WJEC
CBAC

GCE MARKING SCHEME

CHEMISTRY
AS/Advanced

SUMMER 2010

CH2

SECTION A

1. (i)

$$\times\times \quad\quad \text{o o} \quad\quad \times\times$$
$$\times \quad\quad \times \quad\quad \times \quad\quad \times$$
$$\times \quad F \quad _\text{o}^{} \quad O \quad _\text{o}^{} \quad F \quad \times$$
$$\times\times \quad\quad \text{o o} \quad\quad \times\times$$

[1]

all outer electrons must be shown.

(ii) $F_2O + 2Mg \rightarrow MgO + MgF_2$ [1]
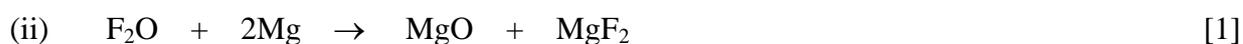
2. 23.8 g produced per 100 g of water   (1)
5×23.8 g produced per 500 g of water   =   119 (g) (1) [2]

3. (i) Ni / Pt /Pd [1]

(ii) eg   because of restricted/no rotation about the double bond [1]

4. (i) C_5H_{12} [1]

(ii)
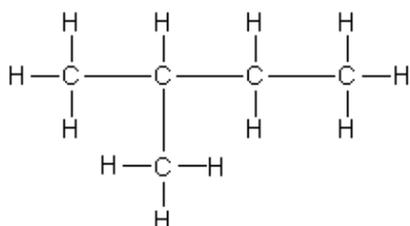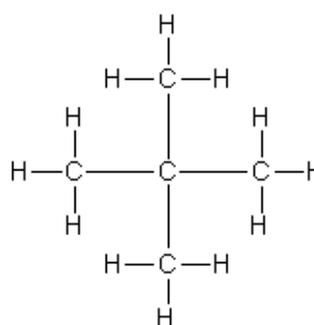
or [1]

5. ………. increases……….   …………………… decreases. [1]

6. elimination / dehydration [1]

Section A Total [10]

SECTION B

7.　　(a)　　(i)

Number of bonding pairs	Number of lone pairs	F – S – F	Shape
6	0	90° / 180°	octahedral

one mark for each correct answer　　　　　　　　　　[4]

(ii)　　There is an unequal electron distribution in the bond (1) because fluorine has a higher electronegativity (in this bond)　　(1)　　　(accept a diagram)　　　[2]

(iii)

Oxidation state of sulfur in SF_6	Oxidation state of sulfur in H_2S	Oxidation state of sulfur in sulfur, S
(+)6	–2	0

(1)

The sulfur atom in sulfur hexafluoride has become less positive / more negative
∴ reduced by reaction with hydrogen sulfide　　　(1)　　　　　[2]

(b)　　　　　　　　　　　　Na^+　　　F^-　　correct formula of both ions　　(1)
　　　　　　　　　　　　　　　6 : 6　　　　　　　　　　　　　　　(1)　　　　[2]

(c)　　(i)

→

[1]
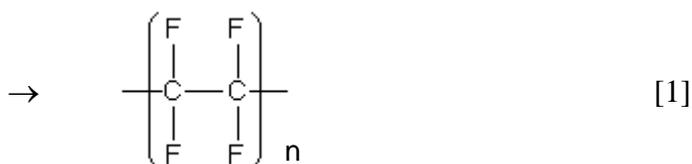
(ii)　　diagram shows　　　correct　δ^+ / δ^-　(1)　correct lone pairs　(1)
　　　　　　　　　　　　　　intermolecular bonding correct (1)　　　　　[3]

Total [14]

8. (a) (i) $Ca + 2H_2O \rightarrow Ca(OH)_2 + H_2$ [1]

(ii) from the graph the mass of pure calcium $= 0.104$ g (1)

% purity of calcium $= \dfrac{0.104 \times 100}{0.115} = 90.4$ (1) [2]

(iii) The (2) outer electrons to be removed are further from the nucleus in a strontium atom/strontium atom is larger/has an extra shell of electrons (1)
There is less electron shielding in the calcium atom / more electron shielding in the strontium atom (1) [2]

(b) addition of a sulfate (ion) / sulfuric acid – white precipitate (1)
addition of an acid-base indicator / pH probe – solution is basic / pH > 7 (1) [2]

(c) strontium
writing / diagram indicates lattice of cations with 'sea' of electrons (1)
electrons able to move (under applied potential), carry charge (1)

graphite
diagram shows hexagonal layer structure (1)
weak intermolecular/Van der Waals forces between layers (1)
(Delocalised) electrons able to move / carry charge (under applied potential) (1) [5]

QWC *ensure that text is legible and that spelling, punctuation and grammar are accurate so that the meaning is clear* [1]

(d) nanotubes consist of layers / pipelines of graphite hexagons (1)
closed at the end by (pentagons of) carbon atoms / OWTTE (1) [2]

Total [15]

9. (a) (i) Homolytic fission – a process of **covalent** bond breaking where each atom
(of the bond) receives an electron (from the bond)   (1)

$$Cl – Cl \rightarrow 2\ Cl\bullet \qquad (1)$$

[2]

(ii) Propagation stage – a stage where a (free) radical reacts and another is generated
(to carry on the reaction)   (1)

$$eg \quad Cl\bullet + CH_4 \rightarrow \bullet CH_3 + HCl \quad (1)$$

[2]
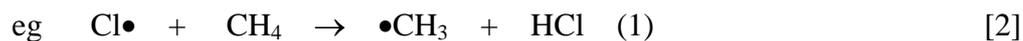
(b) (i) The C – F bond is stronger than the C – Cl bond   (1)
and is not broken by **UV** radiation   (1)   [2]

(ii) I   m/e 60 $\rightarrow$ M_r 60   (1)
$1725\ cm^{-1}$ $\rightarrow$ C = O   (1)
$2500\text{-}3500\ cm^{-1}$ $\rightarrow$ O – H   (1)
likely to be ethanoic acid   (1)   (accept 2-hydroxyethanal)   [4]

II   Reagent – silver nitrate / $AgNO_3$ / silver ions / Ag^+ (assume aqueous) (1)
White precipitate (1)   [2]

Total [12]

10. (a) (i) $2Br^- + Cl_2 \rightarrow Br_2 + 2Cl^-$ [1]
                              accept stoichiometric equation, e.g. using NaBr (not HBr)
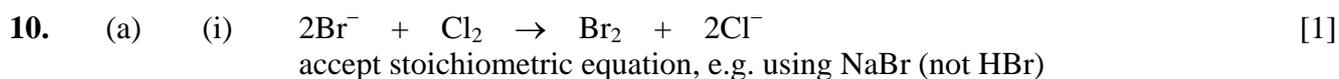
           (ii)   I   An oxidising agent is itself reduced / gains electrons / removes electrons
                              from the other reactant.   [1]

                      II   In this reaction the outer electron shell of a chlorine atom is closer to the
                              nucleus than in a bromine atom / chlorine is a smaller atom (1) and therefore
                              the attraction for the electron is greater (1)   [2]

           (iii)   Iodine is a bigger molecule / contains more electrons (or vice versa) (1)
                   therefore intermolecular Van der Waals forces are greater for iodine (1),
                   (more energy is needed to separate iodine molecules, therefore less volatile than
                   bromine)   [2]

                   (unqualified mention of Van der Waals forces (1))

      (b)   (i) M_r of calcium bromide $\rightarrow$ 200 / 199.9   (1)
                      Concentration = <u>no. of moles</u> = 1200 / 200 ÷ 1 = 6 (mol dm^{-3}) (1) [2]
                                            volume

           (ii)

Compound	Flame colour(if any)
magnesium bromide	none (1)
calcium bromide	brick red (1)

                                                                        [2]

      (c)   (i)

```
        H    Br   Cl
        |    |    |
  Br—C—C—C—H
        |    |    |
        H    H    H
```
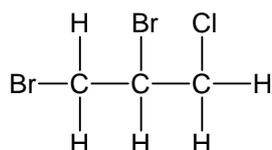
   [1]

           (ii)   I   (Bromine is added) across the double bond   [1]

                      II   Any correct carbocation / H^+ / Cl^+ / NO_2^+ / accept H_2 / accept Cl_2 [1]

                      III   A movement of **two** electrons/an electron pair/a lone pair   [1]

                                                                       Total [14]

11. (a) 1-Chlorobutane is heated / refluxed (1) with aqueous (1) sodium hydroxide.
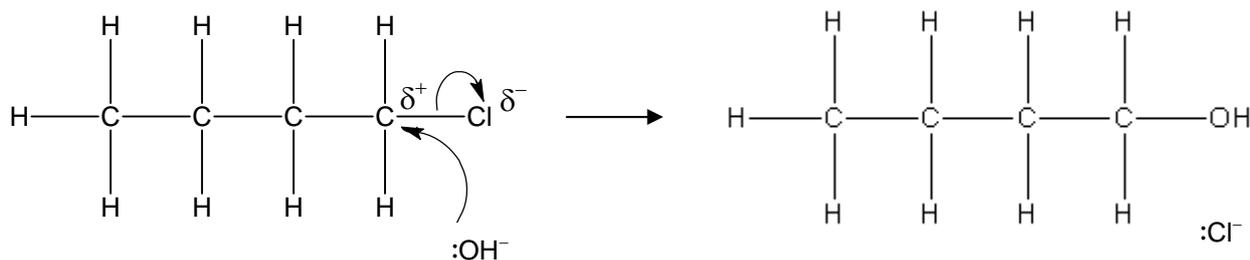
Correct formulae and charges (1) curly arrows (1) polarisation (1)

The reaction mechanism is nucleophilic substitution (1) [6]

QWC select and use a form and style of writing appropriate to purpose and to complex subject matter [1]
organise information clearly and coherently, using specialist vocabulary when appropriate [1] [2]

(b) (i) (2-)methylpropan-1-ol [1]

(ii) number of moles of compound G = $\dfrac{0.50 \times 86}{100}$ = 0.43 (1)

mass of compound G = 0.43×74 = 31.8 / 32 g (1) [2]

(iii) oxidising agent (potassium) dichromate / $K_2Cr_2O_7$ / $Cr_2O_7^{2-}$ (1)

observation orange to green (solution) (1) [2]

accept correct answers based on potassium manganate(VII)

(c) temperature 300°C (1) pressure 60-70 atmospheres (1) [2]

Total [15]

Total Section B [70]