GCE MARKING SCHEME

CHEMISTRY
AS/Advanced

SUMMER 2012

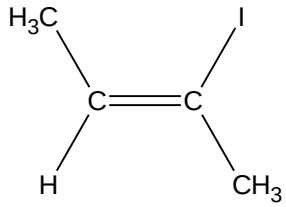
SECTION A

Q.1 (a) $C_{19}H_{40}$ [1]

(b) $C_{19}H_{40} \rightarrow C_8H_{18} + C_{11}H_{22}$ - allow ecf [1]

Q.2 2-chlorobutane [1]

Q.3 [1]



Q.4 any number in range 1 to 6 [1]

Q.5 (a) maximum mass = 44-45 (g) [1]

(b) (less solute would form as a solid) because more will remain in the solution [1]

Q.6 (a) iodine force is Van der Waals/ induced dipole-induced dipole (1)

diamond force is covalent bond/ description of attractive forces in a covalent bond (1) [2]

(b) diamond would have a higher sublimation temperature because it has strong**er** forces/ forces are hard**er** to break [1]

Section A Total [10]

SECTION B

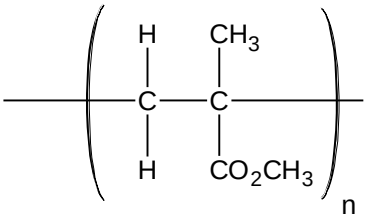
Q.7 (a) (i) one σ bond/ description of σ bond/ diagram to show overlap of s orbitals (1)

one π bond/ description of π bond/ diagram to show sideways overlap of p orbitals (1)

[2]

(ii) joining of **many/lots of** (small) units or many alkenes / molecules to make a **large/long** unit/ molecule [1]

(iii)



[1]

(iv) C_4H_5Cl [1]

(b) (i) BF_3 is planar triangular/ trigonal planar (1)

NH_3 is pyramidal/ trigonal pyramid (1) [2]

(ii) BF_3 has 3 bond pairs (1)

NH_3 has 3 bond pairs and 1 lone pair (1) [2]

QWC the information is organised clearly and coherently, using specialist vocabulary where appropriate [1]

(c) (i) co-ordinate/ dative covalent/ dative
- no credit for 'covalent' [1]

(ii) 109½° (accept any in range 109°-110°) [1]

(iii) 4 bond pairs/ bonds (around B)
- no credit for 'tetrahedral' [1]

Total [13]

Q.8 (a) (i) % H = 14.3 (1)

$$C : H = \frac{85.7}{12.0} : \frac{14.3}{1.01} = 7.14 : 14.16 \text{ (1)}$$

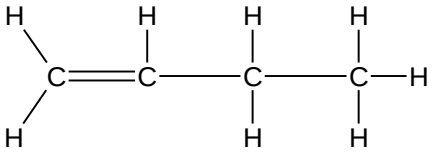
empirical formula = CH_2 (1) [3]

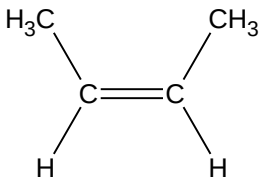
(ii) M_r = 42/ largest fragment has mass 42 (1)

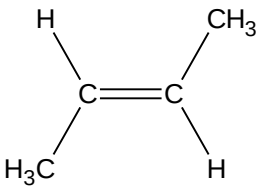
(CH_2 = 14) therefore molecular formula = C_3H_6 (1) [2]

(iii) CH_3 is present [1]

(b) 1 mark for each [3]







Total [9]

Q.9 (a) apparatus in which reaction can occur, e.g. flask/ test tube, and delivery/ rubber tube (1)

apparatus in which to measure volume of gas, e.g. over water with measuring cylinder/ gas syringe (1) [2]

(b) (i) fewer **moles** of barium used / barium has a higher A_r [1]

(ii) reaction faster/ more vigorous/ less cloudy solution formed with barium (1)

because ionisation energy of barium is less/ electrons lost more easily from barium/ barium is lower in the group/
barium hydroxide is more soluble (1) [2]

(c) flame test (1) brick red for calcium **and** (apple) green for barium (1)

OR

add sulfuric acid/ sodium sulfate solution/ potassium sulfate solution (1)

white precipitate with Ba^{2+}, less precipitate/ no precipitate with Ca^{2+} (1) [2]

(d) electrons correct – oxide ion clearly shows that 2 electrons originated from calcium atom (1)
charges correct (1) [2]

(e) (i) add sulfuric acid/ sodium sulfate solution/ potassium sulfate solution (1)

filter (1)

$Ba^{2+} + SO_4^{2-} \rightarrow BaSO_4$ (1)

- state symbols ignored [3]

(ii) moles Ba = 2/137 (1)

mass $BaSO_4 = \frac{2 \times 233.1}{137} = 3.4$ (g) (1) [2]

Total [14]

Q.10 (a) both contain metallic bonds/ positive ions and delocalised electrons labelled on diagram (1)

those in magnesium are stronger/ harder to break/ need more energy to break (1)

because **2** electrons are involved in delocalisation/ attraction to the positive ions (1) [3]

(b) reaction is hydrolysis of halogenoalkane/ nucleophilic substitution of halogenoalkane (1)

$C_4H_9X + OH^- \rightarrow C_4H_9OH + X^-$ X can be Cl or Br (1)

(white precipitate is) silver chloride and (cream precipitate is) silver bromide (1)

$Ag^+(aq) + X^-(aq) \rightarrow AgX(s)$ or $AgNO_3 + X^- \rightarrow AgX + NO_3^-$ (1)

- state symbols ignored [4]

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

(c) caesium ions are bigger than sodium ions – accept 'atoms' (1)

co-ordination number 6 : 6 for sodium and 8 : 8 for caesium (1)

both cubic (1) [3]

(d) reaction is electrophilic addition (1)

two possible products are 1-bromopropane and 2-bromopropane (1)

more 2-bromopropane formed (1)

because of greater stability of intermediate positive ion/ 2° carbocation (1)
[4]

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

Total [16]

Q.11 (a) diagram completed with at least 1 water molecule and indication of interaction between O on one molecule and H on the other (1)

interaction between δ^+ on H and lone pair on O (1)

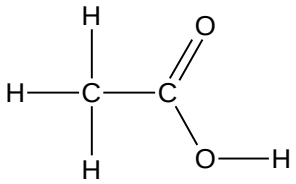
interaction labelled hydrogen bond (1) [3]

(b) (i) reduction/ redox – accept 'oxidation' [1]

(ii) I OH [1]

II OH is also present in water [1]

(c) (i) [1]



(ii) peak at 1650-1750 (1)

due to C=O (1) [2]

Total [9]

Q.12 (a) incomplete p sub-shell/ outer electron configuration s^2p^5/ outer electrons in p subshell/ outer electrons in p orbitals/ valence electrons in p subshell/ valence electrons in p orbital [1]

(b) (i) gaining one electron completes shell/ gives p^6/ takes an electron from another species/gains an electron

- do not accept 'attracts an electron' [1]

(ii) **fluorine** because it is the smallest/ has the greatest electron affinity/ has the least shielding/ has the greatest effective nuclear charge/ oxidising power decreases as the group is descended

[1]

(c) oxidation state is (+)5/ V

- do not accept '5+' [1]

(d) (i) $Cl_2 \rightarrow 2Cl^{\bullet}$ - ignore hf

[1]

(ii) $CH_4 + Cl^{\bullet} \rightarrow HCl + {}^{\bullet}CH_3$ (1)

${}^{\bullet}CH_3 + Cl_2 \rightarrow CH_3Cl + Cl^{\bullet}$ (1) [2]

(e) products: ${}^{\bullet}CFH_2$ and $Cl^{\bullet}$ (1)

C-**Cl** bond is the weak**est**/ **most** easily broken (1) [2]

Total [9]

Section B Total [70]