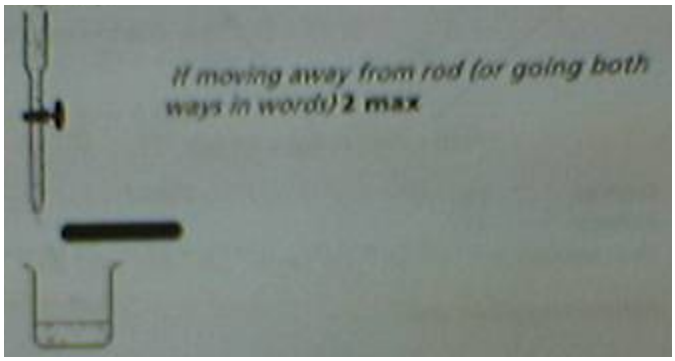
January 2002 Unit 2

1)a) i) Allow a stream of 1-chlorobutane to run from burette/pipette (1)
And see if it is attracted too a charged rod (can be shown on diagram) (1)

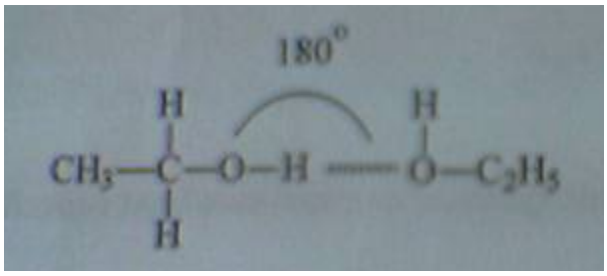


(1)
(3 marks)

ii) A comparison is required or clarifying elecronegativity eg
Contains **Cl** (atom) which is more/very electronegative (than C) (1 mark)

b) i) Hydrogen/H-bonding (1 mark)

ii)



Between correct atoms (1)
Value of bond angle (1) *2nd mark depends on angle being shown across hydrogen bonded H atom.*

c) Cyclohexane with reasonable but not necessarily full explanation (1)

More surface area in contact. (1)

no hydrogen bonds or dipole-dipole interactions but still has a similar boiling point (1)

OR

Number of electrons in 1-chlorobutane 50
Cyclohexane 48

Ethanol 26 (1)

This suggests 1-chlorobutane but boiling point of cyclohexane greater so must have stronger van der waals (1)

2)a) i)

0	+2	-1	+6

Cl 0 □ -1 (1) *MUST have correct signs*

S +2 □ +6 (1)

(2 marks)

ii) Sulphur, S
Chlorine,Cl (1 mark)

iii) Sulphur, 2 atoms changed from +2 to +6 = +8 (1)
Chlorine, 8 atoms changed from 0 to -1 = -8 (1) (2 marks)

iv) Chlorine oxidises sulphur to a higher oxidation state than iodine does (correct values are chlorine □+6 iodine □+2½) (2 marks)

b) i) $Cl_2(g) + H_2O(l) \rightleftharpoons HCl(aq) + HClO(aq)/2H^+(aq) + Cl^-(aq) + ClO(aq)$

All products (1)
Reversible arrows and 3 correct state symbols (1) (2 marks)

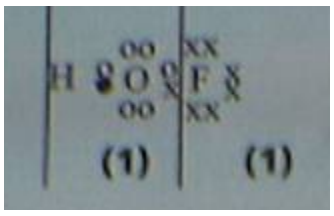
ii) Chlorine has been both oxidised and reduced/increased and decreased in oxidation number (1)
0 to +1 and -1 (1)

(2 marks)

iii) Less HClO with reasonable explanation. (1)
Adding an acid is adding H+ ions which appear on the RHS of the equation and so (by Chatelier's Principle) will drive the equilibrium to the left (1)
OWTTE (2 marks)

Total 13 marks

3)a) i)



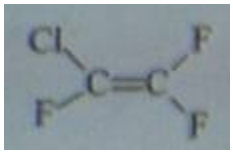
ii) 95-106°

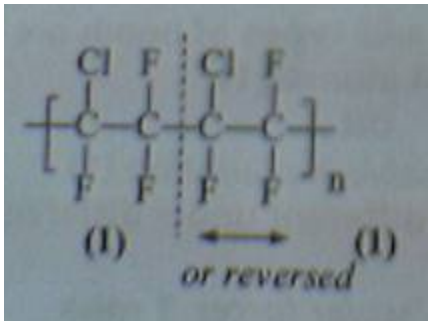
(Only four pairs of electrons around the oxygen atom/tetrahedral so 109.5° **1 mark**)

But (two) lone pairs which take up more room than bonded pairs.

b) i) -1

ii) Only uncombined elements have oxidation number 0
ACCEPT "usually-2 plus qualification
OR comparison with peroxides/fluorides

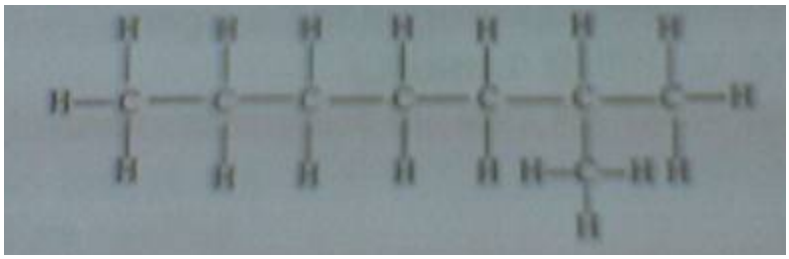
c) i) 

ii) 

4)a) i) Octane
C_8H_{18}

ii) C_8H_{18} (l)/(g) + 12½ O_2(g) □ 8CO_2(g) + 9H_2O(l)/(g)
All formulae (1)
Balancing/state symbols (1)

iii) eg

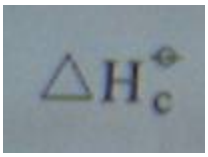


Any branched chain OR number of branches.

b) i) The **complete** combustion OR excess oxygen of 1 mole of the substance

under standard conditions OR quote them ie 298 K, 1 atom

2 marks
1 mark
0

ii) 

iii) Same with some reasonable explanation (1)
because the same **number and types** of bonds are broken
OR same number of C and H atoms (1)
OR
Different with some reasonable explanation (1)
Because bond energies are different under different
Conditions (1)
Reference only to intermolecular forces **1 max**

c) i) Advantage – less pollution OWTTE
ACCEPT renewable source BUT credit once

Disadvantage – less energy per g/per cm^3 /per unit mass
NOT less energy per mole

ii) Renewable

5)a) Average amount in "normal " coffee 102.5 mg
Average amount in "decaf" coffee 3mg

Average amount removed 99.5 mg
% removed $\frac{99.5}{102.5} \times 100 = 97.1\%$
ALLOW 2 or 3 SF ie 97, 97.1

b) i) $CH_4(g) + 2Cl_2(g) \rightarrow CH_2Cl_3(l) + 2HCl(g)$
HCl product (1)
Balancing (1)

ii) Ultraviolet light OR sunlight OR light

c) **Chemical Extraction**
1. Solvents dichloromethane or ethyl ethanoate OR formulae
2. beans **soaked** in **water** to **soften** them

3. **Soaked** in **solvent** to dissolve/remove **caffeine**
4. Treated with **steam** to evaporate/remove **solvent**

The Swiss Water Process

5. **Soaked** in water until **flavour** and **caffeine** has dissolved/removed
6. Passed/filtered through **activated charcoal** to **remove caffeine**
7. Beans re-soaked in/added to/mixed with filtrate to **restore/absorb flavour**

Supercritical fluid Extraction

8. **Same principles** as chemical extraction but uses **carbon dioxide**

d) *__THIS IS MY ANSWER, DID NOT SEE MARK SCHEME__*

Chemical extraction

Cheaper than both other processes (“coffee companies are reluctant to use this method because it cost four times more than the chemical extraction method”, “One major disadvantage to this method is that the equipment used is expensive compared with organic extraction”)