Name _____ Date _____

DNA Structure and Replication Unit Review: From Nucleotides to a Copied Double Helix

Directions: Answer the questions on DNA structure and replication. The last group of questions uses a table of base percentages from five sources.

1. Complete the sentence about the three parts of a DNA nucleotide, using the word bank.

Word bank
ribose • bases • glucose • deoxyribose • phosphate • amino acids

Each nucleotide in DNA is made of a sugar called _____, a _____ group and one of four nitrogen-containing _____.

2. Which three statements describe the structure of a DNA double helix?

☐ A. The bases of the two strands pair up on the inside.
☐ B. Two strands wind around each other like a twisted ladder.
☐ C. The two strands are linked by peptide bonds between amino acids.
☐ D. The sugar and phosphate backbones run along the outside.
☐ E. Each strand is a long chain of glucose molecules.
☐ F. The bases face outward, toward the fluid around the DNA.

3. One strand of a DNA double helix has the base sequence ATGCCA. Reading straight across from it, base by base, what is the sequence of the other strand?

A. TACGGT B. GCATTG C. ATGCCA D. UACGGU

4. When DNA is copied, its two strands come apart, but each strand's sugar-phosphate backbone stays in one piece. Why can the strands separate this way?

A. The paired bases are held by hydrogen bonds, which are weaker than the backbone bonds.
B. The two strands are not attached to each other at all, so they drift apart.
C. The backbones are made of protein, which loosens and unfolds when heated.
D. The paired bases are joined by covalent bonds that are just as strong as those in each backbone.

5. The two strands of a DNA double helix are described as antiparallel. What does this mean?

A. The strands run side by side and point in the same direction.
B. The strands have exactly the same sequence of bases.
C. The strands run side by side but point in opposite directions.
D. The strands are built from two different kinds of sugar.

6. Which statement about how scientists worked out the structure of DNA in the early 1950s is accurate?

A. Watson and Crick discovered DNA itself, a substance no scientist had studied before.
B. Watson and Crick first saw the double helix directly, by looking at DNA through a light microscope.
C. Franklin's X-ray images showed that DNA is one straight strand rather than a helix.
D. Rosalind Franklin's X-ray images of DNA helped Watson and Crick work out its double helix shape.

7. Why must a cell copy all of its DNA before it divides by mitosis?

A. So that the cell can turn some of its DNA into proteins
B. So that each new cell receives only half of the genetic instructions it needs
C. So that each new cell receives a complete set of the genetic instructions
D. So that the old DNA can be broken down and used for energy

8. Match each enzyme to the job it does during DNA replication.
Write the letter of the matching answer on each line.

1. _____ DNA ligase
2. _____ Helicase
3. _____ DNA polymerase

A. Seals the gaps between pieces of new DNA
B. Adds nucleotides one by one to build a new strand
C. Joins amino acids into a protein chain
D. Unwinds the double helix and separates the two strands

9. As DNA is copied, how does the cell decide which base to place at each spot in a new strand?
A. Each base on the old strand pairs with one matching base in the new strand.
B. Bases are added in random order, and mistakes are sorted out later.
C. The new strand copies the old strand's sequence exactly, base for base, in order.
D. The cell reads the protein made from the gene to choose each base.

10. Bacteria were grown for many generations in a medium containing heavy nitrogen, so both strands of their DNA were heavy. They were then moved to a medium with only ordinary light nitrogen and allowed to copy their DNA once. If DNA replication is semiconservative, what would each new double helix contain?
A. Two light strands only, with the heavy DNA broken down
B. Two heavy strands, or else two light strands
C. One heavy strand and one light strand
D. Strands that are each a mix of heavy and light pieces

Base Percentages in Five Sources

In an investigation, DNA was taken from five sources, and the percent of each of the four bases in each sample was measured. Each value in the table is the mean of 3 samples from that source.

Percent of each base in DNA from five sources (each value is the mean of 3 samples)

Source of DNA	Adenine (%)	Thymine (%)	Guanine (%)	Cytosine (%)
Human liver	30.3	30.1	19.5	20.1
Wheat	27.2	27.4	22.6	22.8
Baker's yeast	31.6	31.8	18.3	18.3
The bacterium *E. coli*	24.7	24.9	25.3	25.1
Virus Q	24.1	31.0	25.6	19.3

11. Guanine and cytosine together make up about what percent of the bases in the human liver DNA?
A. About 60 percent B. About 50 percent C. About 40 percent D. About 20 percent

12. Which statement about the five sources is supported by these results?
A. Adenine was the most common base in every source.
B. Each of the four bases made up 25 percent of every source's DNA.
C. Every source had the same percent of each base.
D. The percent of each base differed from one source to another.

13. Which source's DNA is most likely single-stranded rather than a double helix?
A. Human liver B. Virus Q
C. The bacterium *E. coli* D. Baker's yeast

14. Suppose a sixth row were added for double-stranded DNA from a fish, showing 28.0 percent adenine. Based on base pairing, about what percent guanine would that row most likely show?
A. About 28 percent B. About 22 percent C. About 44 percent D. About 72 percent