

DNA Replication Practice Worksheet Questions and Answers PDF

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Part 1: Building a Foundation

Which enzyme is responsible for unwinding the DNA double helix during replication?

Hint: Think about the enzyme that opens up the DNA strands.

- A) DNA Polymerase
- B) Helicase ✓
- C) Ligase
- D) Primase

Helicase is the enzyme that unwinds the DNA double helix.

Which of the following statements about DNA replication are true? (Select all that apply)

Hint: Consider the characteristics of DNA replication.

- A) DNA replication is semi-conservative. ✓
- B) DNA polymerase synthesizes DNA in the 3' to 5' direction.
- C) Okazaki fragments are formed on the leading strand.
- D) Primase synthesizes RNA primers. ✓

DNA replication is semi-conservative and involves RNA primers synthesized by primase.

Describe the role of DNA ligase in DNA replication.

Hint: Think about how DNA fragments are joined together.

DNA ligase joins Okazaki fragments and seals nicks in the DNA backbone.

List the three main stages of DNA replication and briefly describe each.

Hint: Consider the overall process of DNA replication.

1. What is the first stage?

Initiation

2. What is the second stage?

Elongation

3. What is the third stage?

Termination

The three stages are initiation, elongation, and termination.

Part 2: Comprehension and Interpretation

During DNA replication, what is the function of single-strand binding proteins (SSBs)?

Hint: Think about the role of SSBs in maintaining DNA structure.

- A) They synthesize RNA primers.
- B) They prevent the re-annealing of DNA strands. ✓
- C) They join Okazaki fragments.
- D) They unwind the DNA helix.

SSBs prevent the re-annealing of DNA strands during replication.

Which enzymes have proofreading capabilities during DNA replication? (Select all that apply)

Hint: Consider which enzymes are involved in correcting errors.

- A) Helicase
- B) DNA Polymerase ✓
- C) Ligase
- D) Primase

DNA polymerase has proofreading capabilities, while helicase, ligase, and primase do not.

Explain why DNA replication is considered semi-conservative.

Hint: Think about how the new DNA strands are formed.

DNA replication is semi-conservative because each new DNA molecule consists of one old strand and one new strand.

Part 3: Application and Analysis

If a mutation occurs in the gene encoding helicase, what is the most likely effect on DNA replication?

Hint: Consider the role of helicase in the replication process.

- A) RNA primers will not be synthesized.
- B) The DNA strands will not separate. ✓
- C) Okazaki fragments will not be joined.
- D) DNA will be synthesized in the wrong direction.

■ The most likely effect would be that the DNA strands will not separate.

In a laboratory setting, you are observing DNA replication. Which observations would indicate an issue with the lagging strand synthesis? (Select all that apply)

Hint: Think about the characteristics of lagging strand synthesis.

- A) Continuous synthesis without fragments.
- B) Accumulation of unjoined Okazaki fragments. ✓
- C) Lack of RNA primers. ✓
- D) Presence of single-strand binding proteins.

■ Issues with lagging strand synthesis may include accumulation of unjoined Okazaki fragments and lack of RNA primers.

Predict the consequences of a malfunction in DNA ligase during replication.

Hint: Consider the role of ligase in joining DNA fragments.

■ A malfunction in DNA ligase would lead to unjoined Okazaki fragments and incomplete DNA strands.

Which of the following best describes the relationship between DNA polymerase and RNA primers?

Hint: Think about how DNA synthesis is initiated.

- A) DNA polymerase degrades RNA primers.
- B) DNA polymerase requires RNA primers to initiate synthesis. ✓
- C) DNA polymerase synthesizes RNA primers.
- D) DNA polymerase is inhibited by RNA primers.

DNA polymerase requires RNA primers to initiate synthesis.

Part 4: Evaluation and Creation

Evaluate the following statement: "DNA replication can occur without the presence of primase." Is this statement true or false, and why?

Hint: Consider the role of primase in the replication process.

- A) True, because DNA polymerase can initiate synthesis independently.
- B) **False, because primase is essential for synthesizing RNA primers. ✓**
- C) True, because ligase can substitute for primase.
- D) False, because helicase performs the function of primase.

The statement is false because primase is essential for synthesizing RNA primers.

Consider a scenario where a new drug inhibits DNA polymerase. What potential effects might this have on a rapidly dividing cancer cell? (Select all that apply)

Hint: Think about the role of DNA polymerase in cell division.

- A) **Inhibition of DNA replication. ✓**
- B) **Increased mutation rate. ✓**
- C) **Cell cycle arrest. ✓**
- D) Enhanced DNA repair mechanisms.

Inhibition of DNA polymerase would lead to inhibition of DNA replication and potential cell cycle arrest.

Propose a hypothetical experiment to test the effect of a new chemical compound on the efficiency of DNA ligase during replication.

Hint: Consider how you would design an experiment to measure ligase activity.

An experiment could involve comparing ligase activity in the presence and absence of the compound using a DNA substrate.