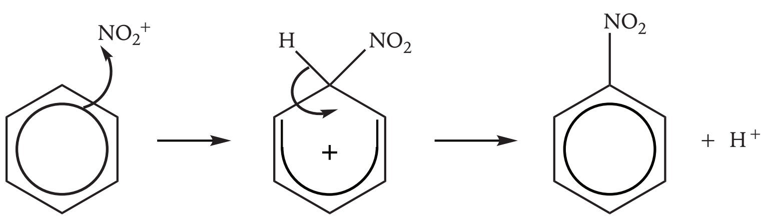
A Level AQA Chemistry

Chapter 21 – answers

Question	Answers	Extra information	Mark	AO Spec reference
01.1	Planar ring structure with delocalised electrons Bond length shorter than cyclohexane single bond but not as short as a double bond.		1 1 1	3.3.10.1
01.2	Benzene is a more stable molecule than cyclohexatriene. benzene (= -208 kJ mol^{-1}) which is less exothermic than cyclohexatriene because there is resonance in the structure/delocalisation of the electrons.	Less exothermic/more endothermic/releases less energy	1 1 1	3.3.10.1, MS
01.3	Bromine (water) Benzene – no change/no (visible) reaction/colour stays the same Cyclohexane – decolourisation of the solution, colour turns from brown/orange to colourless		1 1 1	3.3.4.2, 3.3.10.1
01.4	because addition reactions would disrupt the rings of delocalised electrons and therefore destabilise the structure	OWTTE	1	3.3.10.1
02.1	Concentrated H_2SO_4 and concentrated HNO_3 $2\ H_2SO_4 + HNO_3 \rightarrow 2\ HSO_4^- + NO_2^+ + H_3O^+$ OR $H_2SO_4 + HNO_3 \rightarrow HSO_4^- + NO_2^+ + H_2O$		1 1	3.3.10.2, MS 0.2
02.2	intermediate		3	3.3.10.2
02.3	Electrophilic substitution		1	3.3.10.2

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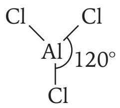
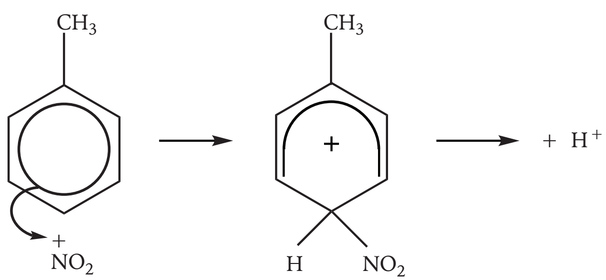
02.4	 3 pairs of bonding electrons and no lone pairs All bonding pairs / bonds repel equally (to arrange themselves as far apart as possible (to minimise repulsion.) Trigonal planar	120° needed on diagram or in explanation	1 1 1 1	3.1.3.5 MS 4.1, MS 4.2
03.1	CH_3Br OR CH_3Cl AND $FeBr_3$ OR $FeCl_3$	Either answer and its corresponding halogen carrier is acceptable	1	3.3.10.2
03.2	Electrophilic substitution		1	3.3.10.2
03.3	Reagents: (Concentrated) H_2SO_4, AND (concentrated) HNO_3 Mechanism: 	Both needed for the mark	1 3	3.3.10.2
03.4	Sn AND concentrated HCl Name of product: 1-amino-4-methylbenzene	Must say concentrated	1 1	3.3.10.2
03.5	Reduction		1	3.3.11.1

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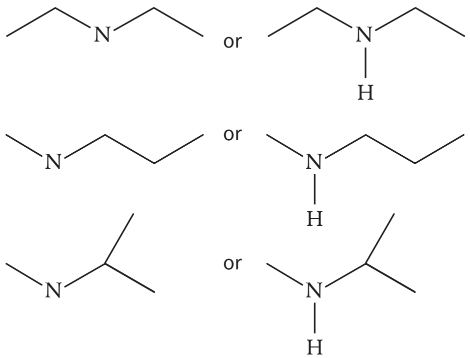
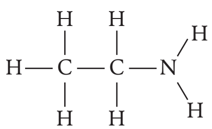
OXFORD Revise

Question	Answers	Extra information	Mark	AO Spec reference
04.1			3	3.3.1.1, MS 4.2
04.2	1 peak As all hydrogens are in the same environment.		1 1	3.3.15
04.3	Name: Ethylamine 		1 1	3.3.1.1, 3.3.12.1, MS 4.2
04.4	Primary amine is stronger base than ammonia As lone pair is more available (to bond with Hs) (because alkyl groups push electron density onto N)	Or reverse	1 1	3.3.11.2
04.5	Nucleophilic addition-elimination		1	3.3.11.3

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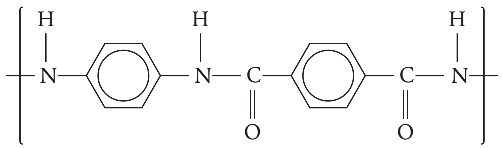
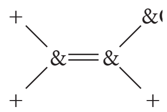
<table>
<tr><th>Question</th><th>Answers</th><th>Extra information</th><th>Mark</th><th>AO
Spec reference</th></tr>
<tr><td>05.1</td><td>
<table>
<tr><th>Polymer</th><th>PVC</th><th>Kevlar</th></tr>
<tr><td>Repeating unit</td><td></td><td>
</td></tr>
<tr><td>Monomer</td><td></td><td></td></tr>
<tr><td>Type of Polymerisation</td><td>Addition</td><td>Condensation</td></tr>
</table>
</td><td>1 mark per box</td><td>1 × 4</td><td>3.3.12.1, 3.3.4.3, MS 4.2</td></tr>
<tr><td>05.2</td><td>addition polymerisation has 100% atom economy because only one product
condensation polymerisation has atom economy is less than 100%, because H_2O/HCl/small molecule also produced</td><td></td><td>1
1</td><td>3.3.4.3, 3.1.2.5</td></tr>
<tr><td>05.3</td><td>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
If burnt: can use the heat to generate electricity
Disadvantages of disposal:
leaking chemicals can damage wildlife,
Takes up large areas of land
If burnt, releases CO_2 (greenhouse gases) and toxic HCl</td><td>Four of the points from the left (at least one advantage and one disadvantage for disposal AND recycling)</td><td>4</td><td>3.3.4.3, 3.3.12.2</td></tr>
</table>

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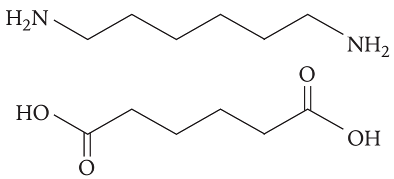
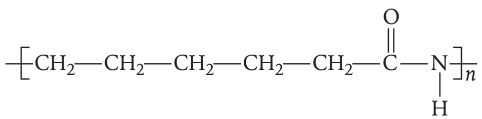
Question	Answers	Extra information	Mark	AO Spec reference
06.1			2	3.3.12.1, MS 4.2
06.2	Polymers have higher melting points than the monomers because there are greater intermolecular forces/forces between molecules, therefore a higher temperature/more energy is needed to overcome them.	Do not allow 'stronger bonds',	1 1	3.3.12.1
06.3	Poly(caprolactam) OR poly(azepan-2-one)		1	3.3.4.3
06.4	Nylon 6 repeating unit: 	Need the brackets, don't need the '*n*'	1	3.3.12.1
06.5	$4\,cm^3 \times 1.06\,g\,cm^{-3} = 4.24\,g$ $4.24\,g / 113\,g\,mol^{-1} = 0.0375\,mol$ (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	3.1.2.5, MS 0.0, 0.2, 2.2
06.6	Two from: Incomplete reaction Impure reactants Did not separate out all of the synthesized nylon 6 or side reactions		2	PS 1.2, PS 4.1

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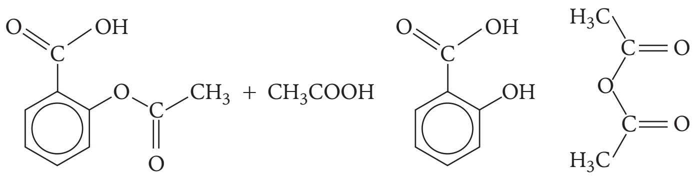
Skills box answers:

1. 2-ethanoyloxybenzoic acid; 2-hydroxybenzoic acid; ethanoic anhydride



2. So that no product or reactant is lost by evaporation./ bonds are strong so it needs a lot of heating
3. Use a dry, clean weighing boat (or another suitable container).
   Add 2-hydroxybenzoic acid to the boat. Record mass of boat + solid.
   Transfer the solid to the flask for heating under reflux.
   Re-weigh the boat. Record mass.
   Calculate (mass of boat + solid) – (boat after transferring solid).
4. Place solid in melting-point tube
   Place in oil/melting-point apparatus and heat gently.
   Record temperatures at which solid starts melting and stops melting.
   Compare melting point to values in data book / from tables / other results.