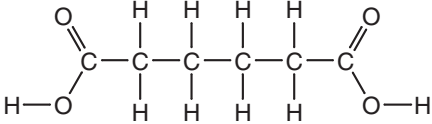
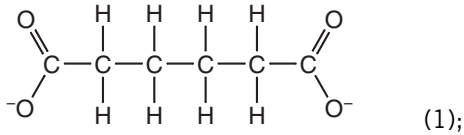
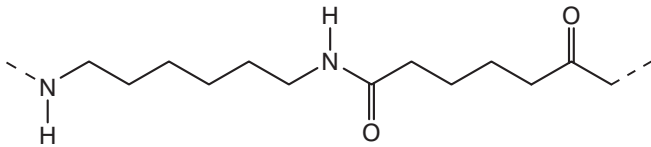
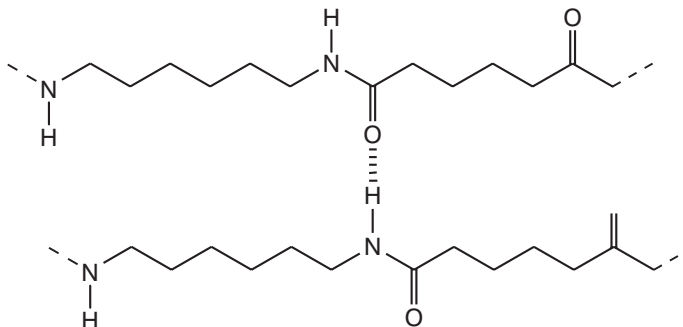
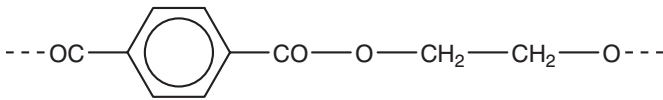
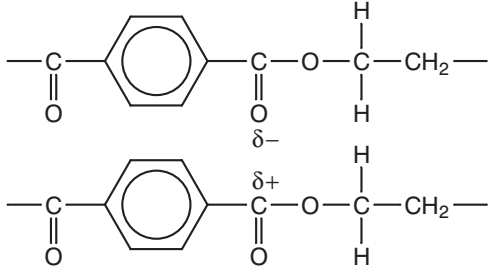




Answers to Designer Polymers End of Unit Test

Q	Answer with marks	Marking suggestions
1(a)	Design (1); he was trying to make a polymer with a structure related to that of silk (1)	
1(b)	Crude oil (1)	
1(c) (i)	(Di)amine (1)	
1(c) (ii)	1,6-Diaminohexane (1)	
1(c) (iii)	$^+\text{H}_3\text{N}(\text{CH}_2)_6\text{NH}_3^+$ (1); (two) Cl^- (1)	
1(d) (i)	(Di)carboxylic acid (1)	
1(d) (ii)	 <p>Carboxylic acid groups correct (1); rest of structure correct (1)</p>	
1(d) (iii)	 <p>(1); (two) Na^+ (1)</p>	Need not be full structural
1(e)	 <p>Central amide link (1); rest of structure (1)</p>	Allow either as dimer or as part of polymer chain (as shown)
1(f)	6 (1); 6 (1)	
1(g)	Polymer – many units joined together (1); condensation – units joined with the elimination (<i>or words to that effect</i>) of water/a small molecule (1)	
1(h)	Acyl/acid chloride (1)	
1(i)	HCl/hydrogen chloride (1)	
1(j)	Acylation (1)	
1(k)	It is expensive (1); it is a highly reactive/dangerous compound (1)	
1(l)	Instantaneous dipole–induced dipole (1)	
1(m)	<p>Hydrogen bonds (1);</p>  <p>hydrogen bond from H joined to N (1); to O (or N) on another chain (1)</p>	Chain details need not be skeletal and may be approximate as long as the relevant atoms are shown

Q	Answer with marks	Marking suggestions
2(a)	Hydroxy/diol/alcohol (1)	
2(b)	 <p>Ester link correct (1); rest of structure (1)</p>	Allow valid alternatives and allow as dimer or as part of polymer chain (as shown)
2(c) (i)	Permanent dipole-permanent dipole (1)	
2(c) (ii)	 <p>δ^- on O (1); attracted to δ^+ on C (of CO) (1)</p>	Many possible correct alternative drawings of structures
2(d) (i)	$\text{Na}^+ \text{ } ^-\text{OOC}-\text{C}_6\text{H}_4-\text{COO}^- \text{Na}^+$ (1) $\text{HOCH}_2\text{CH}_2\text{OH}$ (1)	
2(d) (ii)	Heat/reflux (1)	
2(e) (i)	F/E is more flexible (1)	
2(e) (ii)	Chains less closely-packed/weaker intermolecular forces (1); can move over each other more easily (1)	
2(e) (iii)	F/E has lower T_g (1)	
2(e) (iv)	Less thermal/kinetic energy (1); is needed to make the chains free to move/release them from their crystalline/glassy structure (1)	
2(f) (i)	Burning (1); burying (1)	
2(f) (ii)	Conserves resources (1); does not use up disposal facilities (1)	

Q	Answer with marks	Marking suggestions
3(a) (i)	 (1)  (1)	
3(a) (ii)	(Secondary) amide (1)	Allow peptide
3(b)	The NH groups are protonated (1); disrupting the hydrogen bonds (1)	
3(c) (i)	Reflux (1); with (moderately) concentrated sulphuric acid/(moderately) concentrated sodium hydroxide solution (1)	First mark depends on some acid/alkali being mentioned
3(c) (ii)	Dissolve in <i>minimum</i> of <i>hot</i> solvent (1); allow to crystallise (1); filter, wash and dry (1)	Allow water as solvent
3(c) (iii)	Take a melting point. It should all melt at the same temperature/compare value with known value (1)	
3(d)	<i>Any three</i> properties with reasons (3), one mark for each property related to a structural feature: strong – molecules packed closely together/held by hydrogen bonds 'light' – 'light' atoms C,N,O fire-resistant – few hydrogen atoms/stable benzene rings can be made into a <i>fibre</i> – way molecules are packed low elasticity as a <i>fibre</i> – rigid/delocalised structure	Three properties but no/invalid reasons score 1