1 **(a) (i)** amino acid / peptides; [1]
salt / carboxylate or soap / fatty acid or glycerine / alcohol; [1]
sugars or glucose; [1]
accept: named sugar

(ii) polyester; [1]
allow: named polyester
polyamide; [1]
allow: nylon

(b) one correct amide linkage; [1]
second amide linkage correctly orientated
– NHCO – followed by – NHCO – [1]
note: monomers are amino acids not diamines or dicarboxylic acid

(c) bromine / bromine water / aqueous bromine; [1]
unsaturated - brown / orange to colourless **not:** clear [1]
saturated - stays brown / orange [1]

or: alkaline potassium manganate(VII);
from purple / pink to green / brown;
stays purple;
or: acidic potassium manganate(VII)
from purple / pink to colourless; **not:** clear
stays purple;

[Total: 10]

2 **(a) (i)** $C_nH_{2n+1}OH$ [1]

(ii) 116-17 = 99, 2n+1 = 99, n = 7
for any evidence of working out [1]
$C_7H_{15}OH$ [1]

(iii) 4bps around C; [1]
1 bp on each hydrogen; [1]
2bps and 2nbps on oxygen; [1]

(b) increases yield / moves equilibrium to RHS / favours forward reaction; [1]
high pressure favours side with smaller number of (gas) molecules; [1]

(ii) any two from:
higher temperature / catalyst causes faster reaction;
comment about compromise conditions to give best rate and yield;
at 250^{o}C (lower temp) higher yield / forward reaction favoured;
at 350^{o}C (higher temp) lower yield / back reaction favoured; [3]

(c) methanoic acid; [1]
correct SF showing all bonds; [1]
accept: -OH

(ii) methyl methanoate; [1]

[Total: 14]

3 **(a) (i)** add bromine water / bromine / aqueous bromine; [1]
colourless; [1]

or add potassium manganate(VII) / permanganate; (ignore acid or alkali) [1]
colourless; [1]

(ii) add metal / carbonate / insoluble base / strong alkali **allow:** ammonia with an indicator / use pH meter; [1]
COND: on reagent

metal - hydrogen given off / metal dissolves / effervescence / gas given off / burning splint pops;

carbonate - carbon dioxide given off / effervescence / gas given off / limewater milky;

insoluble base - solution formed / dissolves;

alkali - use of indicator to show neutralisation / temperature increase;

pH meter - gives pH less than 7 [1]

(b) ethyl propenoate; [1]
correct SF all bonds shown;; [2]
allow: [1] for correct displayed ester linkage

(c) number of atoms of each element; [1]
in one molecule; [1]

(ii) 2; [1]

(iii) C=C [1]

(iv) $HOOC(CH_3)C=C(CH_3)COOH$

[Total: 12]

4 **(a) (i)** cracking / heat with catalyst [1]
to make butane [1]
butene reacts with steam/water / hydrated [1]
accept heat and catalyst for cracking but if specified: 450 to 800°C zeolites / aluminosilicates / silica / aluminium oxide/alumina / china / broken pot / porcelain / chromium oxide

(ii) glucose / sugar changed to alcohol / ethanol [2]
accept an unbalanced equation
(catalysed by) enzymes / yeast [1]

(b) butanoic acid [1]
CH_3-CH_2-CH_2-COOH
hydrogen atoms omitted from ends of bonds, penalise once

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

(ii) $C_6H_{12}O_2$
ignore $CH_3COOC_4H_9$ [1]

(iii) correct structural formula of butyl ethanoate showing all bonds [2]

5 **(a) (i)** rate at which methanol formed by forward reaction [1]
equals rate it is reacting in back reaction [1]
rate of forward reaction equals rate of back reaction allow [1]

(ii) low/lower/decreased temperature [1]
high/higher/increased pressure [1]
Explanations not needed but if they are given they must be correct
IGNORE values of temperature and pressure

(iii) high pressure can be used / lower pressure due to expense or safety [1]
cannot use a low temperature as rate would be too slow the rate would not be economic [1]

(b) (i) ester [1]

(ii) soap/sodium stearate or any acceptable salt/glycerol [1]

(iii) burning both fuels forms carbon [1]

growing plants to make biodiesel removes carbon dioxide from atmosphere [1]

(c) (i) correct SF of an octane [1]

(ii) add bromine (water)/bromine in an organic solvent [1]
result octane remains brown/orange/yellow/red [1]
result octane goes colourless/decolourises [1]
not clear/discolours
colour of reagent must be shown somewhere for [3] otherwise max [2]
accept equivalent test using $KMnO_4$ in acid or alkali

6 **(a)** **(i)** correct structural formula of ethanoic acid [1]
allow: –OH **not:** –COOH

(ii) correct structural formula of ethanol [1]
allow: –OH

(b) **(i)** ethyl ethanoate [1]

(ii) $-OC_6H_4COOCH_2CH_2O-$
correct ester linkage [1]
correct repeat units [1]
continuation [1]
accept: boxes if it is clear what the box represents

(iii) any **two** from:
long time to decay
landfill sites
visual pollution / litter
danger to animals
poisonous gases when burnt [2]
accept: any correct suggestion

(c) synthetic – only two monomers [1]
protein – many different monomers [1]
or:
protein has 1 C=O and 1N–H [1]
nylon has 2 C=O / 2N–H [1]
or:
synthetic – one monomer is a dicarboxylic acid and the other is a diamine [1]
protein all monomers are amino acids [1]