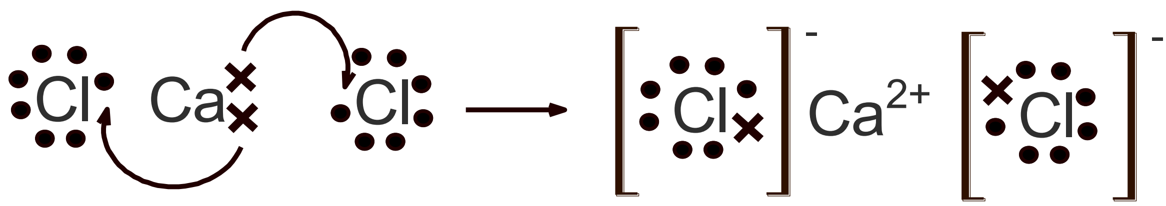
SUMMER 2014 MARK SCHEME

SECTION A

Q.1 Van der Waals' forces < Hydrogen bonds < Covalent bonds [1]

Q.2 2-methylpentan-1-ol allow 2-methyl-1-pentanol [1]

Q.3 1 mark showing movement of electrons; 1 mark showing dot and cross of $CaCl_2$ [2]



Q.4 (a) $\delta-$ N—H $\delta+$ $\delta-$ O—Cl $\delta+$ both for 1 mark [1]

(b) Difference in electronegativity is larger in aluminium oxide (so it is ionic) / the difference is smaller in aluminium chloride (so it is covalent) [1]

Q.5 Reagent: Bromine (water) (1)

Observation(s): hex-2-ene will turn bromine water from orange to colourless, no change for cyclohexane (1) [2]

Q.6 **C** (1) and **E** (1) – penalise one mark for each additional incorrect answer [2]

Section A Total [10]

SECTION B

Q.7 (a) (i)

	magnesium nitrate	*barium chloride*	*sodium hydroxide*
potassium carbonate	white precipitate	white precipitate	no visible change
sodium hydroxide	WHITE PRECIPITATE	NO VISIBLE CHANGE	
barium chloride	NO VISIBLE CHANGE		

All three correct for 2 marks, two correct for 1 mark [2]

(ii) Name of precipitate: Magnesium carbonate (1)
Ionic equation: $Mg^{2+} + CO_3^{2-} \rightarrow MgCO_3$ (1) [2]

(b) (i) Sodium hydroxide solution would turn blue/purple
[Ignore references to potassium carbonate] [1]

(ii) Potassium carbonate would give a lilac flame
Sodium hydroxide would give a golden yellow flame
Barium chloride would give an apple green flame
(2 for all correct, 1 mark for 2 correct)
1 max if any reference to white flame for magnesium [2]

(iii) Barium chloride (1) White precipitate (1) [2]

(c) (i) Sodium **ions** surrounded by $\delta-$ on oxygen atoms of water (1)
Bromide **ions** surrounded by $\delta+$ on hydrogen atoms of water (1)
Marks can be obtained from a labelled diagram – must show minimum of two oxygen/hydrogen atoms around sodium/bromide ions [2]

(ii) *Observation with sodium bromide* cream precipitate (1)

Observation with sodium iodide yellow precipitate (1) [2]

(iii) Reagent: (dilute) ammonia solution (1)
Observation with sodium bromide: precipitate dissolves in part
Observations with sodium iodide: precipitate does not change
both observations required for (1)
[If concentrated ammonia (1) used then sodium bromide will dissolve completely] [2]

(iv) $2NaI + Br_2 \rightarrow 2NaBr + I_2$ allow ionic equation [1]

Total [16]

Q.8 (a) Boiling temperatures increase with increasing chain length / number of carbon atoms / relative mass (1)
More carbon atoms leads to greater number of van der Waals' forces between molecules (1) [2]

(b) (i) Mass of petroleum gases = 1.2% × 145, 000 = 1740g (1)
Moles of butane = 1740 ÷ 58.1 = 30 mol (1)
Volume of butane = 30 × 24 = 720 dm^3 (1) [3]

(ii) I. ultraviolet light [1]
II. $Cl_2 \rightarrow 2Cl\bullet$ [1]
III. (Propane forms) propyl radicals / $C_3H_7\bullet$ (1)
Two $C_3H_7\bullet$ radicals combine together to make hexane (1) [2]

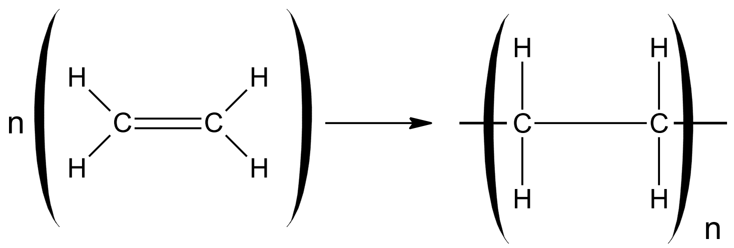
(c) Brent crude would be better as it has more naphtha (1)

Naphtha is cracked to produce alkenes (1)

Cracking is caused by heating / zeolites / aluminosilicates / porcelain (1)

Any valid equation that produces ethene e.g. $C_{10}H_{22} \rightarrow C_2H_4 + C_8H_{18}$ (1)

Polymerisation: Many small molecules joining together to make a large molecule (1)



(1)

Addition polymerisation (1)

e.g. polystyrene, PVC, PTFE and relevant monomer (1)

MAX 6 [6]

QWC: organisation of information clearly and coherently; use of specialist vocabulary where appropriate [1]

Total [16]

Q.9 (a) $1Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$ [1]

(b) Oxidation state of carbon at start = +2 and at end = +4 so it has been oxidised (1)
Oxidation state of iron at start = +3 and at end = 0 so it has been reduced (1)
Credit 1 mark if all oxidation states are given correctly with incorrect or no reference to what has been oxidised/reduced [2]

(c) (i) 6:6 [1]

(ii)

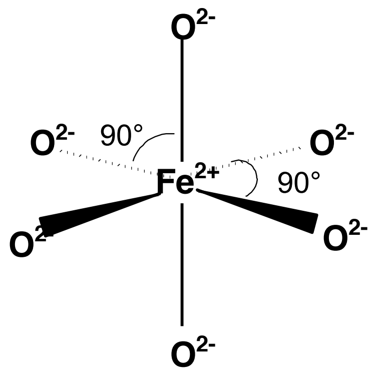


Diagram must be unambiguous, either by showing 3 dimensions, bond angles or through labelling, must identify iron and oxide as ions

[1]

(d) Moles FeO = 20,000 ÷ (55.8 +16) = 278.6 mol (1)
Moles Fe = moles FeO = 278.6 mol (1)
Mass Fe = 278.6 × 55.8/1000 = 15.5 kg (1) [3]

(e) Pair of shared electrons in both (1)

Covalent – 1 electron from each atom **and**
Co-ordinate – 2 electrons from same atom (1) [2]

(f) Lattice / regular arrangement of positive ions (1)
Sea of delocalised electrons (1)
Electrons can move to form an electrical current (1)
Strong forces / bonds between the delocalised electrons and the metal ions require a lot of energy to break / high temperature to overcome (1) [4]
QWC: selection of a form and style of writing appropriate to purpose and to complexity of subject matter [1]

Total [15]

Q.10 (a) (i) **Aqueous** sodium hydroxide (1) Heat [below 110°C] (1) [2]

(ii) Bromobutane cannot form hydrogen bonds (1)
Butan-1-ol can form hydrogen bonds due to its —OH (1)
Hydrogen bonds between butan-1-ol and water molecules allow butan-1-ol to dissolve (1) [3]

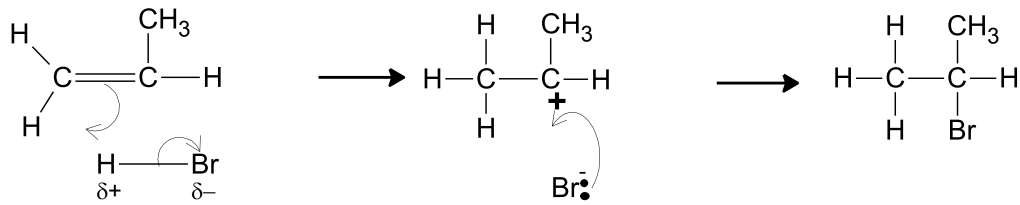
(b) (i) Acidified dichromate(VI) / acidified manganate(VII) (1)
Heat (1) [2]

(ii) Butanoic acid can form hydrogen bonds between molecules (1)
Bromobutane has van der Waals' forces between the molecules (1)
Hydrogen bonds are stronger than van der Waals' so require more energy to break these (1)
[3]

(iii) Fractional distillation [1]

Total [11]

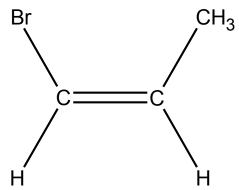
Q.11 (a) (i) 1 mark for arrows in first diagram; 1 mark for arrow in second diagram; 1 mark for all charges



2 max if incorrect isomer given [3]

(ii) 2-bromopropane formed from a secondary carbocation (1)
Secondary carbocations are more stable than primary carbocations (1) [2]

(b) Empirical formula = C_3H_5Br (1)
Molecular formula = C_3H_5Br
(must show use of mass spectrum to gain this mark) (1)
Two molecular ion peaks as there are two isotopes of bromine (1)
Peaks at 15 = CH_3^+ and 41 = $C_3H_5^+$ (1)
550 cm^{-1} = C–Br 1630 cm^{-1} = C=C 3030cm^{-1} = C–H (1)
Molecule is:



(1) [6]

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

Total [12]

Section B Total [70]