GCE MARKING SCHEME

CHEMISTRY
AS/Advanced

SUMMER 2011

CHEMISTRY - CH2

SECTION A

Q.1 (a) Calcium carbonate [1]

(b) Sodium carbonate [1]

Q.2 Metallic (1)
Covalent **and** van der Waals (1) [2]

Q.3 $Ca_3(PO_4)_2$ [1]

Q.4 D [1]

Q.5 Materials that change their properties in response to a change in conditions / environment / surroundings [1]

Q.6 (a) Alkene / double bond (1)
Alcohol / hydroxyl / hydroxy (1) [2]

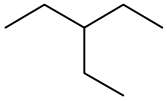
(b) $C_5H_{10}O$ [1]

Total [10]

SECTION B

Q.7 (a) Compound that contains no double bonds / single bonds only
(Accept contains maximum number of hydrogens) [1]

(b) (i) $C_3H_8 + 5O_2 \longrightarrow 3CO_2 + 4H_2O$ [2]
products (1)
balancing (1)

(ii) 

[1]

(c) Cracking (1)
Heat fraction strongly / heat over a catalyst (1)
Accept equation or description of cracking [2]

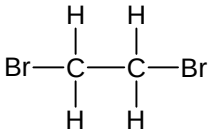
(d) Planar molecule with trigonal arrangement about each atom / bond angles roughly 120° (1)

Four (single) **covalent** C – H bonds and one C = C double bond (1)

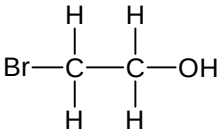
π bond in C = C formed by sideways overlap of p orbital (1) [3]

QWC: Information is organised clearly and coherently, using specialist vocabulary where appropriate. [1]

(e) Electrophilic addition (1)



accept



[2]

(f) Phosphoric acid [1]

(g) Moles ethanol = $\frac{230}{46}$ = 5 (1)

Moles glucose = 2.5 (1)

Mass glucose = 2.5 x 180 = 450 g (1) [3]

Total [16]

Q.8 (a) $C_4H_{10} + Cl_2 \longrightarrow C_4H_9Cl + HCl$ (1)

UV light (1)

any of following for 4 max

$Cl_2 \longrightarrow 2Cl^{\bullet}$ (1)

Free radical substitution / photochlorination (1)

$Cl^{\bullet} + C_4H_{10} \longrightarrow {}^{\bullet}C_4H_9 + HCl$ (1)

${}^{\bullet}C_4H_9 + Cl_2 \longrightarrow C_4H_9Cl + Cl^{\bullet}$ (1)

e.g. $Cl^{\bullet} + Cl^{\bullet} \longrightarrow Cl_2$ (1)

[6]

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

(b) $C_4H_9Cl + NaOH \longrightarrow C_4H_9OH + NaCl$ (1)

Nucleophilic substitution / hydrolysis [2]

(c) Heat with NaOH (1)

Add HNO_3 then $AgNO_3$ (1)

White precipitate seen (1) [3]

(d) Ozone layer depleted / (leads to) increased incidence of skin cancer

Contributes to greenhouse effect / increases global warming [1]

Total [13]

Q.9 (a) C=O absorption at 1650–1750 cm^{-1}

C–O absorption at 1000–1300 cm^{-1}

O–H absorption at 2500–3500 cm^{-1}

3 correct peaks labelled

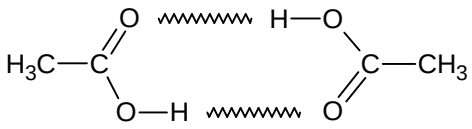
[2]

(2 correct peaks labelled 1 mark)

(b) Molecular ion at m/z 60 shows that M_r is 60 (1)

Peak at m/z 15 shows CH_3 group / peak at m/z 45 shows COOH group (1)
[2]

(c) (i)



[1]

(Accept 1 hydrogen bond)

(ii) (Intermolecular bond formed) when hydrogen attached to a highly electronegative atom (oxygen) (1)

is bonded to an electronegative atom in another molecule (1)

forming very strong dipole – dipole attraction (1) [3]

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

(d) (i) Acidified and heat / reflux [1]

(ii) Colour change from orange to green [1]

(e) Propane would be lower as it cannot form hydrogen bonds / only forms van der Waals forces between molecules (1)

Butan-1-ol would be higher as it (also has hydrogen bonds but) has more van der Waals forces between molecules (1) [2]

Total [13]

Q.10 (a) (i) $4NH_3(g) + 5O_2(g) \longrightarrow 4NO(g) + 6H_2O(g)$ [1]

(ii)

Element	*Initial Oxidation State*	*Final Oxidation State*
Nitrogen	–3	2
Hydrogen	1	1
Oxygen	0	–2

All three rows correct (2)
(1 mark if two rows correct)

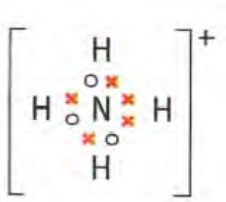
Nitrogen oxidised as its oxidation state has increased (1) [3]

(iii) NH_3 has 3 bonding and 1 non bonding pair of electrons (1)

BF_3 has 3 bonding pairs only (1)

Electron pairs position themselves as far apart as possible (to minimise repulsion) (1) [3]

(b) (i) A covalent bond where one of the atoms has donated both electrons in the shared pair [1]



charge spread over ion (1)

correct bonding (1)

[2]

(iii) Tetrahedral (1)

109½º (1) (accept 109°) [2]

(iv) Water is polar / a polar solvent (1)

Anion is attracted to $H^{\delta+}$ / cation is attracted to $O^{\delta-}$ (1) [2]

Total [14]

Q.11 (a) (i) Lilac flame (1)

White solid / white fumes / potassium melts (1) [2]

(ii) $4K + O_2 \longrightarrow 2K_2O$ [1]

(iii) More reactive (1)

Electrons in rubidium lost more easily / ionisation energy is less / explanation e.g. increased sheilding (1) [2]

(Need reason to get first mark but accept more reactive as reactivity increases down group for 1 mark)

(b) (i) No. moles = $\frac{0.098}{23} = 0.00426$ [1]

(ii) Moles $H_2 = 0.00213$ (1)

Volume $H_2 = 0.00213 \times 24 = 0.0511\ dm^3$ (1) [2]

(iii) Moles NaOH = 0.00426 (1)

Concentration NaOH = $\frac{0.00426}{0.200} = 0.0213\ mol\ dm^{-3}$ (1) [2]

(c) (i) Do the experiment in a fume cupboard [1]

(ii) I 6:6 [1]

II Electrostatic forces between the oppositely charged ions (1)

ionic bonds are / ionic lattice is very strong so large amount of energy needed (1) [2]

Total [14]

Section B Total [70]