DNA Structure And Replication Worksheet Questions and Answers PDF

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Part 1: Building a Foundation

What is the shape of the DNA molecule?

Hint: Think about the common model of DNA.

- ◯ A) Triple Helix
- ◯ **B) Double Helix ✓**
- ◯ C) Single Strand
- ◯ D) Quadruple Helix

> The DNA molecule is commonly described as a double helix.

Which of the following are components of a nucleotide? (Select all that apply)

Hint: Consider the basic building blocks of DNA.

- ☐ **A) Sugar ✓**
- ☐ **B) Phosphate Group ✓**
- ☐ C) Lipid
- ☐ **D) Nitrogenous Base ✓**

> A nucleotide consists of a sugar, a phosphate group, and a nitrogenous base.

Describe the base pair rule in DNA.

Hint: Think about how bases pair with each other.

The base pair rule states that adenine pairs with thymine and cytosine pairs with guanine.

List the four nitrogenous bases found in DNA.

Hint: Consider the letters that represent the bases.

1. 1st Base

Adenine

2. 2nd Base

Thymine

3. 3rd Base

Cytosine

4. 4th Base

Guanine

The four nitrogenous bases in DNA are adenine, thymine, cytosine, and guanine.

In which direction does DNA polymerase synthesize a new strand?

Hint: Consider the orientation of the DNA strands.

- ◯ A) 3' to 5'
- ◯ **B) 5' to 3' ✓**
- ◯ C) 2' to 4'
- ◯ D) 1' to 6'

> DNA polymerase synthesizes a new strand in the 5' to 3' direction.

Part 2: Understanding and Interpretation

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

Hint: Think about the enzymes involved in the initial steps of replication.

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

> Helicase is the enzyme responsible for unwinding the DNA double helix.

What are the roles of DNA polymerase in replication? (Select all that apply)

Hint: Consider the various functions of DNA polymerase during replication.

- ☐ **A) Adding nucleotides to the new strand ✓**
- ☐ B) Unwinding the DNA helix
- ☐ **C) Proofreading the new DNA strand ✓**
- ☐ D) Synthesizing RNA primers

> DNA polymerase adds nucleotides, proofreads the new strand, and synthesizes RNA primers.

Explain why DNA replication is described as semi-conservative.

Hint: Think about how the strands are used in replication.

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

Part 3: Application and Analysis

If a DNA strand has the sequence 5'-ATCG-3', what will be the sequence of the complementary strand?

Hint: Consider the base pairing rules.

- ◯ A) 5'-TAGC-3'
- ◯ **B) 3'-TAGC-5' ✓**
- ◯ C) 5'-CGAT-3'
- ◯ D) 3'-CGAT-5'

The complementary strand will have the sequence 3'-TAGC-5'.

During DNA replication, which of the following processes occur on the lagging strand? (Select all that apply)

Hint: Think about the characteristics of lagging strand synthesis.

- ☐ A) Continuous synthesis
- ☐ **B) Formation of Okazaki fragments ✓**
- ☐ **C) Use of RNA primers ✓**
- ☐ **D) Joining of fragments by ligase ✓**

On the lagging strand, Okazaki fragments are formed, and RNA primers are used.

Describe a real-world scenario where errors in DNA replication could lead to genetic disorders.

Hint: Consider diseases that are linked to genetic mutations.

Errors in DNA replication can lead to mutations that may cause genetic disorders such as cystic fibrosis or sick cell anemia.

Which statement best describes the relationship between the leading and lagging strands during DNA replication?

Hint: Think about how each strand is synthesized.

- ◯ A) Both are synthesized continuously.
- ◯ **B) The leading strand is synthesized continuously, while the lagging strand is synthesized in fragments.** ✓
- ◯ C) Both are synthesized in fragments.
- ◯ D) The leading strand is synthesized in fragments, while the lagging strand is synthesized continuously.

The leading strand is synthesized continuously, while the lagging strand is synthesized in fragments.

Analyze the role of enzymes in DNA replication. Which of the following statements are true? (Select all that apply)

Hint: Consider the functions of different enzymes involved in replication.

- ☐ **A) Helicase separates the DNA strands.** ✓
- ☐ **B) Ligase joins Okazaki fragments.** ✓
- ☐ C) Primase removes RNA primers.
- ☐ **D) DNA polymerase synthesizes new DNA strands.** ✓

Helicase separates the DNA strands, ligase joins Okazaki fragments, and DNA polymerase synthesizes new DNA strands.

Compare and contrast the roles of DNA polymerase and ligase in DNA replication.

Hint: Think about the specific functions of each enzyme.

DNA polymerase synthesizes new DNA strands and proofreads them, while ligase joins Okazaki fragments on the lagging strand.

Part 4: Evaluation and Creation

Which of the following scenarios would most likely result in a mutation during DNA replication?

Hint: Consider the potential errors that can occur during replication.

- ◯ A) Helicase unwinds the DNA too slowly.
- ◯ **B) DNA polymerase fails to proofread correctly. ✓**
- ◯ C) Primase synthesizes too many primers.
- ◯ D) Ligase joins fragments too quickly.

If DNA polymerase fails to proofread correctly, it is likely to result in a mutation.

Evaluate the potential consequences of a malfunction in DNA ligase during replication. (Select all that apply)

Hint: Think about the role of ligase in the overall process of replication.

- ☐ **A) Incomplete DNA strands ✓**
- ☐ **B) Increased mutation rate ✓**
- ☐ C) Continuous synthesis on the lagging strand
- ☐ **D) Fragmentized DNA ✓**

A malfunction in DNA ligase could lead to incomplete DNA strands, increased mutation rates, and fragmented DNA.

Propose a hypothetical experiment to test the efficiency of a new DNA polymerase variant in replicating DNA accurately.

Hint: Consider the methods you would use to measure efficiency.

An experiment could involve comparing the accuracy and speed of the new DNA polymerase variant against a standard polymerase using controlled conditions.