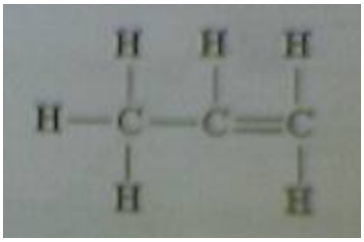
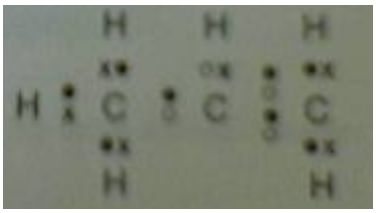
January 2006 Unit 2

1)a) i)

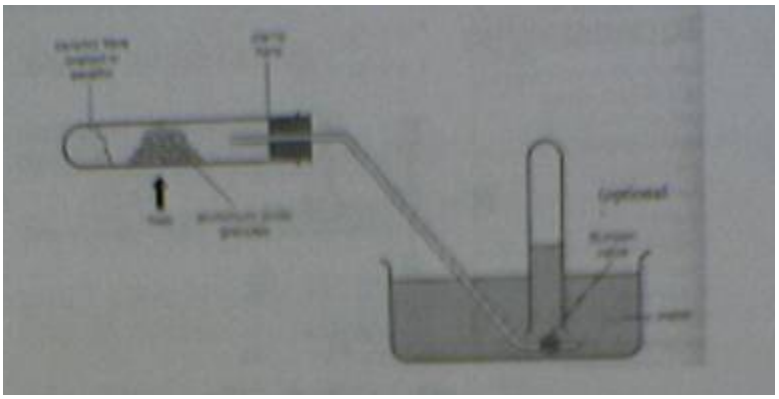


ii)



Allow all dots or crosses
Allow TE for a butene / pentene in (a)(i)
IGNORE circles

b)



Ceramic fibre / glass mineral / cotton wool soaked in (liquid) paraffin (1)
NOT wire wool

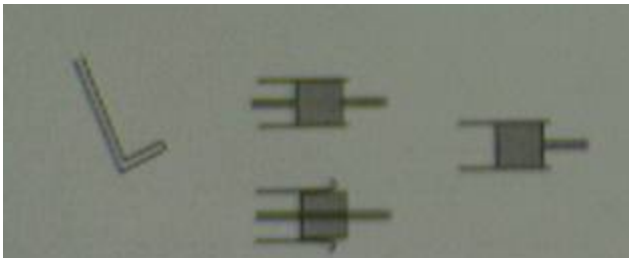
Aluminium oxide / Al2O2 / pumice / porcelain / broken pot etc. in correct position in the tube (1)
Heat directed at solid – must be under some of solid (1)

Collection over water over water / gas syringe (1)
If Bunsen valve must be closed unless under test tube
ACCEPT no tubing after valve

Penalties -1 for each (to a maximum of two penalties)
Apparatus will not “work”, eg. no bung, open tube not under test tube
Even following Bunsen valve
Error in gas collection eg. delivery tubing through or trough or test tube

Delivery tubing shown as single line

ALLOW



c) i) orange / brown / yellow to colourless NOT 'clear'
Any mention of red (0)

ii) $CH_2CHBrCH_2Br$
ALLOW $CH_2CH(OH)CH_2Br$ OR $CH_2CHBrCH_2OH$
ALLOW displayed / semi displayed formulae

d) i) (yield / amount / it) decreases / more propane formed (1)

Fewer (gas) molecules / moles on the left than on the right
OR reaction goes to side with fewer molecules / moles (1)

NOT "equilibrium moves to the left"

Mark independently

ii) endothermic process / kinetic energy increases / heat taken in

iii) none / same yield

e) $(CH_3)_2C=CH_2$
ALLOW displayed formula (1)
ALLOW $C(CH_3)_2=CH_2$
$CH_3C(CH_3)=CH_2$
Double bond need not be shown, but if single bond displayed (0)

(2-)methylpropene (1)
2-methylprop-1-ene
2-methylprop-2-ene
} IGNORE punctuation, spaces etc

Mark independently
No transferred error allowed

2)a) $\Delta H = (2 \times 347) + 612 + (8 \times 413) = +4610$ (KJ mol)

Method (2)
Answer (arithmetic and sign) (1)

+4610 with no working (3)
One multiple wrong / omitted (eg +4263 / +1719) 2 max
Two multiples wrong / omitted (eg +1372) 1 max

b) i) axes suitably labelled with units :"(Number of) carbon atoms" on x-axis and "ΔH(/)KJ mol" on y-axis (1)

Linear and sensible scales (1)
ALLOW one big squares per 1000KJ. Must be one big square per carbon atom

All points correctly plotted and joined with straight line
Or dot-to-dot (1)
Only penalise if points clearly off line

Graph of ΔH vs. Boiling point (0)
Graph of Boiling point vs. number of carbon atoms (0)

ii) 1st mark: bond breaking increasing
2nd mark: quantitative treatment

Eg
(From one alkene to the next) involves the atomisation / breaking extra C-C bond and two extra C-H bonds (2)

OR
A need to break more bonds as chain length increases (1)
Molecules increase by $-CH_2-$ as chain length increases (1)

iii) (+) 4620 ± 30 (KJ mol)

c) i) Van der Waals OR fluctuating / induced dipoles OR London / dispersion forces
NOT vdw

ii) Number of electrons increases (1)

so strength of the van der Waals / intermolecular forces also increases
OR
So there are more van der Waals forces (1)
Mark independently

iii) Two geometric isomers [can be shown in diagram instead) / a cis and trans from exist

OR
Valid argument based on no free rotation about C-C bond □ two isomers

iv) Pent-1-ene because unbranched / straight chain (1)
Greater area (of contact) / more contact between molecules / molecules can align more easily
IGNORE argument based on stacking / packing
IGNORE molecules ca get closer together

d) There is hydrogen bonding in water (1)
Alkenes cannot form hydrogen bonds (with water molecules) / alkene-water interactions too weak (1)
Mark independently

3)a) i) $Cl_2(aq) + 2I^-(aq)$ □ $2Cl^-(aq) + I_2(aq/s)$ OR haved version
Entities (1)

Balancing and state symbols (1)
2nd mark dependent on 1st unless spectator ions included on both sides of equation

ii) Purple/pink/violet/mauve/lilac OR any combination of these colours
Can be prefixed by deep or dark
Any mention of red (0)

iii) Orange OR yellow ALLOW red OR brown
ALLOW any combination of these colours

b) i) iodine in I_2 : 0 iodine in I : -1 (1)
sulphur in SO_2 : +4 sulphur in SO_4^{2-} : +6 (1)

ii) sulphur dioxide / SO2
because of sulphur's increased oxidation number / losing electrons
ALLOW because sulphur dioxide gains oxygen
[both parts needed for the mark]
ALLOW reverse argument ie iodine gains electrons / oxidation number decreases

iii) $I_2(aq) + SO_2(aq) + 2H_2O$ □ $2I^-(aq) + SO_4^{2-}(aq) + 4H^+(aq)$
ALLOW multiples

c) i) The red colour would interfere with the colour change at the end-point
OR so that the colour of the indicator / the end-point can be seen / determined

ii) colourless to (deep / dark) blue / blue-black / black
Any mention of purple (0)

iii) Moles of iodine = (12.2)/1000 x 0.001 = 1.22×10^{-5} / 0.0000122 (1)

Moles of sulphur dioxide
= 1.22×10^{-5} (1)
ALLOW answer equal to or a single digit multiple of answer above

Concentration of SO_2
$1.22 \times 10^{-5} \times (1000)/25$ = 4.88×10^{-4} / 0.000488(mol dm^{-3}) (1)
OR 4.9×10^{-4} / 0.00049(mol dm^{-3})

iv) activated charcoal might react with / absorb SO_2 / (traces of) charcoal might react with I_2 (this giving an understanding of [SO_2] in the wine.

4)a) N_2O

b) Refrigerants / heat transfer agents and anesthetics / they share similar properties
OR properties exemplified
Eg non flammable / non toxic / volatile - any two of these

OR
Refrigeration technology resulted in the production of CFCs which were then found to have properties of anesthetics

OR
Refrigerants / heat transfer agents were found to be anesthetics

c) inertness of fluoride in the C-F bond
inertness of fluoride in the CF2 / CF3 groups
CF / CF2 / CF3 group conferred stability on adjacent / neighbouring C-Ha bonds
NOT interness of C-F bond / fluoride alone

d) i) There is a greater difference between the electronegativities of fluorine and hydrogen than between fluorine and chlorine / chlorine is more electronegative than hydrogen

Answer in terms of relevant relative shifts in electron densities are acceptable.
ACCEPT answers based on relative symmetries, eg electron cloud in CF_3CCl_3 is more symmetric than CF_3CH_2Cl
ACCEPT argument in terms of electropositivities

ii) CF_3CH_2Cl
because it possesses C-H bonds
OR enables (electrostatic) interactions with “brain molecules”
OR because a lower dose can be used

e) (2)-bromo-(2)-chloro-1,1,1-trifluoroethane
OR
(1)-bromo-(1)-chloro-2,2,2-trifluoroethane

IGNORE punctuation

ACCEPT non alphabetic versions
NOT bromochlorotrifluoroethane

f) 100-106.5°
Any value or range of values within this range

g) **Key points**

<u>Advantages of using halothane:</u> Any 5 (max) of these key points

1. Halothane is non/less flammable / non explosive / toxic.
ALLOW inverse argument with reference to $CHCl_3$,
ether or 'earlier anesthetics
(1)

2. It does not cause gastric irritation / post operative vomiting.
ALLOW inverse argument with reference to $CHCl_3$ ether
or 'earlier anesthetics'
(1)

3. It is not thought to cause irreversible liver damage with
repeated dosage.
ALLOW inserve argument (1)

4. Halothane contains a C-Br / bromine / C-H bond,
so it is safer (to use than other CFCs)
ALLOW inverse argument (1)

5. Halothane produces narcosis / anesthesia / deep sleep
at low(er) doses / concentration (than other CFCs)
OR halothane does not need high doses which lead to
breathing paralysis (1)

6. Halothane (was a potent inhalation agent) with a smooth,
pleasant induction (period for the patient)
(1)

<u>Why halothane's use declined:</u>

7. Halothane is associated with post operative
liver dysfunction (1)

8. Safer and cheaper anesthetics / agents (such as enflurane and isofuorane) were discovered (1)