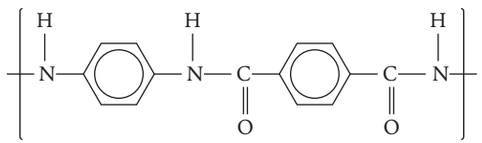
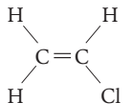
A Level OCR Chemistry

Chapter 24 – answers

<table>
<tr><th>Question</th><th>Answers</th><th>Extra information</th><th>Mark</th><th>AO
Spec reference</th></tr>
<tr><td>1(a)</td><td>
<table>
<tr><th>Polymer</th><th>PVC</th><th>Kevlar</th></tr>
<tr><td>Repeating unit</td><td></td><td>  </td></tr>
<tr><td>Monomer</td><td>  </td><td></td></tr>
<tr><td>Type of Polymerisation</td><td>Addition</td><td>Condensation</td></tr>
</table>
</td><td>1 mark for each correct cell</td><td>4</td><td>6.2.3, M4.2, M4.3</td></tr>
<tr><td>1(b)</td><td>There is a difference.
Addition polymerisation has 100% atom economy because it is addition polymerisation, no other products made
Condensation polymerisation releases a small particle during polymerisation.</td><td>

Allow HCl</td><td>1
1

1</td><td>6.2.3</td></tr>
<tr><td>1(c)</td><td>Three from the following:
Advantages of recycling
• Saves limited resources
• Plastic does not end up in landfill
Disadvantages of recycling
• Costs energy and resources
• Plastic needs collecting and cleaning
Advantages of disposal
• Cheap and easy
• If burnt can use the heat to generate electricity</td><td>Must include at least one advantage and one disadvantage for disposal AND recycling</td><td>1
1
1</td><td>6.2.3</td></tr>
</table>

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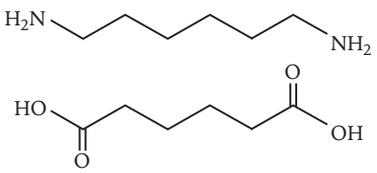
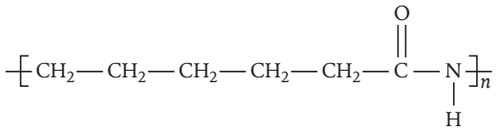
Question	Answers	Extra information	Mark	AO Spec reference
	Disadvantages of disposal • Leaking chemicals can damage wildlife • Takes up large areas of land • If burnt releases CO_2 (greenhouse gases)			
2(a)			1 1	6.2.3, M4.2
2(b)	Polymers have higher melting points than the monomers because there are greater intermolecular forces/forces between molecules, Therefore a higher temperature/more energy is needed to overcome them.		1 1	2.2.2
2(c)	Poly(caprolactam) **OR** poly(azepan-2-one)		1	6.2.3
2(d)	Nylon 6 repeating unit: 	Need the brackets, don't need the '*n*'	1	6.2.3
2(e)	$4\,cm^3 \times 1.06\,g\,mL^{-1} = 4.24\,g$ $4.24\,g / 133\,g\,mol^{-1} = 0.0375\,mol$ (actual) 60% = actual / theoretical × 100 theoretical = 0.375 / 0.6 = 0.0625 mol azepan-2-one units in monomer 0.0625 mol azepan-2-one started with		1 1 1 1	2.1.3, M0.0, M0.2
2(f)	Any **two** from: • Incomplete reaction • Impure reactants • Did not separate out all of the synthesized nylon 6		1 1	1.2.1

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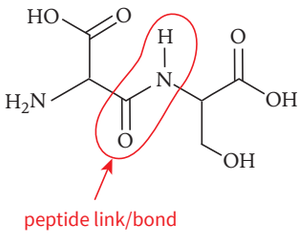
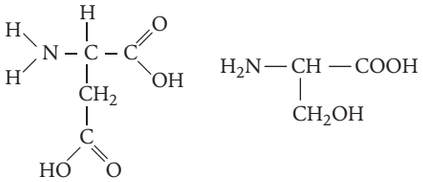
<tr><td>3(a)</td><td> 
</td><td></td><td>1</td><td>6.2.3</td></tr>
<tr><td>3(b)</td><td>Condensation (polymerisation)</td><td></td><td>1</td><td>6.2.3</td></tr>
<tr><td>3(c)</td><td> 

</td><td>1 mark for each amino acids drawn correctly.</td><td>2</td><td>6.2.3, M4.2</td></tr>
<tr><td>3(d)</td><td>Thin-layer chromatography could be used to separate the amino acids
UV light/ninhydrin could be used to highlight/visualise the amino acids
The amino acids could then be identified using their R_f values compared to known values</td><td></td><td>1
1
1</td><td>6.3.1</td></tr>
<tr><td>4(a)</td><td>
<table>
<tr><th>C</th><th>H</th><th>N</th><th>O</th></tr>
<tr><td>46.6 / 12.0</td><td>8.7 / 1.0</td><td>13.6 / 14.0</td><td>31.1 / 16.0</td></tr>
<tr><td>= 3.883333</td><td>= 8.7</td><td>= 0.9714285</td><td>= 1.94375</td></tr>
<tr><td>3.883333 / 0.9714285</td><td>8.7 / 0.9714285</td><td>0.9714285 / 0.9714285</td><td>1.94375 / 0.9714285</td></tr>
<tr><td>4</td><td>9</td><td>1</td><td>2</td></tr>
</table>
Empirical formula = $C_4H_9NO_2$
Which has M_r of 103.0 g mol^{-1} so that must be the molecular formula.</td><td>Need a comment about the empirical formula being the molecular formula/having the M_r = 103 for the last mark.</td><td>

1

1

1
1</td><td>2.1.3, M0.1, M0.2, M2.2</td></tr>
</table>

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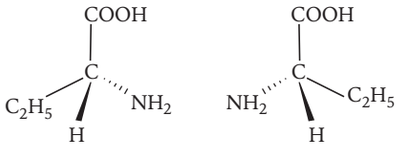
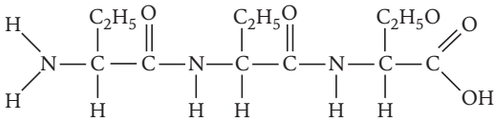
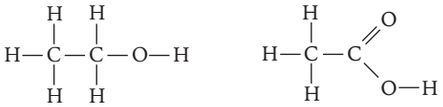
Question	Answers	Extra information	Mark	AO Spec reference
4(b)		Check that there are two different isomers here, not the same isomer but rotated	2	6.2.2, M4.2, M4.3
4(c)(i)			1	6.2.3, M4.2
4(c)(ii)	Condensation		1	6.2.3
5(a)(i)	The acid acts as a catalyst (so is not used up in the reaction)		1	6.2.3
5(a)(ii)		All bonds must be shown	2	6.2.3
5(a)(iii)	$CH_3CH_2CH_2OH$ CH_2COOH	**1** mark for each	1 1	6.2.3
5(b)(i)	$CH_3CH_2COOCH_2CH_2CH_3 + NaOH \rightarrow CH_3CH_2COO^-Na^+ + CH_3CH_2CH_2OH$	Accept correct structures **1** mark for correct reactions **1** mark for correct products	2	6.2.3
5(b)(ii)	Sodium propanoate	**1** mark for either answer	1	4.1.1

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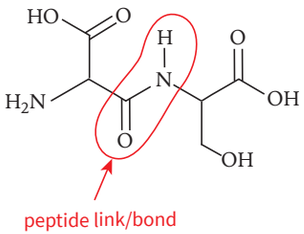
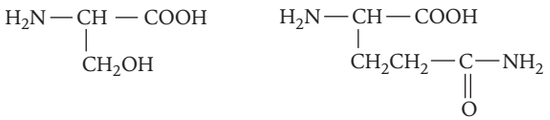
6(a)			1	6.2.3
6(b)(i)	Hydrolysis		1	6.2.3
6(b)(ii)		**1** mark for each structure	1 1	6.2.3
6(c)	There are bigger intermolecular forces between molecules of polymer Polymers have more electrons / stronger dipoles / more hydrogen bonds can form etc. Therefore more energy/higher temperature is needed to overcome these (and melt the substance)	any named types of bonding and cause of it	1 1 1	2.2.2

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Skills box answers:

	Carbon % / **12**	**Hydrogen %** / **1**	C : H	C : H	**Empirical formula**	M_r **of empirical formula**	$M_r \div M_r$ **of empirical formula**	**Molecular formula**
a)	7.14	14.30	1 : 2.00	1: 2	CH_2	14	84 ÷ 14 = 6	C_6H_{12}
b)	8.00	4.00	2:00 : 1	2: 1	C_2H	25	50 ÷ 25 =2	C_4H_2
c)	7.28	12.70	1: 1.75	4: 7	C_4H_7	55	110 ÷ 55 =2	C_8H_{14}
d)	7.82	6.3	1.25: 1	5: 4	C_5H_4	64	128 ÷ 64 = 2	$C_{10}H_8$

Possible structures:

1. Hexene
2. H—C≡C—C≡C—H
3. Cyclooctene
4. Naphthalene (basically two benzene rings stuck together)