

Exercise walk-through

DNA Replication ■ 6.2

eXercise

You must be able to

- describe **semiconservative** 半保留 replication
- state the roles of **helicase** 解旋酶 and **DNA polymerase** 聚合酶
- explain why each new molecule has one old and one new strand

Method — Semiconservative replication

DNA replication is **semiconservative**: the two strands separate, and each acts as a template for a new strand. Each new DNA molecule has **one old** and **one new** strand.

Method — Key enzymes

- **Helicase** unwinds and separates the two strands.
- **DNA polymerase** adds complementary nucleotides to each template strand, building the new strand.

Method — The steps

- 1 Helicase unzips the helix.
2. Each strand is a template.
3. DNA polymerase adds matching bases (A–T, C–G).
4. Two identical double helices result.

Method — A worked idea

If one template strand reads 3'-TACG-5', DNA polymerase builds 5'-ATGC-3' alongside it — an exact complement.

Practice 2.1 ■ 1 mark

What does “semiconservative” mean for DNA replication?

Solution 2.1

Method: Semiconservative replication

Worked steps

Each new molecule keeps one original strand and gains one new strand **B1**.

Practice 2.2 ■ 1 mark

What does helicase do?

Solution 2.2

Worked steps

Unwinds and separates the two DNA strands **B1**.

Practice 2.3 ■ 1 mark

What does DNA polymerase do?

Solution 2.3

Worked steps

Adds complementary nucleotides to build the new strand **B1**.

Exam-style 3.1 ■ 1 mark

After replication, each new DNA molecule contains

- A** two new strands
- B** two old strands
- C** one old and one new strand
- D** only RNA

Solution 3.1

Method: Semiconservative replication

- A two new strands
- B two old strands
- C one old and one new strand
- D only RNA



Worked steps

C — one old and one new strand.

Exam-style 3.2 ■ 2 marks

A cell replicates its DNA.

- (a) Describe the roles of helicase and DNA polymerase.
- (b) A template strand reads 3'-AATGCC-5'. Write the new strand.

Solution 3.2

Worked steps

(a) Helicase unwinds/separates the strands; DNA polymerase adds complementary bases to each template **M1** **A1**. (b) 5'-TTACGG-3' **M1** **A1**.

Exam-style 3.3 ■ 2 marks

Explain why semiconservative replication ensures the two daughter molecules are identical to the original.

Solution 3.3

Method: Semiconservative replication

Worked steps

Each original strand acts as a template, and complementary base pairing forces the new strand to match exactly, so both daughter molecules are copies of the original

M1 A1.