1 **(a) (i)** a compound which contains carbon and hydrogen **only** [1]

(ii) alkanes contain **only** C-C single bonds
or they are saturated (hydrocarbons)
or have the general formula C_nH_{2n+2} [1]

alkenes contain at least one C=C double bond
or they are unsaturated (hydrocarbons)
or have the general formula C_nH_{2n} [1]

(b) $C_{20}H_{42} \rightarrow 2C_4H_8 + 2C_2H_4 + \mathbf{C_8H_{18}}$ [1]

(c) (i) any unambiguous structure of $BrCH_2CH_2Br$ [1]
NOT just $C_2H_4Br_2$

(ii) $CH_3\text{-}CH{=}CH\text{-}CH_3$ [2]
For any butene [1] only

(iii) $(CH_3\text{-}CH_2\text{-}CH{=}CH_2) + H_2O$ [1] $\rightarrow$ $CH_3\text{-}CH_2\text{-}CH_2\text{-}CH_2OH$ [1] [2]
ALLOW $CH_3\text{-}CHOH\text{-}CH_2\text{-}CH_3$
butene reacts with **water/steam** (to form butanol) **ONLY [1]**

(iv) $C_6H_{12} + H_2 \rightarrow C_6H_{14}$ [2]
alkenes react with **hydrogen** [1] **ONLY**

(d) volume of oxygen used = 150 cm^3 [1]

volume of carbon dioxide formed = 100 cm^3 [1]
any equation of the combustion of an alkene
e.g. $2C_5H_{10} + 15O_2 \rightarrow 10CO_2 + 10H_2O$
formulae [1]
COND balancing [1]

2 **(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]

3 **(a (i)** $Zn + 2HCl \rightarrow ZnCl_2 + H_2$ [2]
not balanced = [1]

(ii) 3 bps and 1 nbp around As; [1]
1 bp each hydrogen atom; [1]

(b) (97.4 / 75 =) 1.3 **and** (2.6 / 1 =) 2.6; [1]
empirical formula AsH_2; [1
note: correct formula with no working = [1]

(ii) As_2H_4; [1]

(iii) $H_2As–AsH_2$ / $AsH_2–AsH_2$; [1

(c) (amide / peptide; [1]

(ii) named strong acid / alkali; [1]
allow: HCl / enzymes

(iii) amino acid; [1]
allow: peptides

(d) (Cu and As have more than one oxidation state / valency; [1]

(ii) $3Cu^{2+} + 2AsO_4^{3} \rightarrow Cu_3(AsO_4)_2$ [2]
either side correct = [1]

[Total: 14]

4 **(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]

5 **(a) (i)** ethanol [1]
CH_3-CH_2-OH [1]

propanoic acid [1]
CH_3-CH_2-COOH [1]
independent marking, no ecf
accept C_2H_5
not – HO

(ii) type of compound – salt / sodium carboxylate / alkanoate [1]
not soap / sodium stearate etc
use – soap / cleaning / detergent [1]

(iii) terylene / PET / Dacron / diolen / mylar / crimplene

(b) polyamide / amide / peptide / polypeptide [1]

(ii) correct amide linkage <u>NHCO then CONH</u> [1]
cond to mark 1, 2 monomers (different shading in box) [1]
cond continuation (to **ONE** correct linkage) [1]

OR nylon 6
only one linkage – NHCO [1]
cond only one monomer [1]
cond continuation (to correct linkage) [1]

(iii) use locating agent [1]
measure distance travelled by sample / travelled by solvent front [1]
cond this is $R_f = 0.5$ [1]
for mark 3, either mark 1 or mark 2 must be awarded

accept run a chromatogram of glycine [1]
compare with sample
same position [1] max [2]