

## Sixth form induction session

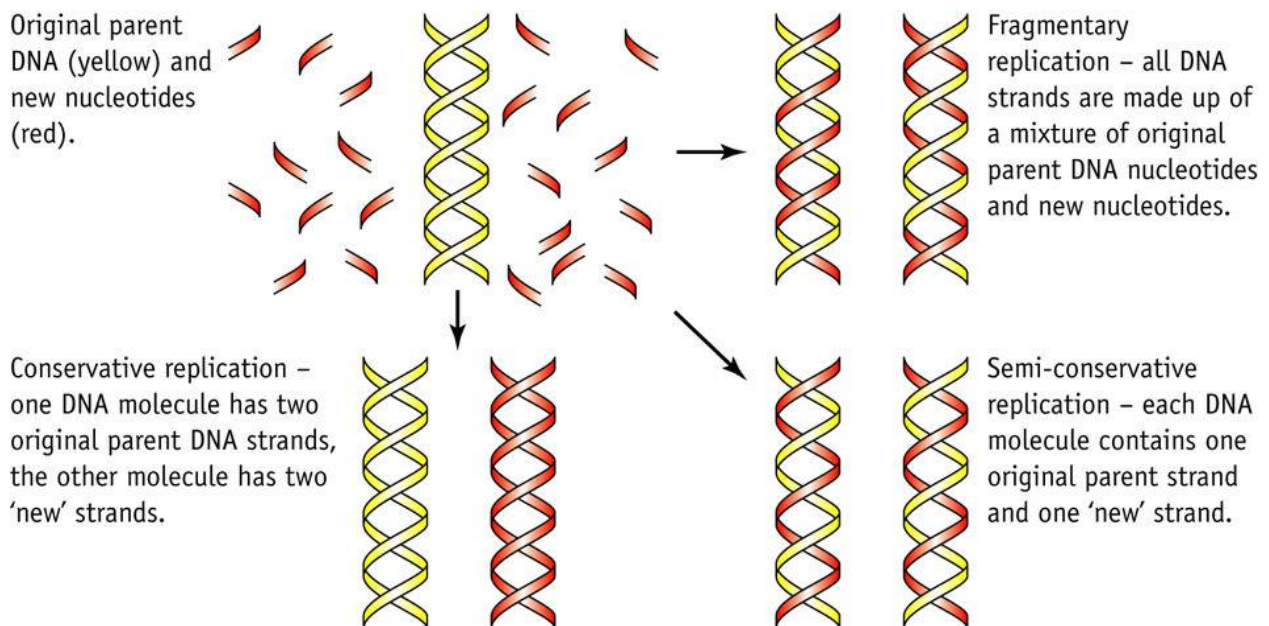
In this booklet make sure you have completed all tasks over Summer including the drawing molecules task.

Please make sure you revise the list of topics at the end of this booklet.

DNA replication - What you need to know.

The specification says:

Describe DNA replication (including the role of DNA polymerase), and explain how Meselson and Stahl's classic experiment provided new data that supported the accepted theory of replication of DNA and refuted other theories.



There are three models we now know that the semi conservative model is correct. **But why?**

**In the conservative model** = two whole new strands of DNA are produced

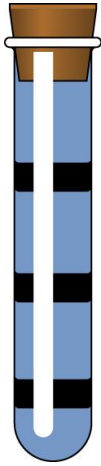
**In the semi conservative model** = one parent strand and one new strand

**Fragmentary model** = DNA is made up of a mixture of parent DNA and new DNA nucleotides.

YOU DO NOT NEED TO KNOW THE OTHER TWO REPLICATION THEORIES IN DETAIL JUST WHY THEY EXIST AND WHAT EVIDENCE FROM MESELSON AND STAHL PROVED THEIR THEORY CORRECT.

Meselson and Stahl used heavy and light nitrogen atoms to prove their theory correct. Bacteria will take in nitrogen from their environment and incorporate it into their DNA.

This principle meant that they could see which theory was correct as once centrifuged (or sorting out the strands into 'heaviness') they could see which nitrogen atoms had been incorporated into the DNA during replication.



When the scientists centrifuged they found a single band of medium DNA after one replication. This must mean that there was one original strand plus one heavy strand  $N^{14} + N^{15}$ . This means that the conservative model can be ruled out as this would mean there would be two heavy strands

When they centrifuged for a second time they found a light and a medium band. This means that as the DNA strand split into heavy and normal there would be two strands that were  $N^{14} + N^{14}$  and two strands that were  $N^{14} + N^{15}$ .

This refuted the fragmentary model as all of the DNA would have been of medium density even on the second replication.

4. (a) Name a component of DNA that contains nitrogen.

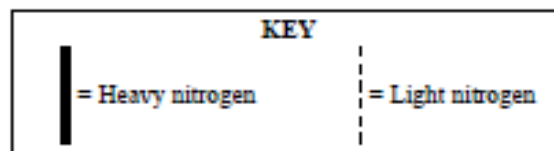
(1)

- (b) When bacteria are grown in conditions containing a heavy form of nitrogen, they will incorporate the heavy nitrogen into their DNA each time DNA replication occurs. After many replications in these conditions, all the nitrogen in the bacterial DNA will be of the heavy form.

If the bacteria are then switched to conditions containing a light form of nitrogen, this will become incorporated each time DNA replication occurs.

The diagram below shows the changes in the DNA composition, over two DNA replications, after the bacteria have been transferred from conditions containing heavy nitrogen to conditions containing light nitrogen.

Complete the diagram to show the DNA composition in the third generation.



DNA before replication in light nitrogen conditions



DNA after the first replication in light nitrogen conditions



DNA after the second replication in light nitrogen conditions



DNA after the third replication in light nitrogen conditions

(2)

**Complete for as Summer work**  
**DNA Questions**

**Q1.**

One function of DNA is to act as a template for the synthesis of messenger RNA.

Place a cross  in the box to complete each of the following statements.

(i) DNA and mRNA both

(1)

- A** contain ribose
- B** contain thymine
- C** have a double helix structure
- D** have a sugar-phosphate chain

(ii) One advantage of DNA having two complementary strands is that

(1)

- A** diploid cells can inherit DNA from both parents
- B** hydrolysis of DNA is faster
- C** semi-conservative replication is possible
- D** transcription and replication can occur at the same time

(iii) Analysis of a sample of DNA found that 40% of the nucleotides contained cytosine. In the same sample of DNA the percentage of nucleotides containing adenine would be

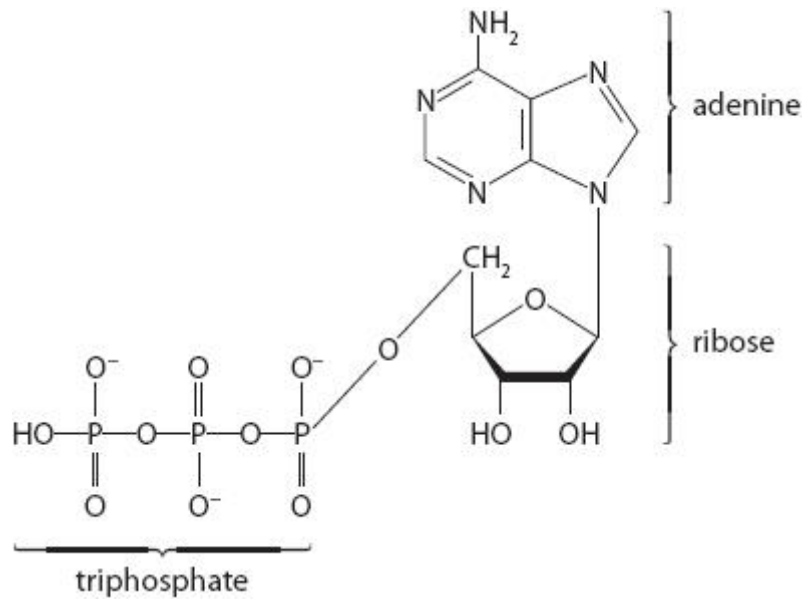
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- A** 10%
- B** 20%
- C** 40%
- D** 60%

**Q2.**

DNA is a polymer made from monomers called nucleotides.

The diagram shows the structure of ATP.



Compare and contrast the structure of ATP and a DNA nucleotide.

(3)

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**(Total for question = 3 marks)**

## **Year 12 Summer work**

### **Task 1 - molecules**

Draw out the following biological molecules and remember them for your induction test in September.

- Alpha glucose
- An amino acid
- A glycerol molecule and a fatty acid chain
- A DNA nucleotide labelled with phosphate, base and 5 carbon sugar.

### **Task 2 - bonding**

- What bond holds 2 alpha glucose molecules together?
- What bond holds a glycerol and 3 fatty acids together?
- What bond holds 2 amino acids together in a dipeptide?
- Name the two bonds in DNA. Where are they found and what do they hold together?

### **Task 3 – water**

- Draw out a molecule of water
- What bonds are formed between different water molecules
- What atoms do these bonds form between?
- Because of the bonding of water name 3 properties of water that make it important for life processes.

## **Topics you need to revise and recap over Summer for the induction assessment:**

**GCSE - Genes, inheritance and genetic disorders including genetic cross diagrams (paper 2)**

**GCSE - Cardiovascular disease (paper 1)**

**GCSE - General Biology maths skills (paper 1 and 2)**

**Induction – DNA and RNA structure**

**Induction – DNA replication**

**Summer work - Biological molecules**

**Bridging the gap (completed in September) – T test**