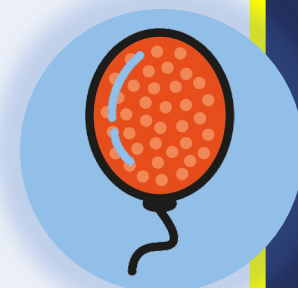


## (HT) Taking it Further: Condensation Polymerisation

Answer the questions below.

1. Define a polymer.  
**A long molecule made up of many repeating units.**
2. Describe what happens during addition polymerisation.  
**The C=C double bonds of monomers are broken so monomers can join together to form a polymer.**
3. Explain why alkanes cannot be monomers.  
**They are saturated so cannot make more bonds with other molecules.**
4. State the chemical formula of water.  
**H<sub>2</sub>O**
5. Describe the bonding in water.  
**An oxygen atom covalently bonds to two hydrogen atoms, so that each atom achieves a full outer shell.**



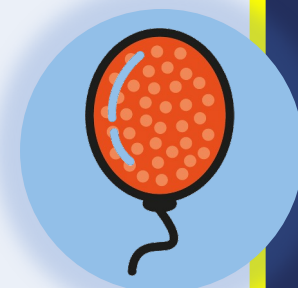
## (HT) Taking it Further: Condensation Polymerisation

### **Do Now:**

1. Define a polymer.
2. Describe what happens during addition polymerisation.
3. Explain why alkanes cannot be monomers.
4. State the chemical formula of water.
5. Describe the bonding in water.

### **Drill:**

1. Name the functional group found in alcohols.
2. Name the functional group found in carboxylic acids.
3. Name the type of compound formed when an alcohol reacts with a carboxylic acid.

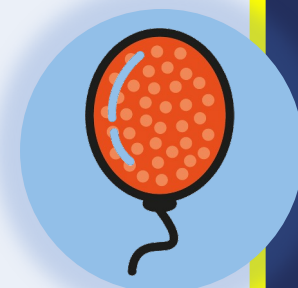


## (HT) Taking it Further: Condensation Polymerisation

### Read Now:

For addition polymerisation to take place, monomers must contain a  $C=C$  double bond. This double bond is broken open to allow the monomer to bond with other monomers to make the polymer chain. In condensation polymerisation, the monomers do not require a  $C=C$  double bond, but the monomers must each have two functional groups. Simple polymers can be made through condensation polymerisation reactions where two monomers contain two of the same functional group. This is how materials such as polyester are made. Condensation polymerisation is also the reaction through which proteins are synthesised from amino acids.

1. State what is required for monomers to undergo addition polymerisation.
2. State what is required for monomers to undergo condensation polymerisation.
3. Give an example of a polymer made from condensation polymerisation.
4. Identify the monomers and polymers when proteins are synthesised from amino acids.



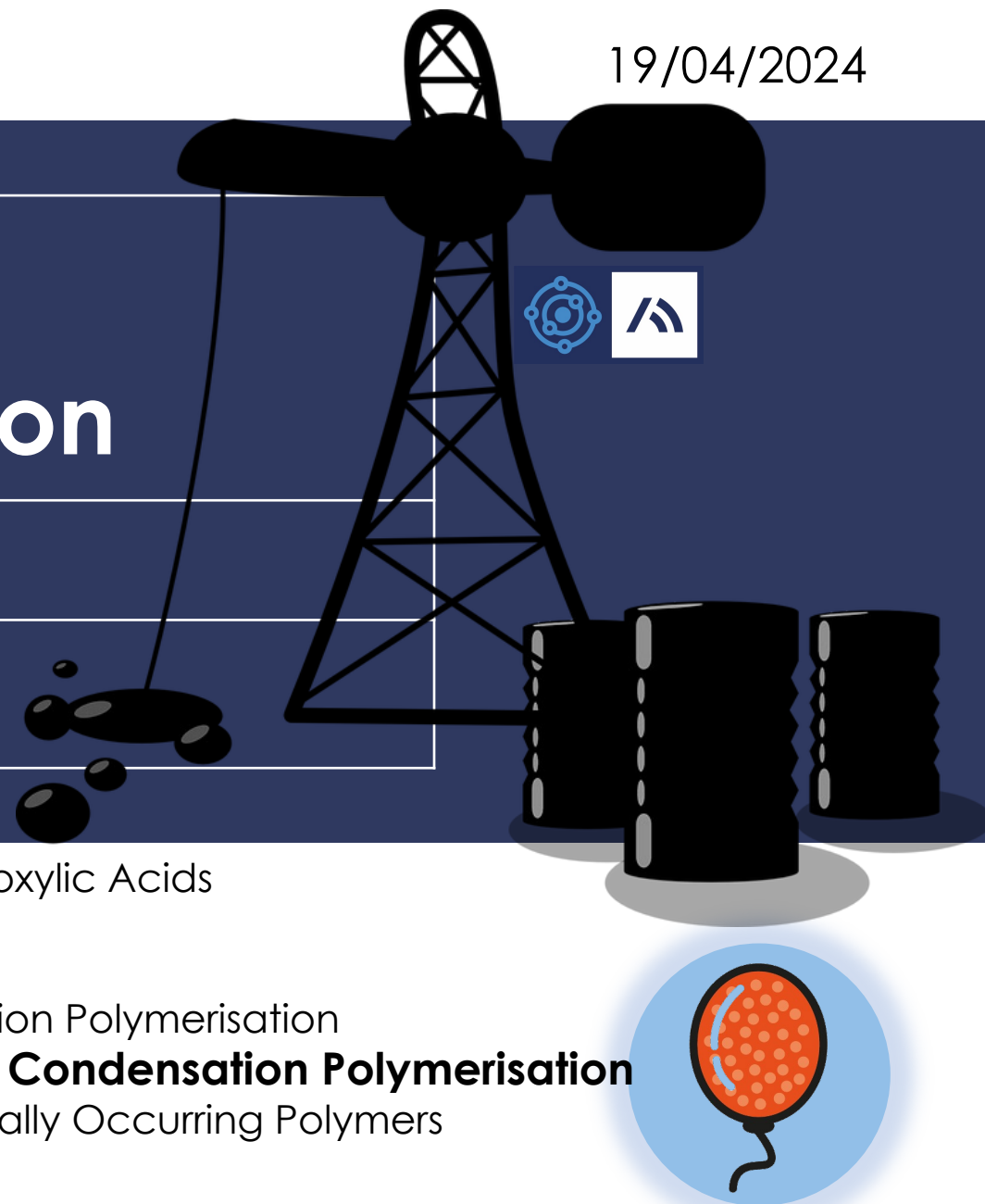
# (HT) Taking it Further: Condensation Polymerisation

C5.1.14

Science  
**Mastery**

C5.1.1 Prior Knowledge Review  
C5.1.2 Crude Oil and Hydrocarbons  
C5.1.3 Fractional Distillation  
C5.1.4 Combustion of Hydrocarbons  
C5.1.5 Cracking  
C5.1.6 Taking it Further: Alkenes  
C5.1.7 Taking it Further: Alcohols  
C5.1.8 Taking it Further: Producing Ethanol by Fermentation  
C5.1.9 Taking it Further: Producing Ethanol from Ethene

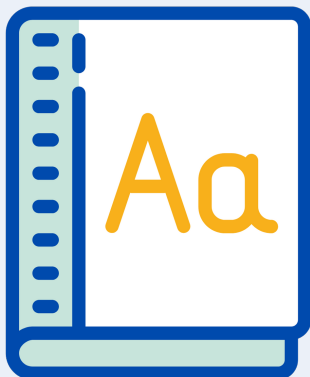
C5.1.10 Taking it Further: Carboxylic Acids  
C5.1.11 Taking it Further: Esters  
C5.1.12 Polymers  
C5.1.13 Taking it Further: Addition Polymerisation  
➤ **C5.1.14 Taking it Further: Condensation Polymerisation**  
C5.1.15 Taking it Further: Naturally Occurring Polymers



## Following this lesson, students will be able to:

- Identify the by-products of condensation polymerisation reactions
- Compare the processes of addition polymerisation and condensation polymerisation

### Key Words:



**polymer**

**monomer**

**polyester**

**condensation**

**polymerisation**

# This is the fix-it portion of the lesson

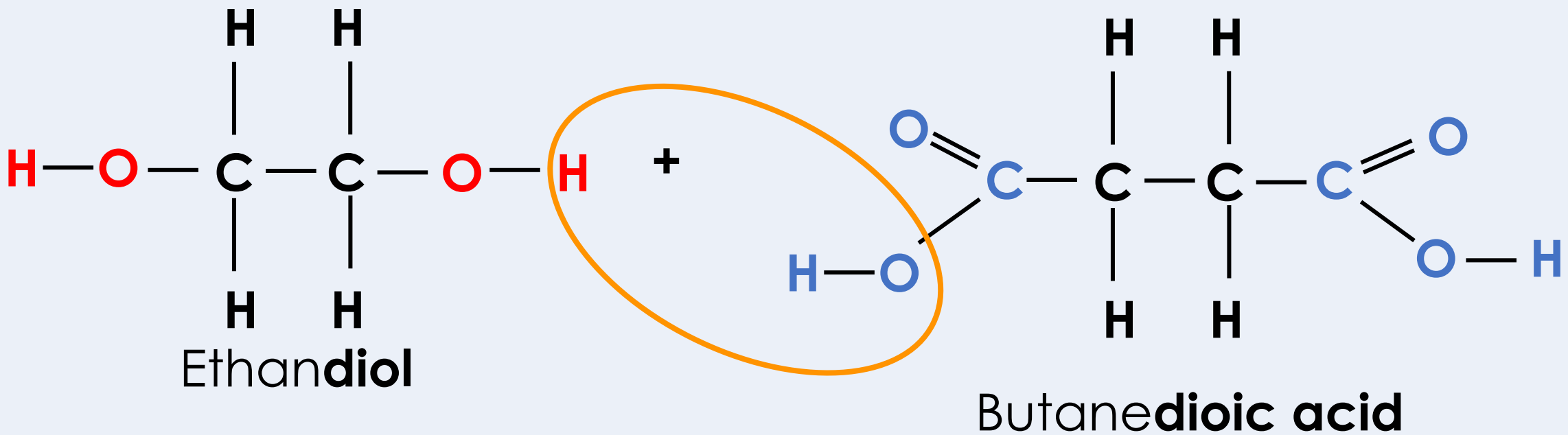
The **fix-it** is an opportunity to respond to gaps in knowledge, especially those identified by the **pre-unit quiz**.

- The teacher should customise this slide as needed, to facilitate
  - **reteach, explanation, demonstration** or **modelling** of ideas and concepts that students have not yet grasped or have misunderstood.
  - **practise** answering specific questions or of key skills.
  - **redrafting** or **improving** previous work.

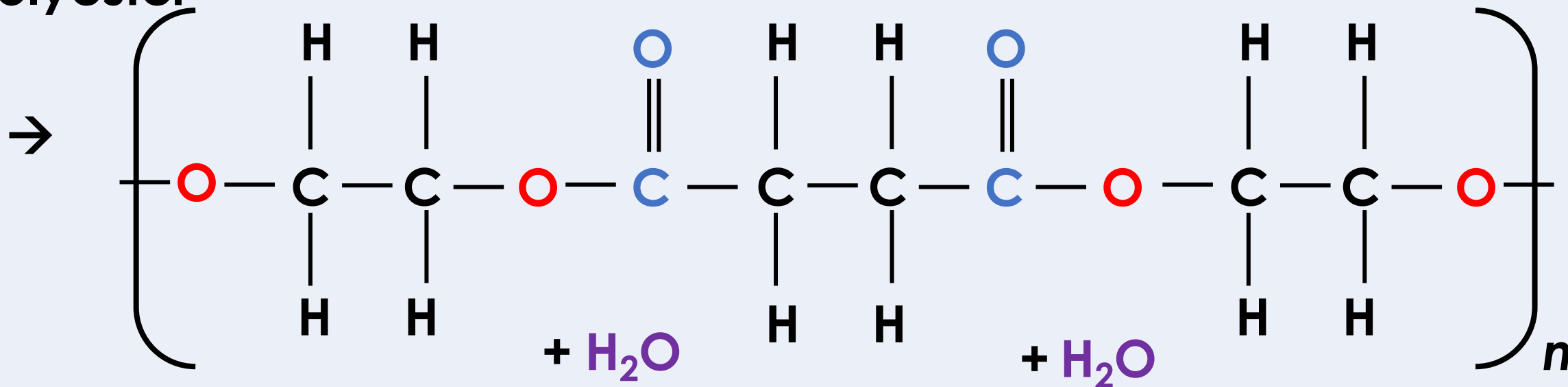
## Answer the questions below.

1. What is the name of the polymer formed through the addition polymerisation of propene?
  - ☐ A. Poly(ethene)
  - ☒ B. Poly(propene)
  - ☐ C. Poly(propane)
2. What happens to the atoms of monomers in addition polymerisation?
  - ☐ A. Some atoms are lost
  - ☐ B. Extra atoms are produced
  - ☒ C. Atoms are not lost or produced
3. What is made during an addition polymerisation reaction?
  - ☐ A. A polymer and another product
  - ☐ B. A polymer and different monomers
  - ☒ C. A polymer only

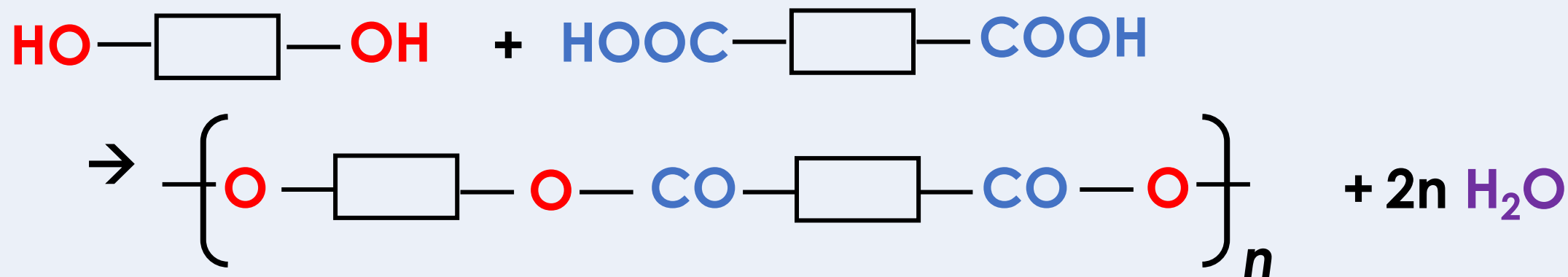
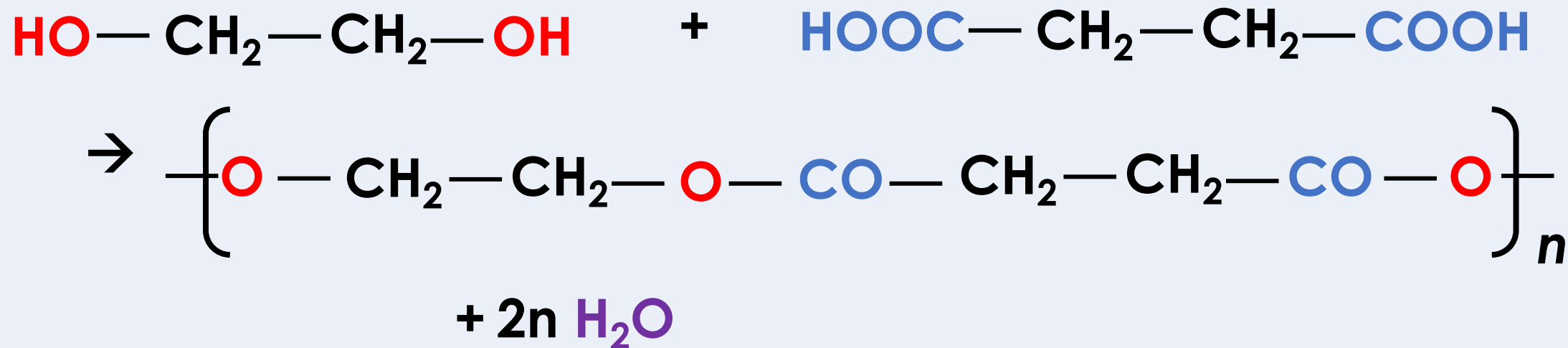
# Condensation Polymerisation



Polyester



# Condensation Polymerisation





# Condensation Polymerisation: Summary

Condensation polymerisation involves **monomers** with **two functional groups**.

When these types of monomers react, they join together, usually losing small molecules such as water, and so the reactions are called **condensation** reactions.

The simplest polymers are produced from two different monomers with **two of the same functional groups** on each monomer.

Can you explain the difference between these two process?

Addition  
polymerisation

*What do the  
monomers or  
reactants need to  
have in each?*

Condensation  
polymerisation

*What are the  
products of each?*

*Do they have  
anything in  
common?*

## Which statements do you agree with?

Addition polymerisation is a physical process while condensation polymerisation is a chemical reaction

Alkenes can be monomers for addition polymerisation

Condensation polymerisation produces a polymer and a small molecule

Monomers for condensation polymerisation must contain one functional group

# Drill

1. Define a polymer.
2. Define a monomer.
3. State what the monomers need for condensation polymerisation to occur.
4. State the products of a condensation polymerisation reaction.
5. Name the functional group found in alcohols.
6. Name the functional group found in carboxylic acids.

## Drill answers

1. Long chain molecules made of many units
2. Small molecules that can be joined together to make a polymer.
3. Each monomer requires two functional groups.
4. A polymer and a small molecule (usually water) are formed.
5. Hydroxyl group
6. Carboxyl group

# I: Types of polymerisation

The formulae below show two monomers.

Explain what type of polymerisation would happen when many of the two monomers reacted.



Both monomers contain two functional groups.

This means they would react in a condensation polymerisation reaction.

This would produce a polymer and water.

## We: Types of polymerisation

The formulae below show two monomers.

Explain what type of polymerisation would happen when many of the two monomers reacted.



Both monomers contain a double bond.

This means they would react in an addition polymerisation reaction.

This would produce a polymer only.

## You: Types of polymerisation

The formulae below show two monomers.

Explain what type of polymerisation would happen when many of the two monomers reacted.



Both monomers contain two functional groups.

This means they would react in a condensation polymerisation reaction.

This would produce a polymer and water.



## Answer the questions below.

1. What is required for monomers to react in condensation polymerisation?
  - ☐ A. The monomers must contain a C=C double bond
  - ☐ B. The monomers must contain water
  - ☒ C. The monomers must contain two functional groups
2. What small molecule is usually produced through condensation polymerisation?
  - ☐ A. A polymer
  - ☒ B. Water
  - ☐ C. Carbon dioxide
3. Which of these is made through condensation polymerisation?
  - ☒ A. Polyester
  - ☐ B. Poly(ethene)
  - ☐ C. Amino acids

## Lesson C5.1.14

What was good about this lesson?

What can we do to improve this lesson?

[Send us your feedback by clicking this link](#)  
or by emailing [sciencemastery@arkonline.org](mailto:sciencemastery@arkonline.org)  
Thank you!