)**
Balance **(1)** – *dependent on 2nd mark* **(3 marks)**

(iii) (Hydrolyse with) NaOH / alkali **(1)**

acidify / neutralise with HNO_3/ excess HNO_3 **(1)**
NOT just "add"

add silver nitrate (solution) **(1)**

yellow ppt **(1)**

(4 marks)

If no hydrolysis **1 max** for last 3 points correct

Total 23 marks

4 (a) (i) sum of the powers to which the **concentration** (terms) are raised in the rate equation / number of species involved up to and including the rate determining step (in the reaction mechanism)

OR
General equation with sum of partial orders explained **(1 mark)**

(ii) constant (of proportionality) in the rate equation / numerically = rate when all concs 1 mol dm^{-3}/correct example **(1 mark)**

(b) (i) Both orders 1 **(1)**

Double concentration of one while other is constant and the rate doubles *OR* refer to two specific experiments **(1)**

(2 marks)

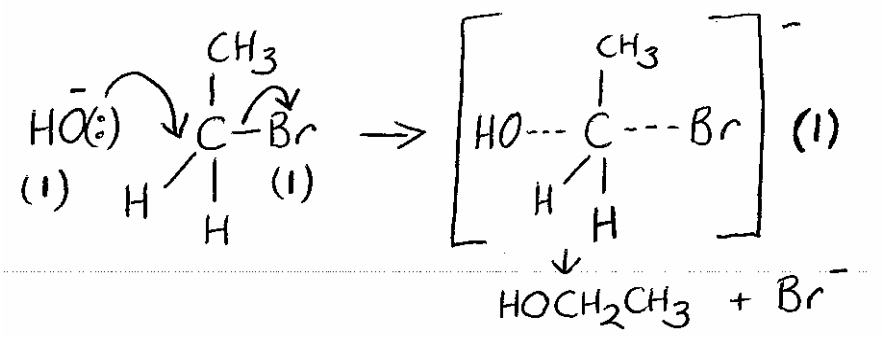
(ii) rate = $k[CH_3I][OH^-]$
consequential on (i) **(1 mark)**

(iii) e.g. k = rate/$[CH_3I][OH^-]$

so k = 1(.0) x 10^{-3} **(1)** $mol^{-1}\ dm^3\ s^{-1}$ **(1)**

Consequential on (ii) **(2 marks)**

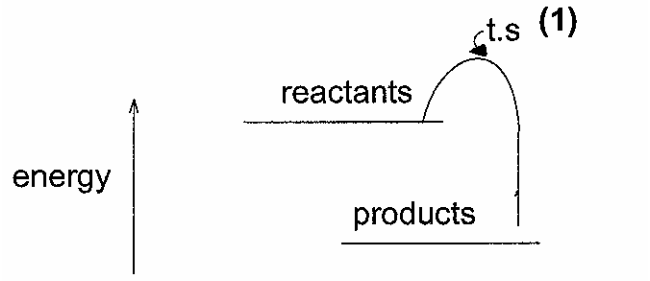
(c) (i) *IGNORE shape and position of bonds*
DO NOT ALLOW OH·····C



Arrow from bond to Br must be in first step
Lone pair not essential, but if it is shown the arrow must start from it.
ALLOW arrow from negative charge
Max 1 *for completely correct* S_N1 *mechanism*

(3 marks)

(ii)



Energy labelled and levels of reactants and products **(1)**
If double hump can get **1 (out of 2)** for levels

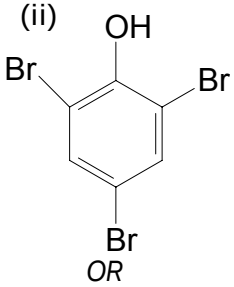
(2 marks)

Total 12 marks

5 (a) (i) $C_6H_5O^-Na^+$ / C_6H_5ONa/ $C_6H_5O^-$

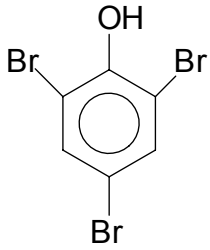
Do not allow covalent O-Na **(1 mark)**

(ii)



No other Isomer allowed

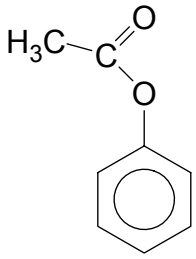
OR



(1 mark)

IGNORE bond to H of OH

(iii)



(1 mark)

No ring substitution allowed

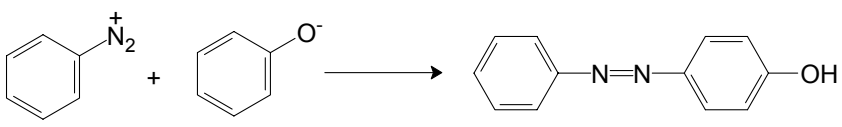
(b) (i) $NaNO_2$ / sodium nitrite / nitrate(III) **(1)**

conc aq / dil HCl / hydrochloric acid **(1)**
NOT HCl

Any temperature between 0 – 10 °C
OR range between 0-10 °C **(1)**
NOT "less than 10 °C"

IGNORE everything before phenylamine eg starting from benzene
Conditions are dependent on correct or nearly correct reagents **(3 marks)**

(ii)



Correct diazonium ion **(1)** if $-^+N{\equiv}N$ the + must be on correct N

Correct equation **(1)**
IGNORE position of OH group
Can include Cl^- if equation is balanced
ALLOW + $C_6H_5OH \rightarrow$ ……. + H^+ **(2 marks)**

(iii) Alkaline/alkali/sodium hydroxide/ NaOH /KOH/potassium hydroxide/ sodium carbonate/sodium hydrogencarbonate
IGNORE temperature

(1 mark)

Total 9 marks
TOTAL FOR PAPER: 75 MARKS