



# **GCE MARKING SCHEME**

**CHEMISTRY  
AS/Advanced**

**JANUARY 2014**

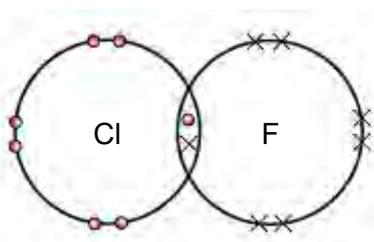
## CH2

## Section A

Q.1 C [1]

Q.2 (a)  $\text{Cl}^{\delta+} - \text{F}^{\delta-}$   
Electronegativity decreases down the group / fluorine is more electronegative (than chlorine) / chlorine is less electronegative (than fluorine) [1]

(b) [1]



Q.3 It has a full / stable (outer) electron shell [1]

Q.4 (a)  $\text{C}_6\text{H}_{12}\text{Br}_2$  [1]

(b) Elimination [1]

Q.5 Temperature 200-300 (accept 470-570K)  
Pressure 60-70 (accept 6000-7000 kPa) [1]

Q.6 Hex-2-ene (ignore references to cis/trans/E/Z) [1]

Q.7 (a) A process of bond breaking where the two electrons (of the covalent bond) go to one of the two atoms in the bond [1]

(b)  $(\text{CH}_3)_3\text{C}^+$  and  $\text{Cl}^-$  (accept  $(\text{CH}_3)_3\text{C}^-$  and  $\text{Cl}^+$ ) [1]

**Total Section A [10]**

**Section B**

- Q.8 (a) In  $\text{SO}_2$  the oxidation number of sulfur is +4  
In  $\text{SO}_2\text{F}_2$  the oxidation number of sulfur is +6 (1)  
Increase in (positive) oxidation number is oxidation (1) [2]
- (b) The electrons in the bonds between sulfur and fluorine and sulfur and oxygen take up the position of minimum repulsion / maximum separation [1]
- (c) (i) A lone pair donor / a species that seeks out a relatively positive site [1]  
(ii) eg  $\text{H}_2\text{O}$  /  $\text{OH}^-$  /  $\text{Cl}^-$  (or other halogen) /  $\text{CN}^-$  / correct formula of an amine [1]  
(iii) A shift of **two** electrons [1]
- (d)  $\text{SO}_2\text{F}_2 + 2\text{Ca}(\text{OH})_2 \rightarrow \text{CaSO}_4 + \text{CaF}_2 + 2\text{H}_2\text{O}$   
[(1) for correct formulae, (1) for balancing **if** formulae correct] [2]
- (e) (i) UV radiation (1) is able to break the C—Cl and C—Br bonds (1) giving radicals (1) that attack / breakdown the ozone layer [3]  
(ii) The S—F bond in sulfonyl fluoride is too strong to be broken by UV radiation [1]

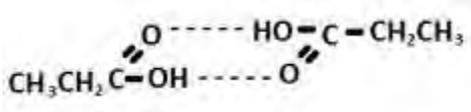
**Total [12]**

Q.9 (a) (i)  $165 \pm 5 \text{ }^\circ\text{C}$  [1]

(ii) As the number of carbon atoms in the acids increase the boiling temperature increases (1)  
This is due to an increase in induced dipole-induced dipole / Van der Waals forces (1) between molecules (1) [3]

(iii) As the molecules increase in size the relative importance of the —COOH group decreases (1)  
There is therefore less of a tendency to hydrogen bond **with water** (becoming less soluble) (1) [2]

(b) (i) Acidified (potassium) dichromate (accept  $\text{H}^+$ ,  $\text{Cr}_2\text{O}_7^{2-}$ ) / Acidified (potassium) manganate(VII) (accept  $\text{H}^+$ ,  $\text{MnO}_4^-$ ) [1]

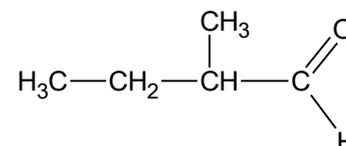
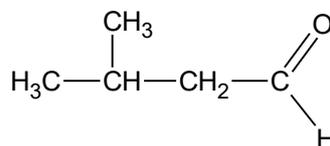
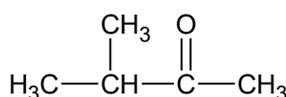
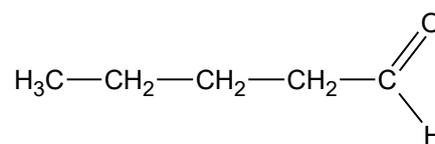
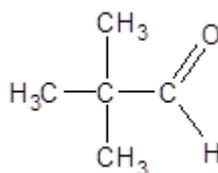
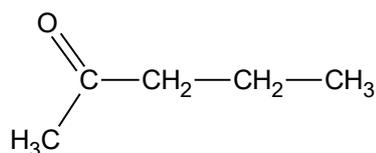
(ii)  [1]

(iii) I 0.050 [1]

II 0.025 [1]

III  $0.025 \times 186 = 4.65 \text{ (g)}$  [1]

(iv) Any 2 of the following:



[2]

(c) (i)  $\frac{49.3}{12} = 4.11$   $\frac{43.8}{16} = 2.74$  (1) Ratio of C:O is 3:2 (1) [2]

(ii) There are four oxygen atoms per molecule  $\therefore$  6 carbon atoms (and 4 oxygen atoms)  
 $\therefore n = 6 - 2$  in the acid groups  $\therefore n = 4$  [1]

**Total [16]**

- Q.10 (a) (i) Number of moles of HCl =  $\frac{80 \times 0.20}{1000} = 0.016$  (1)
- Number of moles of calcium needed = 0.008 (1)
- Number of moles of calcium actually used =  $\frac{0.40}{40} = \sim 0.010$  (1)
- (∴ calcium is present in excess)
- [Calculation could be carried out in grams] [3]
- (ii) gas bubbles / effervescence / some calcium 'dissolves' / colourless solution produced [1]
- (b) Mass of E in solution at 0 °C =  $0.13 \times 2 = 0.26$  g (1)
- ∴ Quantity precipitated =  $1.50 - 0.26 = 1.24$  g (1) [2]
- (c) (i) Brick red / orange-red [1]
- (ii) Cream precipitate (accept off-white precipitate) [1]
- (iii)  $\text{Ag}^+ + \text{Br}^- \rightarrow \text{AgBr}$  [1]
- (iv) Red / brown solution [1]
- (v) Calcium bromide is an ionic compound (1)  
and contains  $\text{Ca}^{2+}$  and  $\text{Br}^-$  ions (1)  
Chlorine reacts with the bromide ions in a redox / displacement reaction (1)  
Chlorine is a more powerful oxidising agent / has a greater affinity for electrons than bromine (1)  
 $2\text{Br}^- + \text{Cl}_2 \rightarrow \text{Br}_2 + 2\text{Cl}^-$  (1) [5]
- QWC: ensure that text is legible and that spelling, punctuation and grammar are accurate so that the meaning is clear [1]

**Total [16]**

- Q.11 (a) Iodine contains weak van der Waals forces /  
bonds between each molecule (1)  
Less energy is needed to overcome these weaker forces (1) \*  
Diamond contains strong covalent bonds between each atom (1)  
and more energy is needed to overcome these 'bonds' (1) \*  
\* alternative marks
- Neither iodine nor diamond contain free / delocalised electrons to carry the  
charge (necessary for them to conduct electricity) (1) [4]
- QWC: organise information clearly and coherently, using specialist  
vocabulary when appropriate* [1]
- (b)  $K^+$  and  $I^-$  correctly given (1) and in their correct places on the diagram (1) [2]
- (c) An excess / stoichiometric / 0.05 mol (1) of potassium sulfate (aq) is added  
to the barium chloride solution  
Mixture is stirred (1) \* and then filtered (1)  
Precipitated barium sulfate is then washed with distilled water (1)  
and dried (1) \* [4]  
\* alternative marks
- QWC: Select and use a form and style of writing appropriate to purpose  
and to complex subject matter* [1]

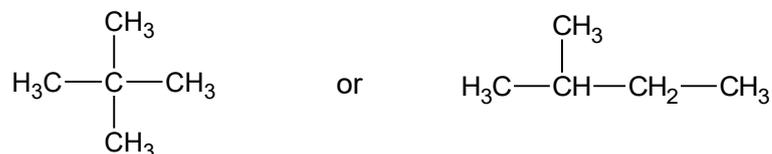
**Total [12]**

- Q.12 (a) (i) Petroleum is heated/evaporated (1)  
Fractions condense at different temperatures / separated into fractions with different boiling temperatures (1)

[2]

- (ii)  $C_5H_{12}$  (1)

Branched chain therefore



(1)

[2]

- (b) (i) It enables more useful compounds to be made from the compound [1]

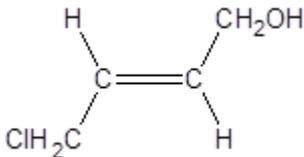
- (ii)  $C_9H_{20} \rightarrow CH_4 + C_4H_6 + C_4H_{10}$  [1]

- (c) (i) UV light [1]

- (ii) A step during which a radical reacts and another one is formed [1]

- (iii)  $Cl\cdot + CH_4 \rightarrow \cdot CH_3 + HCl$



- (d) (i)  [1]

- (ii) Aqueous sodium hydroxide [1]

- (iii) Pt / N / Pd [1]

- (iv) Compound **E** does not contain an O—H bond (1)  
This is present in Compound **D** at a frequency of  $2500-3550\text{ cm}^{-1}$  (1)

[2]

**Total [14]****Total Section B [70]**