GCE MARKING SCHEME

CHEMISTRY
AS/Advanced

JANUARY 2014

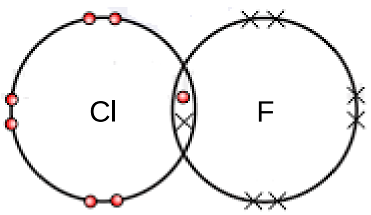
CH2

Section A

Q.1 C [1]

Q.2 (a) $Cl^{\delta+}$— $F^{\delta-}$
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) $C_6H_{12}Br_2$ [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) $(CH_3)_3C^+$ and Cl^- (accept $(CH_3)_3C^-$ and Cl^+) [1]

Total Section A [10]

Section B

Q.8 (a) In SO_2 the oxidation number of sulfur is +4

In SO_2F_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 H_2O / OH^- / Cl^- (or other halogen) / CN^- / correct formula of an amine [1]

(iii) A shift of **two** electrons [1]

(d) $SO_2F_2 + 2Ca(OH)_2 \rightarrow CaSO_4 + CaF_2 + 2H_2O$

[(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 sulfuryl fluoride is too strong to be broken by UV radiation [1]

Total [12]

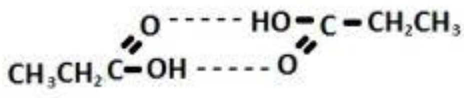
Q.9 (a) (i) 165 ± 5 °C [1]

(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 H^+, $Cr_2O_7^{2-}$) / Acidified (potassium) manganate(VII) (accept H^+, MnO_4^-) [1]

(ii)



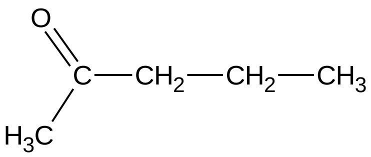
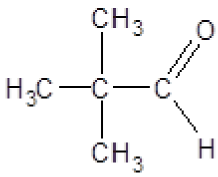
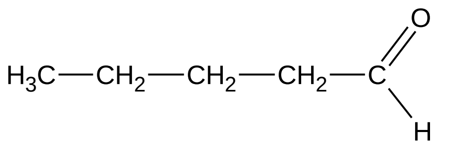
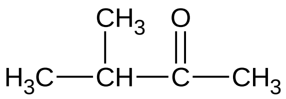
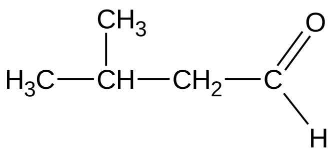
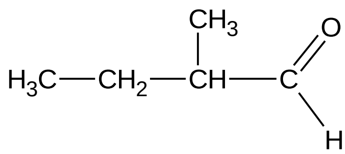
[1]

(iii) I 0.050 [1]

II 0.025 [1]

III $0.025 \times 186 = 4.65$ (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)

($\therefore$ 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)

$\therefore$ 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) $Ag^{+} + Br^{-} \rightarrow AgBr$ [1]

(iv) Red / brown solution [1]

(v) Calcium bromide is an ionic compound (1)
and contains Ca^{2+} and 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)
$2Br^{-} + Cl_2 \rightarrow Br_2 + 2Cl^{-}$ (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]

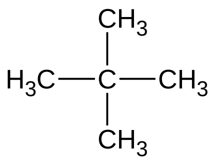
Total [12]

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



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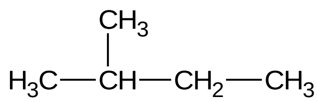


(1)

[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]

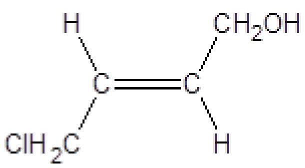
(c) (i) UV light [1]

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

(iii) $Cl\bullet + CH_4 \rightarrow \bullet CH_3 + HCl$

[or $\bullet CH_3 + Cl_2 \rightarrow CH_3Cl + Cl\bullet$] [1]

(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 cm^{-1} (1)

[2]

Total [14]

Total Section B [70]