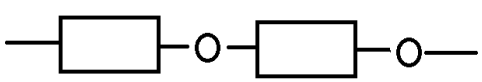
<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>1(a)(i)</td><td>compound containing carbon and hydrogen only;</td><td>1</td></tr>
<tr><td>(a)(ii)</td><td>$_nH_{2n+2}$;
C_nH_{2n};</td><td>2</td></tr>
<tr><td>(b)(i)</td><td>mol C = 54.54 / 12 or 4.5(45) and mol H = 9.09 / 1 or 9.09 and mol O = 36.37 / 16 or 2.27;
C_2H_4O;</td><td>2</td></tr>
<tr><td>(b)(ii)</td><td>M_r of C_2H_4O = 44;
88 / 44 = 2 therefore $C_4H_8O_2$;</td><td>2</td></tr>
<tr><td>(c)</td><td><table><tr><td>methyl ethanoate;</td><td>ethyl methanoate;</td></tr><tr><td>CH_3COOCH_3;</td><td>HCOO $_2H_5$;</td></tr></table></td><td>4</td></tr>
<tr><td>(d)</td><td>met propanoate;</td><td>1</td></tr>
<tr><td>(e)(i)</td><td>condens</td><td>1</td></tr>
<tr><td>(e)(ii)</td><td>/ H_2O;</td><td>1</td></tr>
<tr><td>(e)(iii)</td><td>dicarboxylic acid or diacyl chloride;
diol;</td><td>2</td></tr>
</table>

Question	Answer	Marks
2(a)(i)	**step 2 and** it is electron gain / oxidation state decreases;	**1**
(a)(ii)	(ion) **and** it accepts electrons / gets reduced / oxidation state decreases;	**1**
(b)	*prediction:* the '*not covered*' section will be black; the '*covered in thick card*' section will be white / cream; the '*covered in thin card*' section will be grey; *explanation:* the more light, the more silver ions are reduced;	 **1** **1** **1** **1**
(c)(i)	carbon dioxide + water → glucose + oxygen reactants correct; products correct;	 **1** **1**
(c)(ii)	chlo	**1**
(c)(iii)	 one correct –O– link between rectangles; two correct glucose units with continuation bonds;	 **1** **1**
(c)(iv)	the reaction of glucose with oxygen to release (carbon dioxide and water and) energy; **or** the reaction of glucose in a biological system to release energy;	**1**

3 **(a) (i)** 82.76/12 and 17.2(4)(/1)
or evaluation: 6.89 / 6.9(0) and 17.2(4) [1]

C_2H_5 [1]

OR
82.76 / 100 × 58 = 48 and 17.24 / 100 × 58 = 10
or evaluation i.e. 48 and 10 [1]

C_2H_5 [1]

(ii) (C_2H_5 =) 29 [1]

(58 / 29 =2) C_4H_{10} [1]

OR:
82.76 / 100 × 58 = 48 and 17.24 / 100 × 58 = 10
or evaluation i.e. 48 and 10 [1]

48 / 12 = 4 10 / 1 = 10 (therefore) C_4H_{10} [1]

(b) (i) C_nH_{2n} [1]

(ii) CH_2 [1]

(c) (contains) double bond / triple bond / multiple bond(s) / not all bonds are single [1]

(contains) carbon and hydrogen **only** [1]

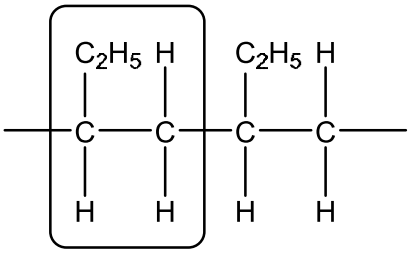
(d) bromine / bromine water [1]

no change / stays brown / orange / yellow / red-brown or only changes in UV [1]

(brown / orange / yellow) to colourless / decolourised

(e) **(i)** circle / brackets around any 2 consecutive carbon atoms in the main chain and all attached atoms [1]

e.



(ii) $CH_3CH_2CH=CH_2$ / $C_2H_5CH=CH_2$ (double bond must be shown) [1]

butene / but-1-ene

(iii) $(CH_3)_2C=CH_2$ / $CH_3CH=CHCH_3$ / $(CH_2)_2CHCH_3$ / $(CH_2)_4$ [1]

[Total:15]

4 **(a) (i)** butanoic acid [1]
methanol [1]

(ii) number of moles of ethanoic acid = 0.1 [1]
number of moles of ethanol = 0.12(0) [1]
the limiting reagent is ethanoic acid [1]
number of moles of ethyl ethanoate formed = 0.1 [1]
maximum yield of ethyl ethanoate is 8.8 g [1

(b) correct ester linkage [1]
two ester linkages (COND on M1) [1]
continuation (COND on M2) [1]

(c) add bromine water/bromine [1]
turns colourless [1]
remains brown/orange/reddish brown/yellow [1]

ALLOW: potassium manganate(VII) (acidic or alkaline) [1]
correct colour colourless/green or brown ppt [1]
stays pink/purple [1]

(ii) ester 1 [1]
COND alkyl group is C_nH_{2n+1} which is NOT $C_{17}H_{33}$
or $C_{17}H_{35}$ is C_nH_{2n+1} **or** less hydrogen [1]

(iii) soap **or** (sodium) salt (of a carboxylic acid) **or** carboxylate

alcohol [1]

[Total: 17]

5 **(a) (i)** enzymes (1) [1]

(ii) reduces growth of microbes / rate of reproduction of microbes is lower / microbes are dormant (1)
fewer (enzymes) to decay food (1)
OR
enzymes less efficient at lower temperatures (1)
slower reaction rate (1) [2]

(b) correct linkage (1)
rest of molecule correct **and** continuation shown (1)
(other product is) water (1) [3]

(c) any **three** from:
photosynthesis (1)
light / photochemical (1)
chlorophyll / chloroplasts (1)
carbon dioxide and water needed (1)
(glucose and) oxygen (1) [3]

[Total: 9]