GCE MARKING SCHEME

CHEMISTRY
AS/Advanced

JANUARY 2011

CH2

SECTION A

1.   (a)   Specific health problem e.g. liver disease / cirrhosis / heart failure / stroke   [1]

      (b)   **Acidified** potassium dichromate(VI) / **Acidified** potassium manganate(VII)   [1]

2.   Bones / teeth / coral / shells / muscle contraction (accept skeleton)   [1]

3.   B / H_2O [1]

4. $Cl_2 + 2\ NaBr \rightarrow Br_2 + 2\ NaCl$ or $Cl_2 + 2\ Br^- \rightarrow Br_2 + 2\ Cl^-$ [1]
                      (State symbols not required)

5.   (a) δ- O-H δ+ δ- C-H δ+ δ+ B-Cl δ- δ+ C=O δ-

            2 correct for 1 mark, all four for 2 marks   [2]

      (b)   O-H   [1]

6.

Element	Initial oxidation State	Final oxidation state	Oxidation or reduction
xenon	+2	0	reduction
oxygen	-2	0	oxidation

1 mark for each line completely correct

(If all oxidation states correct without oxidation/reduction indicated then award 1 mark
in total.)   [2]

Section A Total [10]

SECTION B

7. (a)

Test	Observation	
Flame test	<u>Lilac</u> flame	(1)
Addition of nitric acid followed by aqueous silver nitrate	White precipitate	(1)
Addition of sodium hydroxide solution	White precipitate	(1)

[3]

(b) Heat to evaporate some water to form a saturated solution
(Do not accept evaporate all water or to dryness) (1)

<u>Allow to cool</u> for crystals to form (1)

Filter off crystals / evaporate at room temperature (1)   [3]

(c) (i)   1.25 g   [1]

(ii)   169.9 / 170   [1]

(iii) Moles carnallite = 1.95 / 169.9 = 1.15×10^{-2} moles
Moles water = 1.25 / 18.02 = 6.94×10^{-2} moles
Both moles for (1)

X = 6.94×10^{-2} / 1.15×10^{-2} = 6   (Mark consequentially) (1)   [2]

(d) Moles carnallite = 100 000 / 169.9   = 588.6 moles   (1)
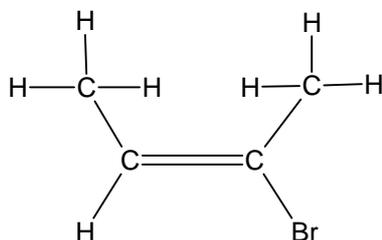
This produces 588.6 moles of $MgCl_2$ (1)

Mass $MgCl_2$ = 588.6 x 95.3 = 56.1 kg or 56100 g
[units must be stated to obtain mark]   (1)   [3]

Total [13]

8. (a) (i) Compounds A and B have C=C double bonds, but compound B does not (1)

There is restricted rotation **about the double bond** (1) [2]

(ii)

Correct connectivity of bonds (1)

Correct geometrical isomer (1) [2]

(b) (i) Orange to colourless (do not accept 'clear') [1]

(ii) 2,3-dibromobutane [1]

(iii) Cannot form hydrogen bonds / strong intermolecular forces **with water molecules** [1]

(iv) Sodium or potassium hydroxide (1)
Dissolved in alcohol and heat (1) [2]

(c) (i) 1 mark for arrows in first diagram; 1 mark for dipole on H-Br molecule; 1 mark for arrow in second diagram; 1 mark for charges in second stage [4]
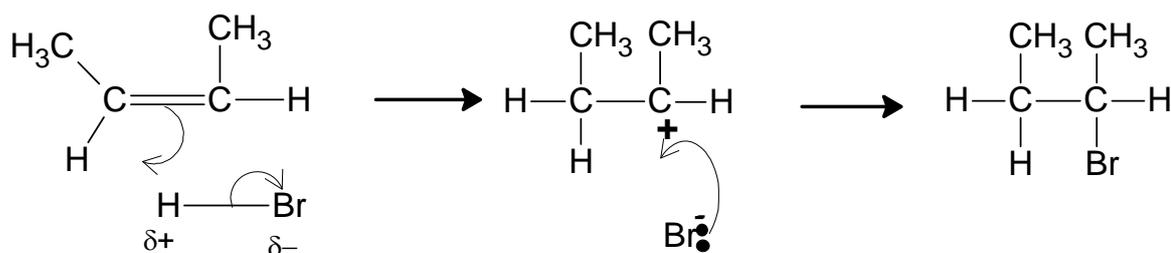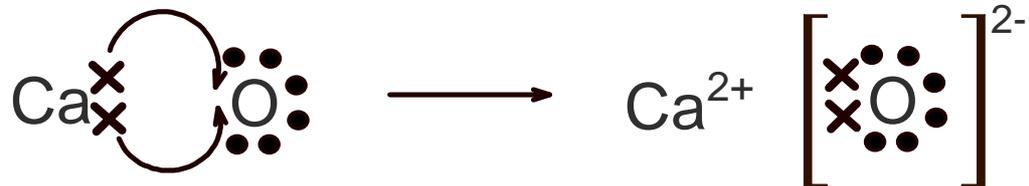

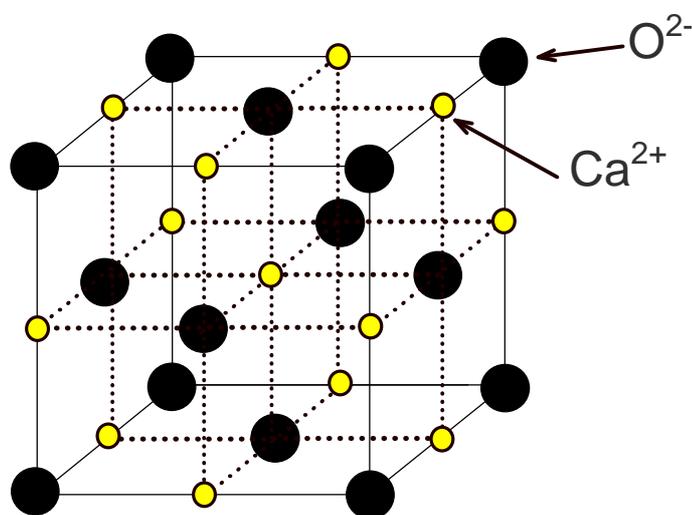(ii) Electrophilic addition [1]

Total [14]

9. (a) M_r (CaCO$_3$) = 100.1 M_r (CaO) = 56.1   both values gives 1 mark

Atom economy = (56.1 /100.1) x 100 = 56.0 %   (1)   [2]

(b) 1 mark showing movement of electrons; 1 mark showing dot and cross of CaO   [2]

(c) (i) 1 mark for cubic arrangement; 1 mark for 6 counterions arranged octahedrally around each ion   [2]

Accept smaller diagram that shows the octahedral arrangement of ions around counterions

(ii) (CaO and NaCl have 1:1 formulae), CaCl$_2$ has 1:2   [1]

(d) (i) 3 Ca + 2 H$_3$PO$_4$ → Ca$_3$(PO$_4$)$_2$ + 3 H$_2$

1 mark for formula of calcium phosphate; 1 mark for equation

All total of 1 mark for balanced equation with incorrect formula for calcium phosphate
e.g. 2 Ca + 2 H$_3$PO$_4$ → 2 CaPO$_4$ + 3 H$_2$ [2]
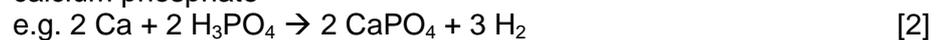
(ii) Calcium sulfate is insoluble (1)

This produces a **layer** over the surface of the metal preventing reaction (1)   [2]

Total [11]

10. (a) $Cl_2 \rightarrow 2\ Cl^\bullet$ [1]

(b) Fractional distillation (1)
Different products have **different boiling points** (1) [2]

(c) (i) One intermediate is a $C_5H_{11}^\bullet$ radical / a five carbon radical (1)
Two of these radicals combine together in a termination reaction (1) [2]

(ii) Peak at 650-800 cm^{-1} (due to C-Cl bond) in chloropentane will be
gone (1)
Peak at 2500-3500 cm^{-1} (due to O-H) in pentanol will be present
(also accept 1000-1300 cm^{-1} for C-O bond) (1) [2]

(d) (i) Pentan-1-ol has hydrogen bonding between molecules but
1-chloropentane does not (1)
Hydrogen bonding is the strongest intermolecular force (1) [2]

(ii) Both compounds have similar hydrogen bonding **between molecules** (1)
Pentan-1-ol is a larger molecule than propan-1-ol (1)
Pentan-1-ol has more stronger van der Waals forces **between
molecules** than propan-1-ol (1)
Any 2 out of 3 [2]

(iii) Propan-1-ol (1)

-OH can hydrogen bond **with water** (whilst –Cl cannot) (1)

Pentanol has a larger part of the molecule that cannot hydrogen bond
/ hydrocarbon chain is hydrophobic (1) [3]

(e) C-Cl has the largest δ+ on carbon / C-I has smallest δ+ on carbon (1)

If dipole was controlling factor, C-Cl would be fastest as nucleophile most
attracted to this (1)

Easier to break bonds as go down the group / bonds get weaker down the
group (1)

If bond strength was the governing factor we would expect rate to become
greater down the group (1)

Dipole is not the controlling factor for rate / Bond strength is the governing
factor (1)
[MAX 4]

*QWC: legibility of text, accuracy of spelling, punctuation and grammar, clarity
of meaning.* [1]

Total [19]

11. (a) (i) Li [1]

        (ii) K [1]

        (iii) Li / Na / K / Mg / Ca [1]

        (iv) O [1]

    (b) Structures (Max 4 points on structure)
- Graphite: Giant covalent structure OR Hexagonal layers of carbon atoms
- Graphite: Delocalized electrons between the layers
- Aluminium: Lattice of **positive** metal **ions**
- Aluminium: (Sea of) delocalized electrons
- Caesium chloride: (Lattice of) anions and cations / giant ionic

Conditions required
- Graphite and Aluminium can conduct as solids
- Caesium chloride must be a liquid/solution to conduct

How material conducts
- Aluminium and Graphite: (Delocalised) electrons move to form a current
- Caesium chloride: **Mobile ions** carry allow electricity to flow

                              1 mark for each point giving [MAX 6]

QWC: 2 marks [2]
- *selection of a form and style of writing appropriate to purpose and to complexity of subject matter.*
- *organisation of information clearly and coherently; use of specialist vocabulary where appropriate.*

    (c) Nanoscale electrical wires / electronic circuitry [1]
        (accept miniature/tiny)

                                        Total [13]

                                  Section B Total [70]