1 **(a)** **(i)** C_4H_8 only
CH_2 (Allow C_1H_2) [2

(ii) Any unambiguous structural formula of methyl cyclopropane or but-1-ene or but-2-ene or methyl propene [1]

(iii) M1 same molecular formula [1]

M2 different structural formulae or different structures
or different arrangement of atoms [1]

(iv) If 'No':
one an alkane, the other an alkene
or
one is saturated / has single bonds, the other is unsaturated / has a double bond
ignore: references to the 'functional group'

If 'yes'
both alkanes **or** both saturated
ignore: references to the 'functional group' [1]

(b) **(i)** M1 Action of heat or catalyst or thermal decomposition (on an alkane) [1]
Ignore steam. Ignore pressure.

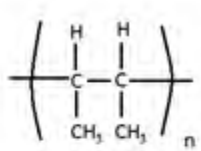
M2 Long-chained molecules or alkanes form smaller molecules (not smaller fraction) or forms smaller alkenes (or alkanes) [1]

(ii) $C_{10}H_{22}$ [1]

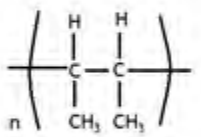
(c) **(i)** M1 Correct structure of one repeat unit [1]

M2 Continuation bonds **COND** on M1 [1]

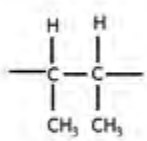
M3 use of brackets and subscript 'n' **COND** on M1 and M2 [1]



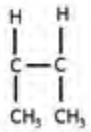
= 3 marks



or



= 2 marks



= 1 mark

(ii) dibromoethane or 1,2-dibromoethane [1]

2 **(a) (i)** $35\,cm^3$ [1]
$40\,cm^3$ [1]

(ii) forms carbon monoxide [1]

poisonous **or** toxic **or** lethal **or** prevents blood carrying oxygen
or effect on haemoglobin [1]
NOT just harmful

(b) (chlorobutane **or** butyl chloride [1]
number not required but if given must be 1, it must be in correct position

(ii) light **or** UV**or** 200°C **or** lead tetraethyl [1]

(iii) any correct equation for example 2-chlorobutane
or dichlorobutane [1]

(c) correct repeat unit [1]
COND continuation [1]
-(CH(CH_3)-CH_2)-

(ii) butan-1-ol **or** butan-2-ol **or** butanol [1]
if number given then formula must correspond for second mark and number must be in correct position

structural formula of above [1]
CH_3-CH_2-CH_2-CH_2OH **or** CH_3-CH(OH)-CH_2-CH_3
NOT C_4H_9OH
if first mark not awarded then either formula will gain mark [1]
ACCEPT either formula for "butanol"

(iii) CH_3-CH(C*l*)-CH_3 **or** CH_3-CH_2-CH_2-C*l* [1]
NOT C_3H_7Cl
response must not include HC*l*
if equation given look at RHS only

[Total: 12]

3 **(a)** butanol [1]
no number needed but if one is given it has to be 1

structural formula (all bonds shown) [1]
accept –OH **NOT** –HO

ethanoic acid [1]
structural formula (all bonds shown) [1]
accept –OH **NOT** –HO
no conseq marking
if all bonds are not shown (CH_3–CH_2–), penalise once

(b) **(i)** must have correct ester linkage [1]
COND continuation and a group on either side of the ester group [1]

Accept –COO–

(ii) accept any sensible suggestion
ropes, clothing, bottles, packaging, bags [1]

(c) **(i)** 8 [1]

(ii) double bond becomes single and 4 bonds per carbon atom [1]
COND a bromine atom on each carbon [1]
$C_2H_4Br_2$ ONLY [1]
accept a structural formula with hydrogen atoms

(iii) corn oil [1]

(d) 100g of fat react with 86.2g of iodine
884g of fat react with **762** g of iodine [1]
limit 762 x 2
one mole of fat reacts with 762/254 moles of iodine molecules
one mole of fat reacts with **3** moles of iodine molecules [1]

number of double bonds in one molecule of fat is **3** [1]
limit 6
consequential marking allowed provided the number of double bonds is an integer.

[Total: 14]

4 **(a) (i)** any correct equation **[1]**

(ii) structural formulae from but-1-ene, but-2-ene, methylpropene **or** cyclobutane Any **TWO** **[2]**

(b) (light **or** 200°C **or** lead tetraethyl **[1]**

(ii) substitution **or** photochemical **or** chlorination **or** free radical or halogenation **[1]**

(iii) 1-chlorobutane, 2-chlorobutane, dichlorobutane etc.
Any **TWO** **[2]**

(c) (i) $CH_3CH_2CH_2OH$ **or** $CH_3CH(OH)CH_3$ **[1]**

(ii) $CH_3CH(Br)CH_2Br$ **[1]**
NOT 1,3-dibromopropane

(d) moles of CH_3-CH = CH_2 reacted = 1.4/42 = 0.033 **[1]**
conseq
maximum moles of CH_3-CH(I)-CH_3 that could be formed = 0.033 **[1]**
conseq
maximum mass of 2-iodopropane that could be formed = 5.61 g **[1]**
accept 170 x 0.033 = 5.61 and 170 x 0.033333 = 5.67
conseq unless greater than 100%
percentage yield 4.0/5.67 x 100 = 70.5% **[1]**
Do not mark consequently to a series of small integers. There has to be a serious attempt to answer the question, then consequential marking is appropriate.