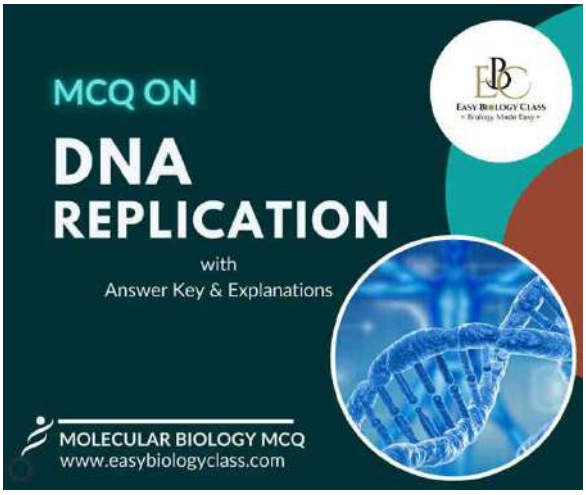


MCQ on DNA Replication with Answer Key and Explanations

DNA replication is the process by which a cell duplicates its DNA, ensuring that each daughter cell receives an identical copy during cell division. It begins with the unwinding of the double helix, followed by the synthesis of complementary strands by the enzyme DNA polymerase. This results in two identical DNA molecules, each composed of one original strand and one newly synthesized strand. This is an MCQ on DNA Replication with Answer Key and Explanations. You can download these MCQ as PDF from the download link provided below.

1. **Which enzyme is responsible for unwinding the DNA double helix during replication?**
   a) DNA polymerase
   b) Helicase
   c) Ligase
   d) Primase

2. **What is the role of single-strand binding proteins (SSBs) during DNA replication?**
   a) Unwind the DNA
   b) Prevent the re-formation of the double helix
   c) Synthesize new DNA strands
   d) Remove RNA primers

3. **Which direction does DNA polymerase synthesize a new DNA strand?**
   a) 5' to 3'
   b) 3' to 5'
   c) 5' to 5'
   d) 3' to 3'

4. **What is the purpose of the RNA primer in DNA replication?**
   a) To initiate the synthesis of the leading strand
   b) To act as a template for DNA synthesis
   c) To provide a free 3' hydroxyl group for DNA polymerase
   d) To remove nucleotides from the DNA strand

5. **During DNA replication, which enzyme is responsible for the removal of RNA primers?**
   a) DNA polymerase I
   b) DNA polymerase III
   c) Ligase
   d) Helicase

6. **What are Okazaki fragments?**
   a) Short segments of RNA synthesized during replication
   b) Short segments of DNA synthesized on the lagging strand
   c) Sections of DNA where replication begins
   d) Long continuous DNA segments on the leading strand

7. **Which enzyme is responsible for joining Okazaki fragments on the lagging strand?**
   a) DNA polymerase I
   b) DNA polymerase III
   c) Ligase
   d) Primase

8. **In eukaryotic cells, where does DNA replication occur?**
   a) Cytoplasm
   b) Mitochondria
   c) Nucleus
   d) Endoplasmic reticulum

9. **Which component is necessary for the DNA polymerase to begin synthesis of a new strand?**
   a) RNA primer

b) DNA ligase

c) Nucleotide triphosphates

d) Helicase

10. **What is the function of DNA polymerase I in prokaryotic DNA replication?**

a) Synthesize the leading strand

b) Synthesize the lagging strand

c) Remove RNA primers and replace them with DNA

d) Unwind the DNA double helix

11. **Which DNA polymerase is primarily responsible for synthesizing the leading strand in eukaryotes?**

a) DNA polymerase α

b) DNA polymerase β

c) DNA polymerase δ

d) DNA polymerase ε

12. **What is the role of topoisomerase in DNA replication?**

a) Add nucleotides to the growing DNA strand

b) Unwind the DNA double helix

c) Relieve torsional strain ahead of the replication fork

d) Synthesize RNA primers

13. **Which of the following statements about DNA replication is true?**

a) DNA replication is bidirectional

b) DNA replication occurs in one direction only

c) DNA replication involves only one strand at a time

d) DNA replication is a non-templated process

14. **How does the proofreading function of DNA polymerase help maintain genetic stability?**

a) By adding more nucleotides to the DNA strand

b) By removing incorrect nucleotides and replacing them with correct ones

c) By unwinding the DNA helix

d) By synthesizing RNA primers

15. **Which protein complex is responsible for the formation of the sliding clamp in eukaryotic DNA replication?**
    a) RFC
    b) PCNA
    c) RPA
    d) ORC

16. **In which phase of the cell cycle does DNA replication occur?**
    a) G1 phase
    b) S phase
    c) G2 phase
    d) M phase

17. **What is the role of primase in DNA replication?**
    a) Synthesize RNA primers
    b) Unwind the DNA double helix
    c) Replace RNA primers with DNA
    d) Seal nicks in the DNA strand

18. **How does the replication fork move along the DNA?**
    a) By extending the leading strand only
    b) By extending both the leading and lagging strands simultaneously
    c) By synthesizing Okazaki fragments only
    d) By removing RNA primers

19. **Which of the following is NOT a function of DNA polymerase III?**
    a) Synthesizing the leading strand
    b) Synthesizing the lagging strand
    c) Proofreading newly synthesized DNA
    d) Removing RNA primers

20. **What distinguishes the leading strand from the lagging strand during DNA replication?**
    a) The leading strand is synthesized discontinuously, while the lagging strand is synthesized continuously

b) The leading strand is synthesized continuously, while the lagging strand is synthesized discontinuously

c) The leading strand is synthesized in the 5' to 3' direction, while the lagging strand is synthesized in the 3' to 5' direction

d) The leading strand requires multiple primers, while the lagging strand requires only one primer

21. **Which component of the replication machinery helps to maintain the stability of the DNA polymerase on the DNA strand?**

a) Sliding clamp

b) Topoisomerase

c) Single-strand binding proteins

d) Primase

22. **What is the function of the origin recognition complex (ORC) in DNA replication?**

a) Unwind the DNA double helix

b) Load the helicase onto the DNA

c) Initiate DNA synthesis by marking the origin of replication

d) Synthesize RNA primers

23. **What is the primary role of the 3' to 5' exonuclease activity of DNA polymerase?**

a) Remove incorrect nucleotides during DNA synthesis

b) Add nucleotides to the growing DNA strand

c) Unwind the DNA double helix

d) Join Okazaki fragments

24. **Which of the following proteins is involved in the stabilization of single-stranded DNA during replication?**

a) RPA

b) RFC

c) PCNA

d) Topoisomerase

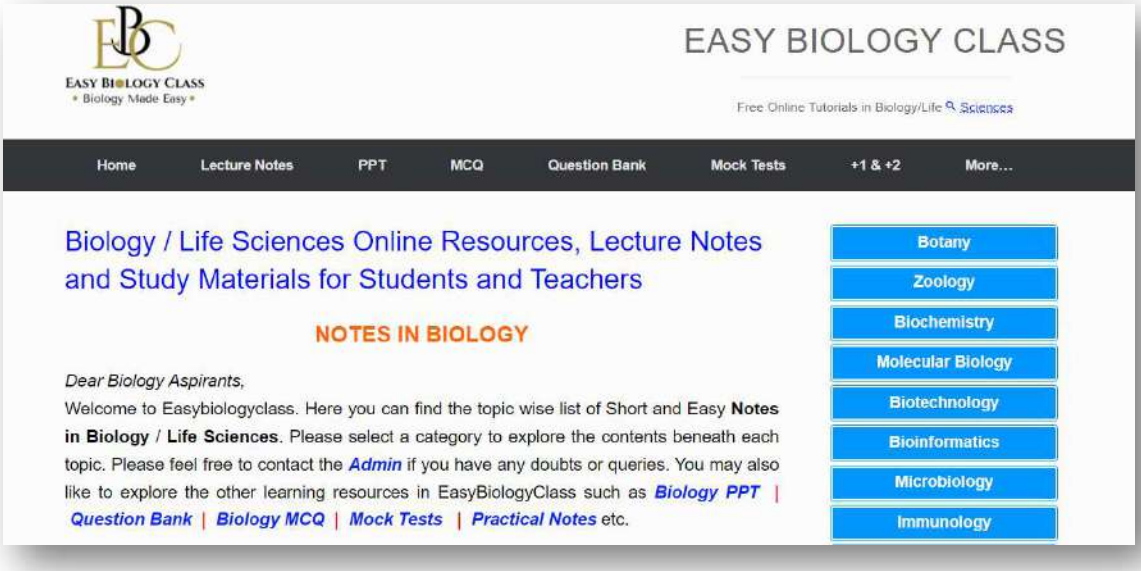
25. **During DNA replication, which of the following is a key difference between prokaryotic and eukaryotic replication?**

a) Prokaryotic replication occurs in the nucleus, while eukaryotic replication occurs in the cytoplasm

b) Eukaryotic replication involves multiple origins of replication, while prokaryotic replication has a single origin

c) Prokaryotic DNA replication is more complex due to multiple DNA polymerases

d) Eukaryotic DNA replication lacks a proofreading mechanism



Answer Key

1. **b) Helicase**

   Helicase unwinds the DNA double helix to allow replication to proceed.

2. **b) Prevent the re-formation of the double helix**

   Single-strand binding proteins stabilize the unwound DNA and prevent it from re-annealing.

3. **a) 5' to 3'**

   DNA polymerase synthesizes new DNA strands in the 5' to 3' direction.

4. **c) To provide a free 3' hydroxyl group for DNA polymerase**

   The RNA primer provides the necessary 3' hydroxyl group for DNA polymerase to start synthesis.

5. **a) DNA polymerase I**

   DNA polymerase I removes RNA primers and replaces them with DNA.

6. **b) Short segments of DNA synthesized on the lagging strand**

   Okazaki fragments are short DNA segments synthesized on the lagging strand during replication.

7. **c) Ligase**

   DNA ligase joins Okazaki fragments to create a continuous DNA strand.

8. **c) Nucleus**

   DNA replication occurs in the nucleus of eukaryotic cells.

9. **a) RNA primer**

   DNA polymerase requires an RNA primer to start DNA synthesis.

10. **c) Remove RNA primers and replace them with DNA**

    DNA polymerase I in prokaryotes removes RNA primers and fills in the gaps with DNA.

11. **d) DNA polymerase ε**

    DNA polymerase ε is primarily responsible for synthesizing the leading strand in eukaryotes.

12. **c) Relieve torsional strain ahead of the replication fork**

    Topoisomerase relieves the torsional strain that builds up ahead of the replication fork.

13. **a) DNA replication is bidirectional**

    DNA replication is bidirectional, proceeding in both directions from the origin of replication.

14. **b) By removing incorrect nucleotides and replacing them with correct ones**

    The proofreading function of DNA polymerase ensures high fidelity by correcting errors during DNA synthesis.

15. **b) PCNA**

    PCNA (Proliferating Cell Nuclear Antigen) forms the sliding clamp that helps DNA polymerase stay attached to the DNA.

16. **b) S phase**

    DNA replication occurs during the S phase of the cell cycle.

17. **a) Synthesize RNA primers**

    Primase synthesizes RNA primers that provide a starting point for DNA polymerase.

18. **b) By extending both the leading and lagging strands simultaneously**

    The replication fork moves by extending both the leading and lagging strands concurrently.

19. **d) Removing RNA primers**

    Removing RNA primers is not a function of DNA polymerase III; this task is performed by DNA polymerase I.

20. **b) The leading strand is synthesized continuously, while the lagging strand is synthesized discontinuously**

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

21. **a) Sliding clamp**

    The sliding clamp helps maintain DNA polymerase stability on the DNA strand during replication.

22. **c) Initiate DNA synthesis by marking the origin of replication**

    The origin recognition complex (ORC) marks the origin of replication and initiates the process.

23. **a) Remove incorrect nucleotides during DNA synthesis**

    The 3' to 5' exonuclease activity of DNA polymerase removes incorrect nucleotides.

24. **a) RPA**

    RPA (Replication Protein A) stabilizes single-stranded DNA during replication.

25. **b) Eukaryotic replication involves multiple origins of replication, while prokaryotic replication has a single origin**

    Eukaryotic cells have multiple origins of replication to accommodate their larger genomes, whereas prokaryotic cells typically have a single origin.