

# OCR (A) Chemistry A-level

## Topic 6.2.3 - Polyesters and Polyamides

### Flashcards

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# What is condensation in terms of polymers?



# What is condensation?

Small molecule eliminated (usually  $\text{H}_2\text{O}$ ) to form a larger molecule



How many monomers are  
condensation polymers  
usually formed from?



How many monomers are condensation polymers usually formed from?

two



What properties do these  
monomers forming  
condensation polymers  
have?



What properties do these monomers forming condensation polymers have?

Each has two functional groups



# Examples of condensation polymers?





# Examples of condensation polymers?

Polyesters

Polyamides

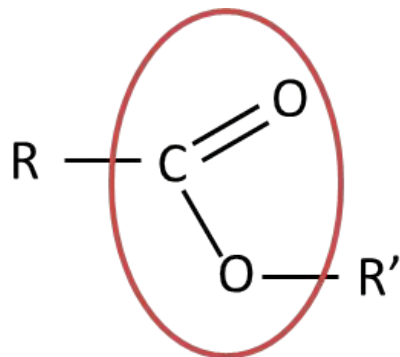
Polypeptides



# What is the linkage in a polyester?



# What is the linkage in a polyester?



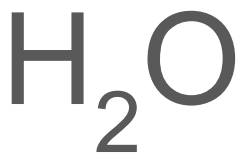
The ester linkage



What molecule is eliminated  
in formation of a polyester?



What molecule is eliminated in formation of a polyester?



What are the two monomers  
which form a polyester  
(generic names and  
structures)?



What are the two monomers which form a polyester (generic names and structures)?

Diol and dicarboxylic acid or a molecule with both alcohol and a carboxylic acid functional groups

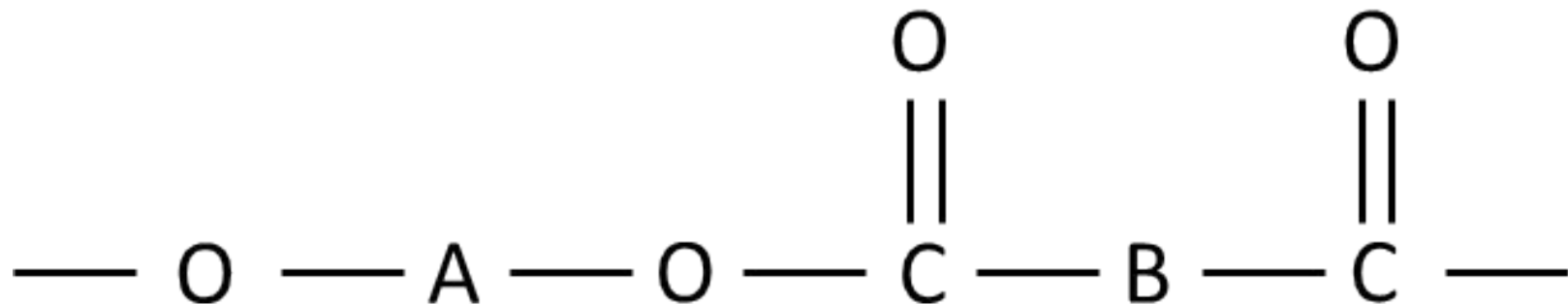


Draw a generic repeating unit for a polyester.





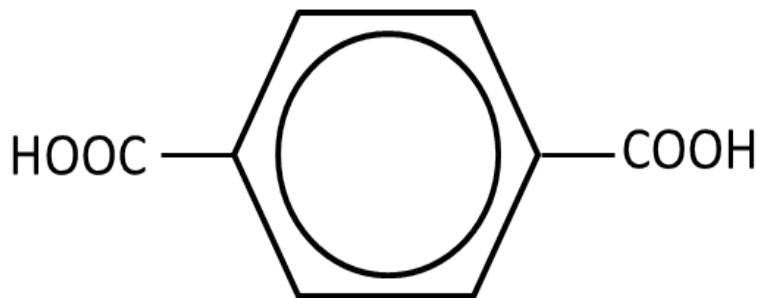
Draw a generic repeating unit for a polyester.



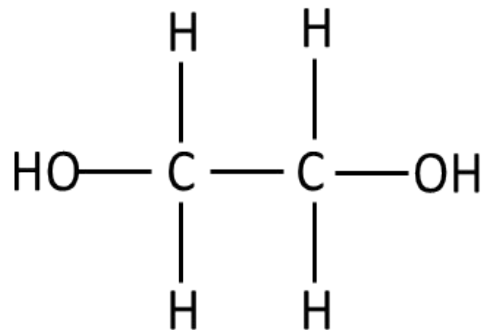
# Which monomers is Terylene made from?



# Which monomers is Terylene made from?



Benzene-1,4-dicarboxylic acid



Ethane-1,2-diol

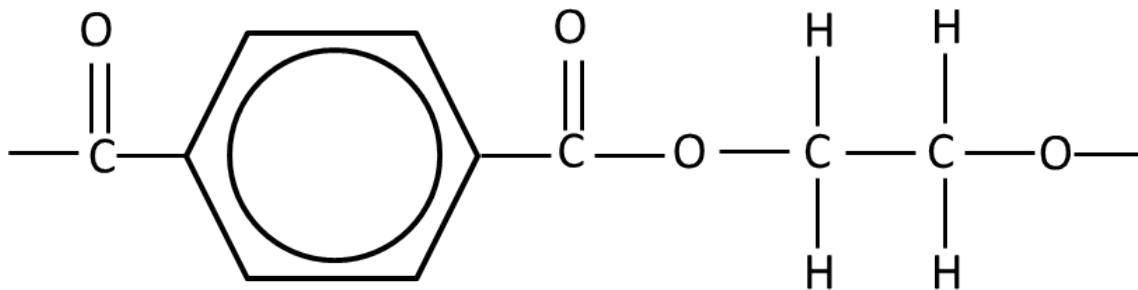


# Draw the repeating unit of Terylene.





Draw the repeating unit of Terylene.



# What is Terylene used for?



# What is Terylene used for?

## As a fibre for making clothes

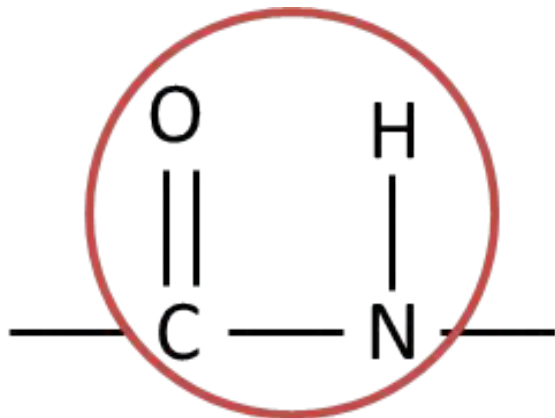


# What is the linkage in a polyamide?





# What is the linkage in a polyamide?



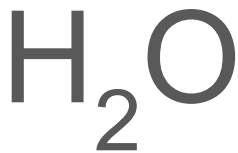
The peptide linkage



Which molecule is eliminated when a polyamide is formed?



Which molecule is eliminated when a polyamide is formed?



What are the two monomers  
used to form a polyamide  
(generic names and  
structures)?



What are the two monomers used to form a polyamide (generic names and structures)?

Diamine and dicarboxylic acid



# Examples of polyamides?



# Examples of polyamides?

## Nylon, Kevlar



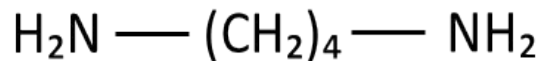
Which monomers is  
Nylon-6,6 made from?





# Which monomers is Nylon-6,6 made from?

1,6-diaminohexane



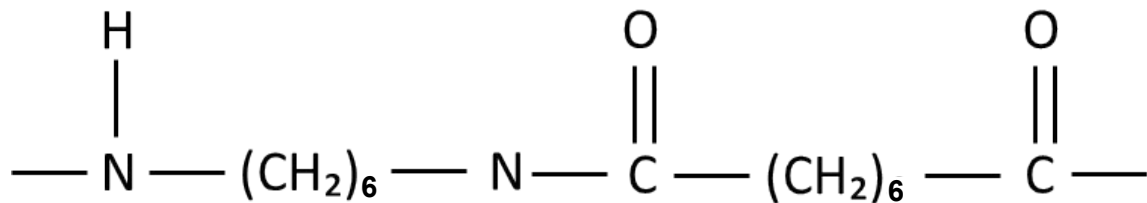
Hexanedioic acid



Draw the repeating unit of  
Nylon-6,6.



Draw the repeating unit of Nylon-6,6.



If you are making Nylon in the lab, what monomers would you use and why? What molecule is eliminated?



If you are making Nylon in the lab, what monomers would you use and why? What molecule is eliminated?

Use hexane-1,6-diacyl chloride as the rate of reaction is much faster. HCl is eliminated



# What is Kevlar used for?



# What is Kevlar used for?

In body armour (bullet proof vests, stab vests), helmets (e.g. F1 drivers'), oven gloves



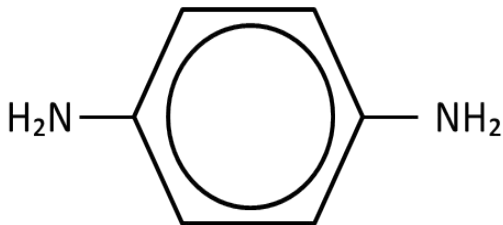
# Which monomers make up Kevlar?



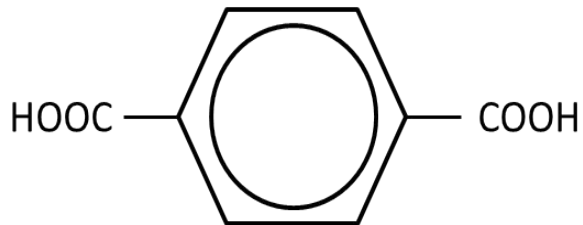


# Which monomers make up Kevlar?

1,4-diaminobenzene



Benzene-1,4-dicarboxylic acid

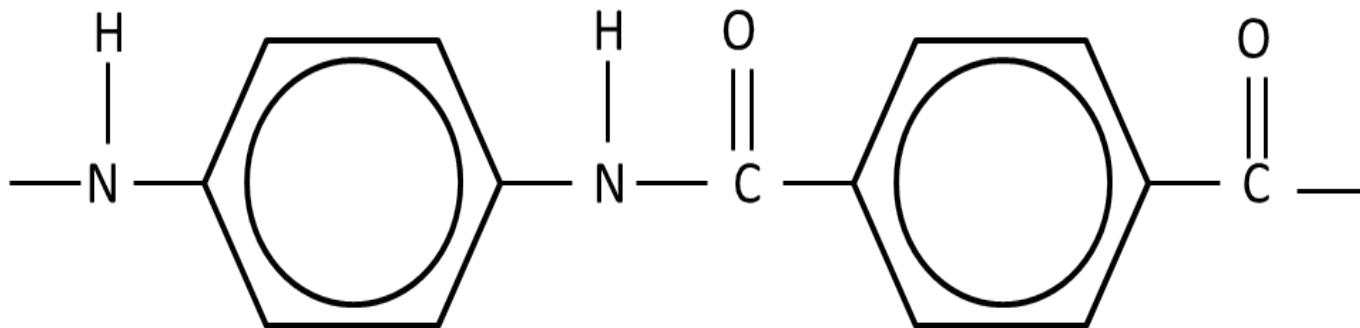


# What is the repeating unit of Kevlar?





# What is the repeating unit of Kevlar?



# Why are poly(alkenes) not biodegradable?



# Why are poly(alkenes) not biodegradable?

Non-polar C-H and C-C bonds



# Why is it bad to burn poly(alkenes)?



# Why is it bad to burn poly(alkenes)?

Releases  $\text{CO}_2$ ,  $\text{CO}$ , C (soot) and other toxic chemicals from monomers



# Where do most poly(alkenes) end up?





Where do most poly(alkenes) end up?

Landfill sites



# Why can condensation polymers be broken down?



Why can condensation polymers be broken down?

They have polar bonds



# How are condensation polymers broken down?



# How are condensation polymers broken down?

## Hydrolysis (opposite of condensation)



What is the difference  
between addition and  
condensation  
polymerisation?



What is the difference between addition and condensation polymerisation?

Condensation makes the polymer and eliminates a small molecule; addition polymerisation breaks  $C=C$  to form only one product (just the polymer).



# Explain hydrogen bonding between polyamides.





# Explain hydrogen bonding between polyamides.

Both C=O and N-H are polar bonds, as N's electronegativity > H's and O's electronegativity > C's.

Hydrogen bonding between H  $\delta^+$  and O  $\delta^-$  in different molecules

Uses the lone pair of electrons on the O atom.



# Why do polyesters not show hydrogen bonding?

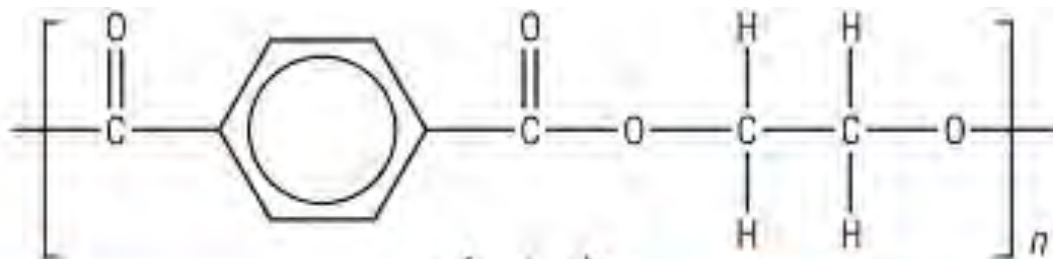


# Why do polyesters not show hydrogen bonding?

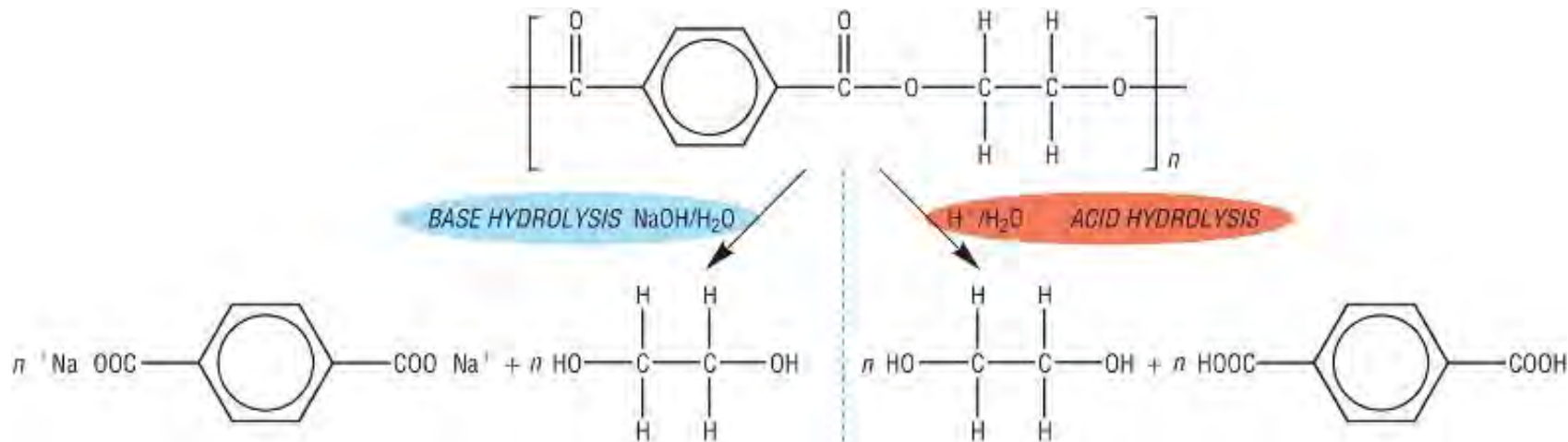
All O-H bonds are removed during polymerisation



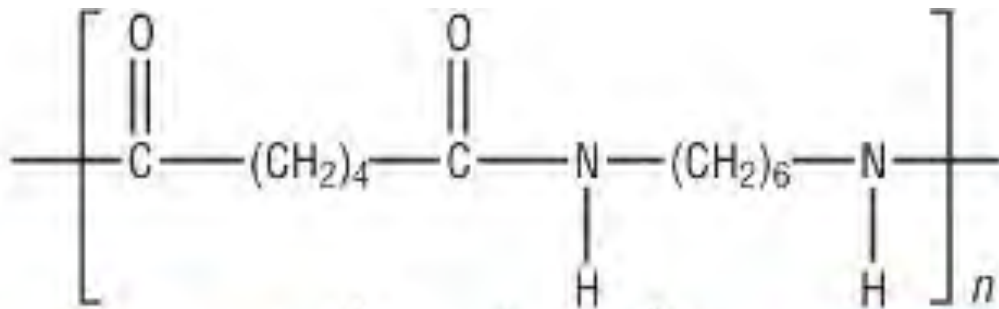
Write the products of acid and base hydrolysis of this polyester?



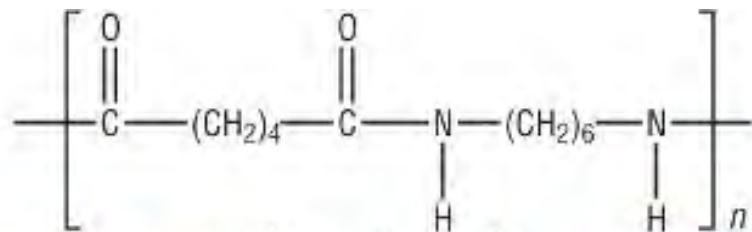
Write the products of acid and base hydrolysis of this polyester?



Write the products of the acid and base hydrolysis of this polyester?



Write the products of the acid and base hydrolysis of this polyamide?



**BASE HYDROLYSIS** NaOH/H<sub>2</sub>O

**H<sup>+</sup>/H<sub>2</sub>O** **ACID HYDROLYSIS**

