

## Taking it Further: Naturally Occurring Polymers

**Answer the questions below.**

1. Name the functional group found in carboxylic acids.

**Carboxyl group**

2. State what monomers require to be able to undergo condensation polymerisation.

**Two functional groups**

3. Name the small molecule that is usually produced through condensation polymerisation.

**Water**

4. Name the organelle that contains DNA in eukaryotic cells.

**Nucleus**

5. Describe the structure of DNA.

**Repeating nucleotides made of a base (A,C,T,G), a phosphate and a sugar. Two strands of DNA are wrapped in a double helix.**



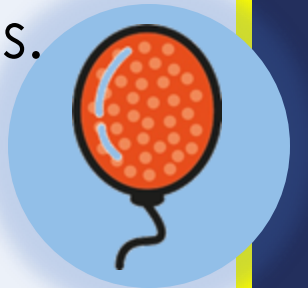
## Taking it Further: Naturally Occurring Polymers

### **Do Now:**

1. Name the functional group found in carboxylic acids.
2. State what monomers require to be able to undergo condensation polymerisation.
3. Name the small molecule that is usually produced through condensation polymerisation.
4. Name the organelle that contains DNA in eukaryotic cells.
5. Describe the structure of DNA.

### **Drill:**

1. Name the organelles that are found in both plant and animal cells.
2. Explain the difference between eukaryotic and prokaryotic cells.
3. Give an example of a prokaryotic cell.



## Taking it Further: Naturally Occurring Polymers

### Read Now:

DNA (deoxyribonucleic acid) is one of the most important naturally occurring polymers in the world as it contains the instructions needed for all living organisms (and viruses) to grow, survive and reproduce. DNA consists of a double helix structure, with two strands of DNA. Each strand contains repeating nucleotide units, each of which contains a base, a sugar and a phosphate group. There are four different bases found in DNA and they are complementary pairs. Cytosine always binds to guanine and adenine always binds to thymine. These repeating nucleotide units are the monomers that make up the polymer DNA.

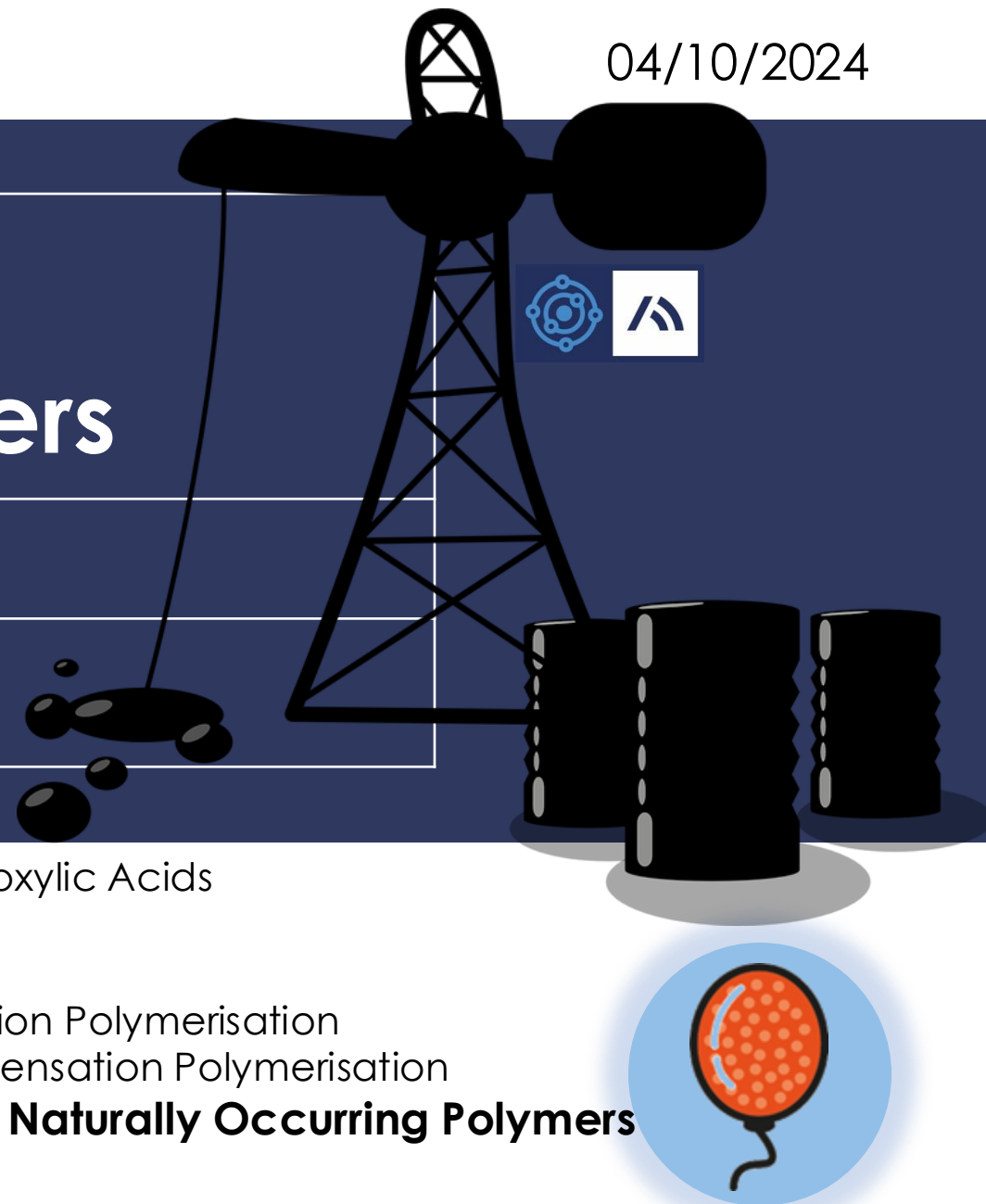
1. Explain why DNA is important.
2. Describe the structure of DNA
3. Identify the complementary base pairs in DNA.
4. Identify the monomers that make up the polymer DNA.



# Taking it Further: Naturally Occurring Polymers

C5.1.15

Science  
**Mastery**



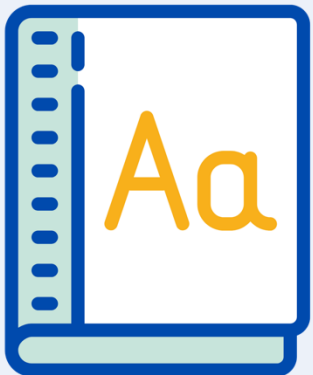
C5.1.1 Prior Knowledge Review  
C5.1.2 Crude Oil and Hydrocarbons  
C5.1.3 Fractional Distillation  
C5.1.4 Combustion of Hydrocarbons  
C5.1.5 Cracking  
C5.1.6 Taking it Further: Alkenes  
C5.1.7 Taking it Further: Alcohols  
C5.1.8 Taking it Further: Producing Ethanol by Fermentation  
C5.1.9 Taking 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 different naturally occurring polymers and their monomers
- Describe the structure of DNA
- (HT) Describe how polypeptides are produced from amino acids

## Key Words:



**DNA**

**nucleotide**

**double helix**

**polypeptide**

**cellulose**

# 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 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

# Naturally Occurring Polymers

Some polymers can be man-made, but many are naturally occurring.

One of the most important naturally occurring polymers is **DNA**.

DNA contains the **genetic instructions** for development and functioning of living organisms and viruses.

Most DNA molecules are **two polymer chains** held together in a **double helix**.

DNA is a **polymer** made from **nucleotide monomers**.

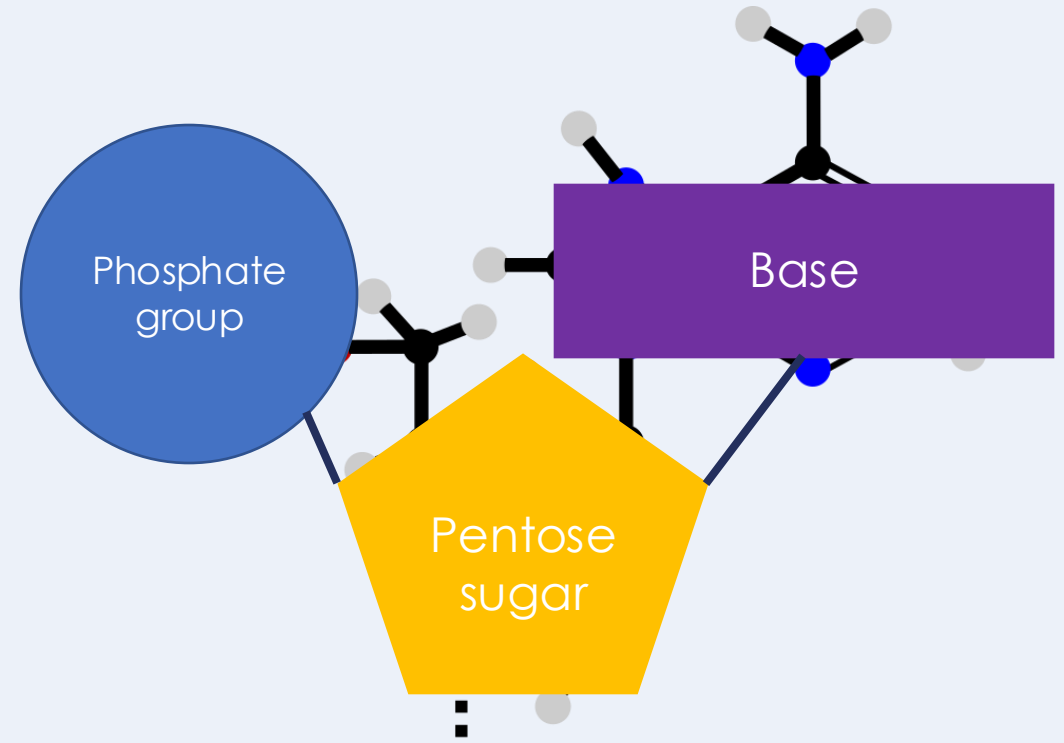
Other naturally occurring polymers and their monomers are:

Polymer	Monomer
Starch	Glucose
Cellulose	(Beta) Glucose
Protein	Amino acids



# The structure of DNA

- DNA is a polymer made up from repeating units called **nucleotides**
- Nucleotides are made up of three parts – **phosphate** group, **sugar** and a **base**
- The phosphate and sugar make the **backbone** of the DNA
- There are 4 different types of base (**A**, **T**, **C** and **G**)
- **Hydrogen bonds** between the bases hold the two **strands** together.

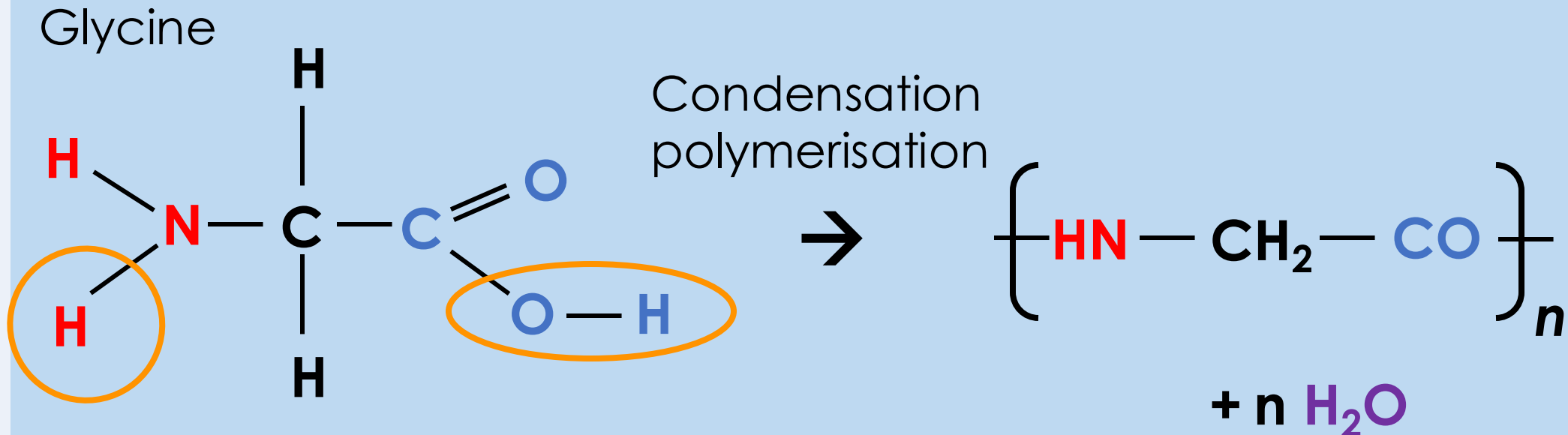


# Amino acids and polypeptides

*Higher Tier only*

Amino acids contain **two different functional groups** in a molecule.

This means they can react to form **polypeptides** through **condensation polymerisation**.



## Which statements do you agree with?

Amino acids have two different functional groups in the molecule

Amino acids have the same functional group on either side of the molecule

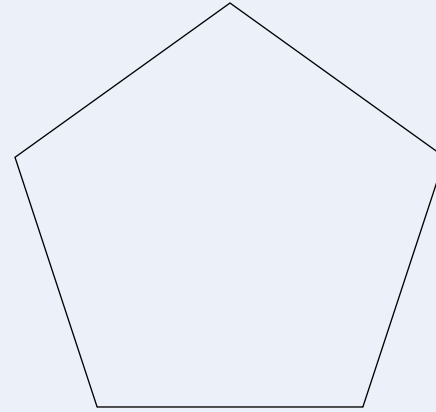
Polypeptides can be formed from amino acids through addition polymerisation

Polypeptides can be formed from amino acids through condensation polymerisation

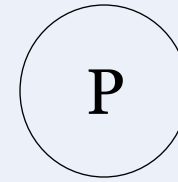
With your partner, draw and describe the structure of DNA.

- Describe the overall structure of DNA
- Draw and label the structure of one nucleotide
- Consider how these nucleotides join together to form a single polymer strand

**Stretch:** The two DNA strands are **antiparallel**. Suggest what this means.



Sugar



Phosphate



Base

## Answer the following questions:

1. Identify the three parts of a nucleotide:
  - A. Glucose, phosphate and adenine
  - B. Sugar, phosphorus and base
  - C. Sugar, phosphate and base ✓
2. Select the correct complementary base pairs:
  - A. A with T and C with G ✓
  - B. A with G and T with C
  - C. A with C and T with G
3. The percentage of the base thymine (T) in a human's DNA was found to be 28%. Calculate the percentage of human DNA that is adenine (A).
  - A. 14%
  - B. 28% ✓
  - C. 22%

# Drill

1. Describe the function of DNA.
2. Describe the structure of DNA.
3. Describe what makes up a nucleotide.
4. State the complementary base pairs.
5. Give two other naturally occurring polymers.
6. (HT) State whether the functional groups found in amino acid molecules are the same or different.
7. (HT) Name the type of reaction that produces a polypeptide from amino acids.
8. (HT) Name the other product of this reaction.

## Drill answers

1. It contains the genetic instructions for development and functioning of living organisms and viruses.
2. Two polymer chains made up of nucleotides held in a double helix.
3. A base, a phosphate and a sugar
4. A and T, C and G
5. Starch, cellulose, proteins
6. The functional groups are different
7. Condensation polymerisation
8. Water

# I: Explain: *to use scientific understanding to make something clear or state the reason for something happening*

Example question:

**Explain** why DNA is described as a polymer.

Model answer:

- DNA consists of two strands held in a double helix
- Each strand contains repeating nucleotide units
- This means that DNA is a polymer because it consists of **repeating subunits**/monomers

To 'explain' your answer should:

- Begin with a **scientific statement**.
- Use 'this means that', 'because' or 'so' **to link your statement to the question**.



# **We: Explain: to use scientific understanding to make something clear or state the reason for something happening**

Example question:

**Explain** why polypeptides are described as polymers.

Model answer:

- Polypeptides consists of amino acids in a chain
- This means that polypeptides are polymers because they consist of **repeating subunits**/monomers

To 'explain' your answer should:

- Begin with a **scientific statement**.
- Use 'this means that', 'because' or 'so' **to link your statement to the question**.



# You: Explain: to use scientific understanding to make something clear or state the reason for something happening

Example question:

**Explain** why starch is described as a polymer.

Model answer:

- Starch consists of glucose molecules in a chain
- This means that starch is a polymers because is consists of **repeating subunits**/monomers

To 'explain' your answer should:

- Begin with a **scientific statement**.
- Use 'this means that', 'because' or 'so' **to link your statement to the question**.



## Answer the questions below.

1. What are the monomers that make up DNA?

- ☒ A. Nucleotides
- ☐ B. Amino acids
- ☐ C. Base pairs

2. Which of these is a naturally occurring polymer?

- ☐ A. Poly(ethene)
- ☒ B. Cellulose
- ☐ C. Glucose

3. How can polypeptides be produced from amino acids?

- ☒ A. Amino acids contain two different functional groups so can undergo condensation polymerisation
- ☐ B. Amino acids contain two different functional groups so can undergo addition polymerisation
- ☐ C. Amino acids contain two of the same functional group so can undergo condensation polymerisation

## Lesson C5.1.15

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!