1 **(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

2 **(a** same general formula
same chemical properties
same functional group
physical properties vary in predictable way
common methods of preparation
consecutive members differ by CH_2
any **two** [2]
mark first two
ignore others unless it contradicts a point which has been awarded a mark

(b) $2HCOOH + CaCO_3 \rightarrow Ca(HCOO)_2 + CO_2 + H_2O$ [2
not balanced = [1]

(ii) zinc + methanoic acid → zinc methanoate + hydrogen [2]
[1] for each prod

(iii) protected by <u>oxide</u> layer [1]

(c) butanoic acid [1]
CH_3-CH_2-CH_2-COOH / $C_4H_8O_2$ / C_3H_7COOH / C_4H_7OOH
C_2H_4O [1]
mark **ecf** to molecular formula

3**(a)(i)** general molecular formula
same functional group
physical properties show trend — bp increase with n
same chemical properties
common methods of preparation
any **TWO** **[2]**

(ii) $C_8H_{17}OH$ Mass of one mole = 130 (g) **[2]**
if formula correct but mass wrong **[1]**

(b) propan-1-ol **or** propan-2-ol **[1]**
corresponding structural formula **[1]**
name and formula must correspond for **[2]** if not **ONLY [1]**

(c)(i) structural formula of isomer **[1]**

(ii) carbon dioxide and water **[1]**
pentene **[1]**
pentanoic acid **[1]**

TOTAL = 10

4 (a)

molecular formula [1]
Must be able to give isomers, need not be alkenes
two corresponding isomers [2]
If do not correspond then MAX [2] out of [3]

(b) (i) ethanol [1]
structure [1]

(ii) ethane [1]
structure [1]

(c) (i) many simple molecules **or** monomers [1]
form one large one **or** macromolecule or chain [1]

(ii) addition polymer only one product- the polymer [1]
condensation - polymer and water etc [1]

(iii) correct unit [1]
COND evidence of polymer in structure eg shows continuation such as terminal bonds [1]

(d) (i) water proof **or** impervious **or** flexible **or** good adhesion **or** non-biodegradable **or** unreactive [1]

(ii) steel in contact with water **or** air [1]

(iii) zinc more reactive
oxygen /water reacts with zinc not iron
sacrificial protection
zinc anodic
steel receives electrons from zinc
zinc forms cations
cell
TWO valid points [3]

TOTAL = 17