DNA Replication Worksheet

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Name: _____
Date: _____
Class: _____

Part A: Multiple Choice Questions

1. Which enzyme is responsible for unwinding the DNA double helix during replication?
   - a) DNA ligase
   - b) DNA gyrase
   - c) DNA helicase
   - d) DNA polymerase
2. Which strand is synthesized continuously during DNA replication?
   - a) Leading strand
   - b) Lagging strand
   - c) Both strands
   - d) Neither strand
3. Which fragments are synthesized on the lagging strand during DNA replication?
   - a) Helicase fragments
   - b) Ligase fragments
   - c) Okazaki fragments
   - d) Primase fragments
4. Which enzyme is responsible for joining the Okazaki fragments?
   - a) DNA helicase
   - b) DNA gyrase
   - c) DNA ligase
   - d) DNA polymerase
5. Which enzyme relieves the tension caused by the unwinding of the DNA double helix?
   - a) DNA helicase
   - b) DNA gyrase
   - c) DNA ligase
   - d) Primase

Part B: Short Answer Questions

1. Explain the significance of the leading and lagging strands in DNA replication.
2. Describe the role of primase in DNA replication.
3. Why is DNA replication considered to be semi-conservative?
4. How do DNA polymerases ensure the accuracy of DNA replication?
5. What is the function of topoisomerase in DNA replication?

Part C: True or False

1. DNA replication occurs during the S-phase of the cell cycle.
    a. True / False
2. DNA ligase is responsible for unwinding the DNA double helix.
    a. True / False
3. The lagging strand is synthesized in a continuous manner.
    a. True / False
4. Okazaki fragments are found on the leading strand.
    a. True / False
5. DNA replication starts at multiple origins in eukaryotic cells.
    a. True / False

Part D: Diagram Analysis

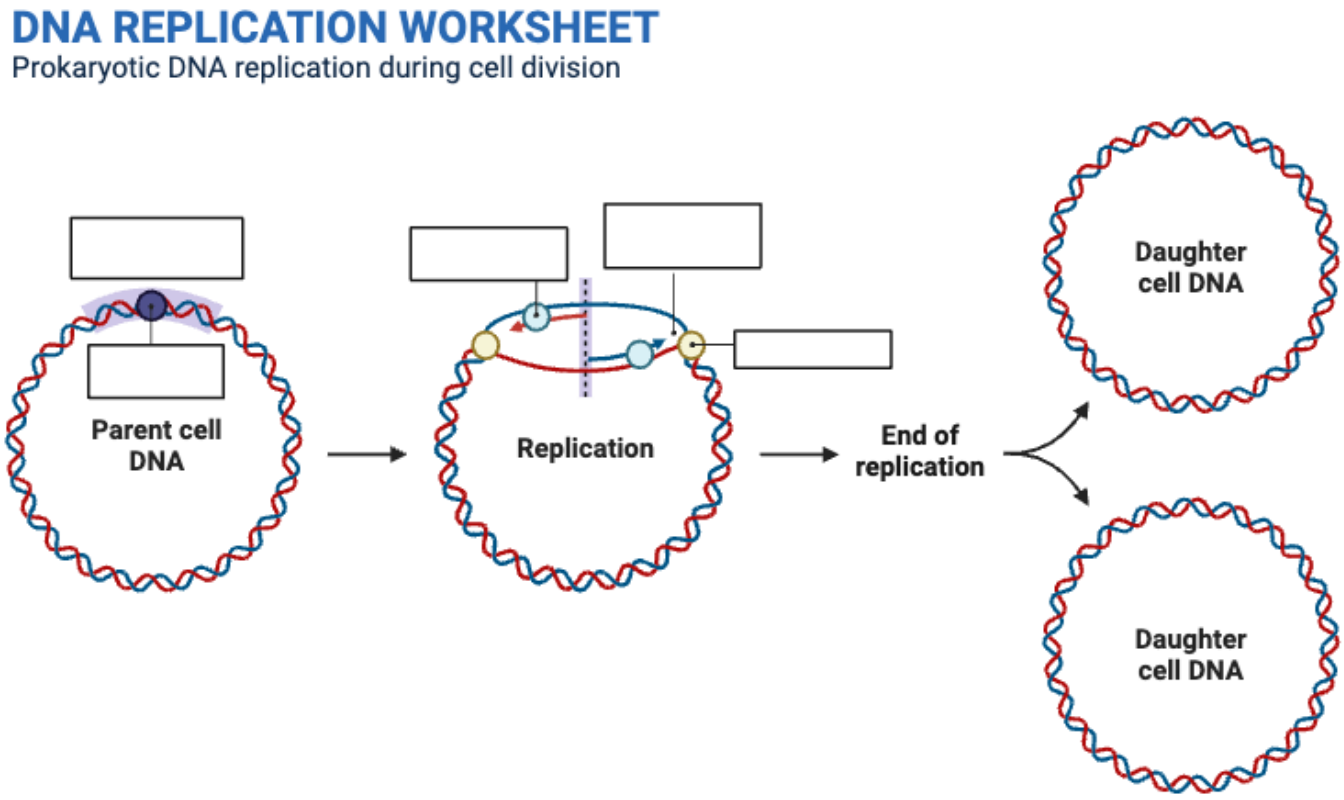


Figure 1

1. Examine the provided Figure 1 of a Prokaryotic DNA Replication. Label the following:
    a. Origin of Replication
    b. Polymerase
    c. Replication Fork
    d. DNA helicase
    e. Initiator

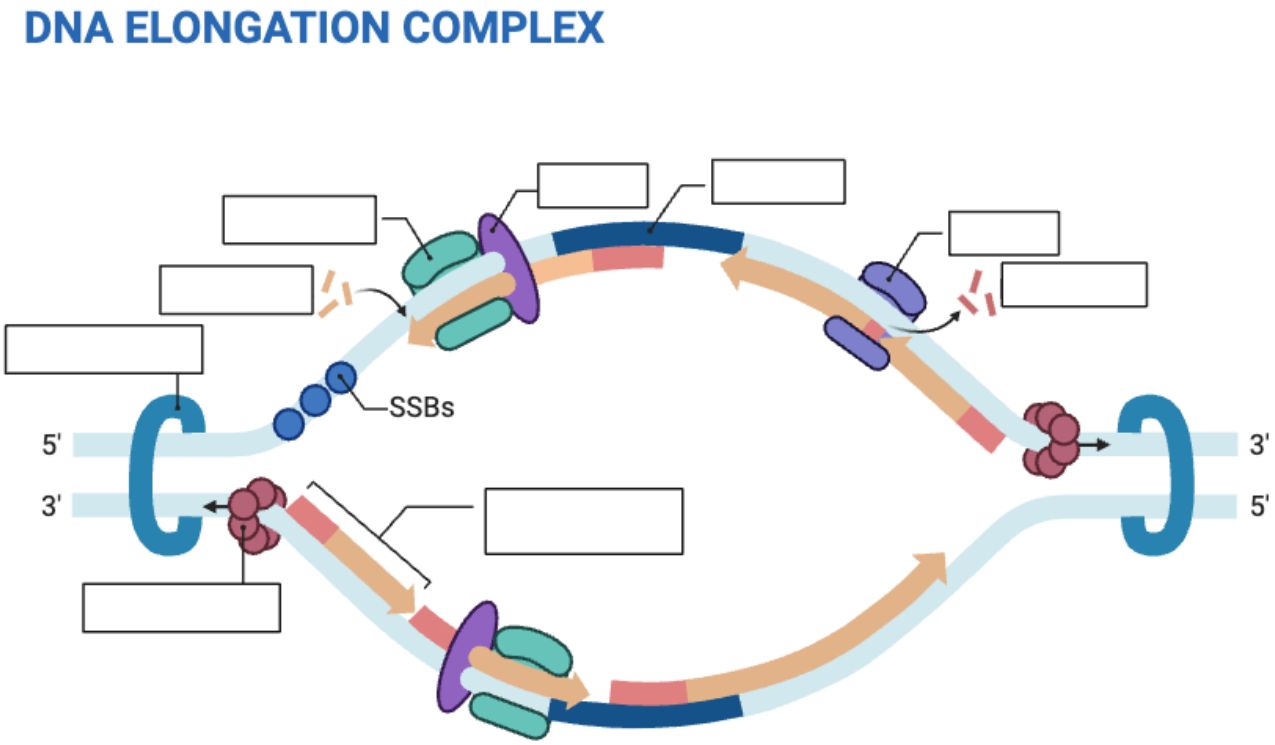


Figure 2

2. Examine the provided Figure 2 of a DNA Replisome (Eukaryotic Replication). Label the following:
    a. Topoisomerase
    b. Nucleotides
    c. Pol δ/ε/III
    d. PCNA
    e. Origin
    f. Pol 1
    g. Okazaki fragments
    h. Helicase

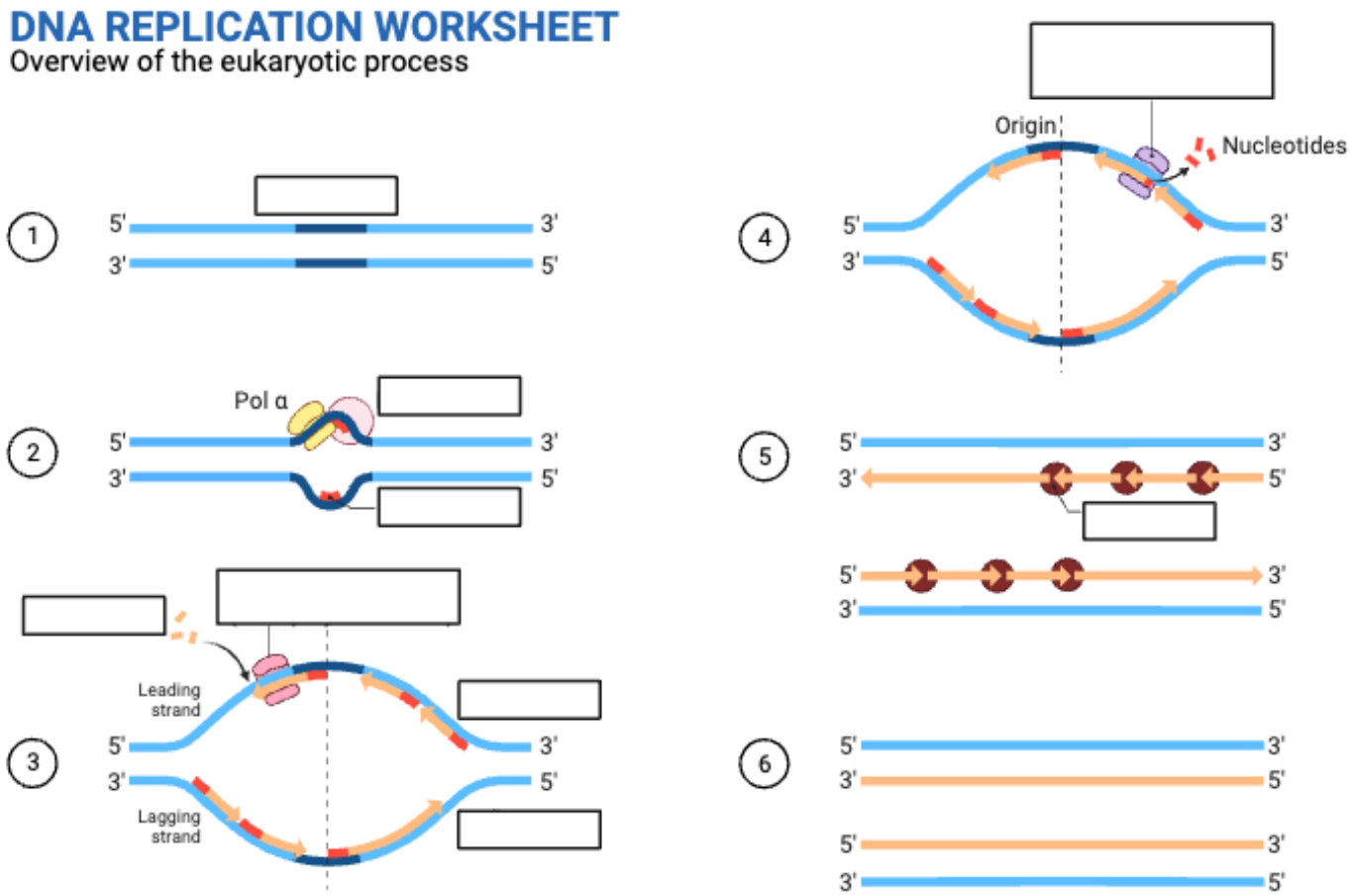


Figure 3

3. Examine the provided Figure 3 of a DNA Replisome (Eukaryotic Replication). Label the following:
    a. RNA primer
    b. Nucleotides
    c. Primase
    d. Pol δ/ε/III (DNA polymerization)
    e. Origin
    f. Lagging strand
    g. Leading strand
    h. **Pol 1** (Primer removal)
    i. Ligase

Part E: Essay Question

Discuss the importance of DNA replication in the context of genetic inheritance and cell division. Highlight the key enzymes involved and their specific roles in the replication process.

Answer Key for Worksheet on DNA Replication

Part A: Multiple Choice Questions

1. c) DNA helicase
2. a) Leading strand
3. c) Okazaki fragments
4. c) DNA ligase
5. b) DNA gyrase

Part B: Short Answer Questions

1. The leading strand is synthesized continuously in the 5' to 3' direction, in the same direction as the replication fork movement. The lagging strand is synthesized discontinuously in short segments called Okazaki fragments, in the opposite direction of the replication fork movement.
2. Primase synthesizes a short RNA primer complementary to the DNA strand, providing a starting point for DNA polymerase to begin DNA synthesis.
3. DNA replication is considered to be semi-conservative because, during replication, one strand of the original DNA molecule serves as a template for the synthesis of a complementary strand, resulting in two DNA molecules, each containing one original strand and one newly synthesized strand.
4. DNA polymerases have proofreading activity. If an incorrect nucleotide is incorporated during synthesis, the polymerase detects the mismatch and removes the incorrect nucleotide, replacing it with the correct one.
5. Topoisomerase relieves the tension and supercoiling caused by the unwinding of the DNA double helix by introducing temporary breaks in the DNA strands.

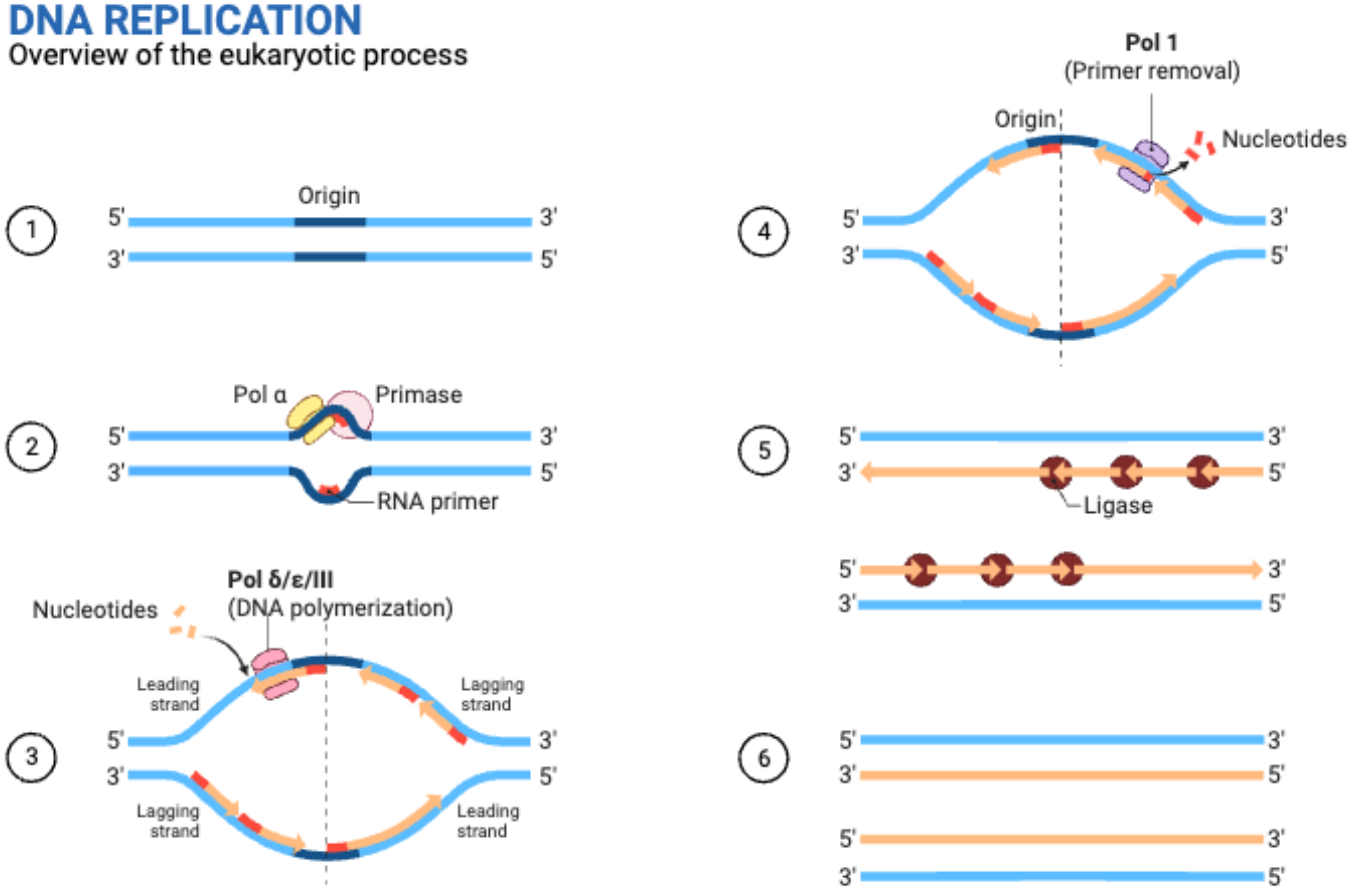
Part C: True or False

1. True
2. False
3. False
4. False
5. True

Part D: Diagram Analysis

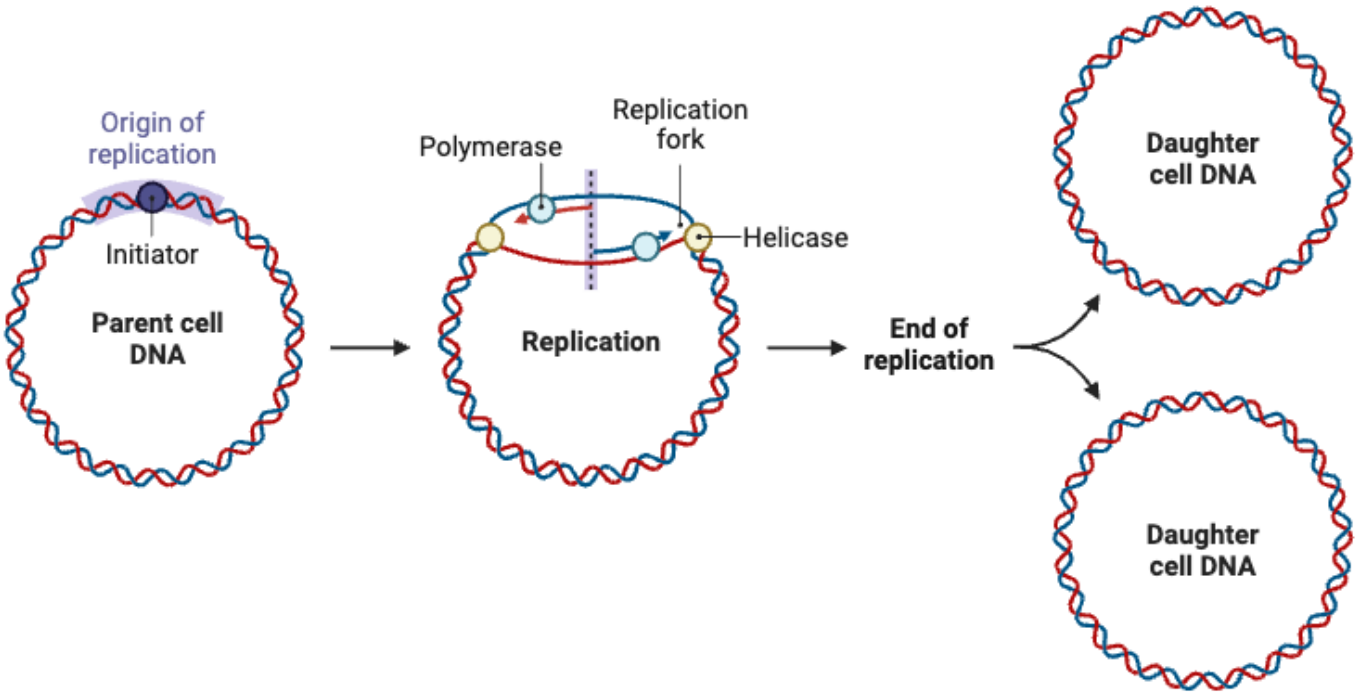
DNA REPLICATION

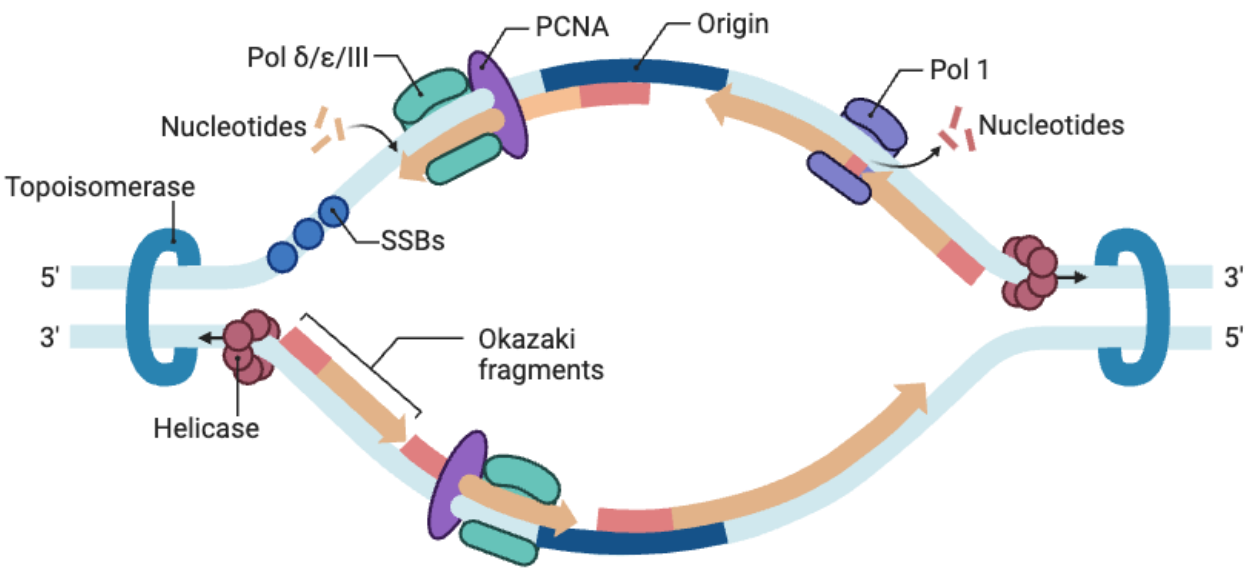
Overview of the eukaryotic process



DNA REPLICATION

Prokaryotic DNA replication during cell division





Part E: Essay Question

DNA replication is crucial for genetic inheritance as it ensures that genetic information is accurately passed from one generation to the next. During cell division, DNA replication ensures that both daughter cells receive an exact copy of the genetic material. Key enzymes involved in DNA replication include DNA helicase, which unwinds the double helix; primase, which synthesizes RNA primers; DNA polymerase, which synthesizes the new DNA strand; DNA ligase, which joins Okazaki fragments on the lagging strand; and topoisomerase, which relieves supercoiling.
