ANSWER KEY.

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DNA Replication

Biology | ANSWER KEY

Directions: Answer each question in the space provided. Show your work for every calculation. For Claim, Evidence, Reasoning (CER) questions, write all three parts.

1. Complete the sentences using these words: helicase, DNA polymerase, template, semiconservative.

a. The enzyme that unwinds the DNA is _____.

b. The enzyme that adds new nucleotides is _____.

c. Each old strand acts as a _____ for the new strand.

d. Because each new molecule has one old and one new strand, replication is called _____.

a. helicase b. DNA polymerase c. template d. semiconservative

2. A template strand reads ACGGTCAT. Write the new strand that DNA polymerase builds along it.

TGCCAGTA

3. A 450-base-pair DNA segment is copied once. How many new nucleotides are added? Show your work.

Each of the 2 old strands gets a new strand of 450 nucleotides: 2 x 450 = 900.

Answer: 900 new nucleotides.

4. One DNA molecule is copied through 4 rounds of replication. (a) How many molecules are there at the end? (b) How many contain a strand from the original molecule? (c) How many are made only of new strands?

(a) 2^4 = 16 molecules. (b) 2, because the 2 original strands each end up in a different molecule. (c) 16 - 2 = 14.

5. Why must a cell copy its DNA before it divides?

Each new cell needs a complete set of DNA instructions. If the DNA were not copied first, the new cells would each have only part of it.

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6. The table shows Meselson-Stahl results. Write a Claim, Evidence, Reasoning response: do the data support the conservative model or the semiconservative model?

Generation	Bands seen
0 (all N-15, heavy)	one low band (heavy)
1	one middle band (hybrid)
2	one middle band (hybrid) and one high band (light)

Claim: The data support the semiconservative model.

Evidence: After one copying there was one middle (hybrid) band and no heavy or light band. After two copyings there was a hybrid band and a light band.

Reasoning: The conservative model predicts separate heavy and light bands after one copying, which was not seen. A hybrid band means each molecule has one old and one new strand, and copying hybrids gives half hybrid and half light molecules.

7. Describe what helicase does and what DNA polymerase does in replication.

Helicase unwinds the double helix and separates the two strands at the replication fork. DNA polymerase reads each template strand and adds nucleotides that pair with it (A with T, G with C) to build a new strand.

8. DNA polymerase proofreads. Explain what that means and why it matters.

It checks each new base pair, removes a base that does not pair correctly, and adds the correct one. This keeps copies accurate so that cells receive nearly exact copies of the DNA.

9. An error in copying is not fixed. Name what this error is called and explain how it could affect the variation of traits in a population.

It is a mutation. If the mutation is in cells that form gametes and the organism survives, the new version of the gene can be inherited, which adds genetic variation to the population.

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