1 **(a) (i)** have same molecular formula / both are C_5H_{12} [1]
they have different structural formulae / different structures [1]

(ii) CH_3-CH_2-CH=CH-CH_3 / any other correct isomer [1]

(b) (i) CH_2-(Br)-CH_2Br [
NOT: $C_2H_4Br_2$
dibromoethane [1]
NOTE: numbers not required but if given must be 1, 2

(ii) CH_3-CH_2-CH_3 [1]
NOT: C_3H_8
propane [1]

(iii) CH_3-CH_2-CH_2-CH_2-OH / CH_3-CH_2-CH(OH)-CH_3 [1]
butanol [1]
numbers not required but if given must be correct and match formula

(c) CH_3-CH=CH-CH_2-CH_3 [1]
CH_3-CH=CH-CH_3 [1]

(ii) pink / purple [1]
colourless [1]
NOT: clear

(d) -CH_2-CH(CN)-CH_2-CH(CN)-
correct repeat unit CH_2-**CH**(CN)
COND: at least 2 units in diagram [1]
continuation [1]

[Total:16]

2 **(a) (i)** contains <u>only</u> carbon, hydrogen and oxygen [1]
hydrogen (atom) to oxygen (atom) ratio is 2:1 [1]
ALLOW: C:H:O as 1:2:1 or $C_n(H_2O)_n$

(ii) condensation
polymerisation [1]

(b) (i) cells / micro-organisms / plants / animals / metabolic reactions [1]
obtaining energy from food / glucose / nutrients [1]

(ii) $2C_2H_5OH + 2CO_2$ [2]
allow: C_2H_6O for C_2H_5OH
not balanced = (1) only

(iii) to prevent aerobic respiration / to get anaerobic respiration / to prevent ethanoic acid / lactic acid / carboxylic acids being formed / to prevent oxidation of ethanol [1]

(c) displayed formula of methyl butanoate [2]
NOTE: all bonds must be shown
NOTE: award (1) if error in alkyl groups but correct displayed structure of –COO–

(d) (i) alcohol, e.g. glycerol, circled [1]
ALLOW: if only part of glycerol molecule is circled as long as it involves an OH group

(ii) saturated
correct reason based on group $C_{17}H_{35}$ / all C–C bonds / no C = C bonds [1]

(iii) salt / carboxylate / alkanoate [1]
(making) soap [1]
ACCEPT: detergent / washing

(e) at least one correct amide linkage –CONH– [1]
continuation shown at both ends of chain [1]
diagram showing three (different) amino acid residues [1]

[Total: 18]

3 **(a) (i)** $CH_3–CH_2–CH_2–OH$ [1]
NOT: C_3H_8O
between 2030 and 2050 [1]

(ii) $C_5H_{11}OH + 7½\ O_2 \rightarrow 5CO_2 + 6H_2O$ [1

(b) any three from:
same general formula
same functional group
same chemical properties
same methods of preparation
accept consecutive members differ by CH_2 [3]

(c) same molecular formula [1]
different structures / different structural formulae [1]

(ii) $CH_3–CH_2–CH(OH)–CH_3$ / $(CH_3)_3C–OH$

(d) number of moles of glucose = 72/180 = 0.4 [1]
maximum number of moles ethanol = 0.8 [1]
maximum mass of ethanol, M_r = 46 g, 0.8 × 46 = 36.8 g [1
or
180 (g) produces 2 × 46 = 92 (g) (1)
(72 (g) produces) 72/180 × 92 (1)
= 36.8 (g) (1)

(ii) crack (petroleum or alkane) [1]
react with water / hydrate (ethene to make ethanol) [1]

conditions for cracking
(temperature) 450to 800 °C / (catalyst) zeolites / aluminosilicates / silica / aluminium oxide / alumina / china / broken pot / chromium oxide
or
conditions for hydration
(temperature) 300 °C / (pressure) 60 atmospheres /
(catalyst) phosphoric acid [1]

[Total: 15]

4 **(a) (i)** CH_2/H_2C [1]

(ii) same ratio of C:H (atoms) / all cancel to CH_2 / because general formula is C_nH_{2n} / same ratio of atoms or elements (in the compound) / C:H ratio is 1:2; [1]

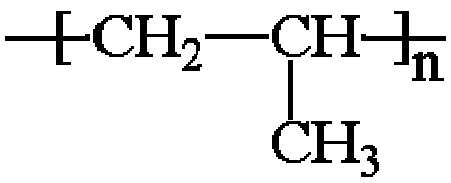
(b) (i) propanoic / propionic (acid); [1]
ethanoic / acetic (acid); [1]

(ii) formula of ethene / but-2-ene / any symmetrical alkene; [1]

(c) (i) $CH_3CH(Br)CH_2Br$ [

(ii) $CH_3CH(OH)CH_3$ / $CH_3CH_2CH_2OH$ / C_3H_7OH [

(d)



correct unit; [1]
accept: more than one repeat unit
continuation bonds at **both** ends; [1]

(e) if C_5H_{10} is given award 3 marks;;; [3]
if $C_{10}H_{20}$ is given award 2 marks;;
if 1:7.5:5 / 2:15:10 is given award 2 marks;;
in all other cases a mark can be awarded for moles of O_2 (= 2.4/32 =) 0.075 **AND** moles of CO_2 (= 2.2/44 =) 0.05;

$2C_5H_{10} + 15O_2 \rightarrow 10CO_2 + 10H_2O$ [1
accept: multiples including fractions
allow: ecf for correct equation from any incorrect alkene