Biology 12 Name: _____

Cell Biology Per: ___ Date: _____

Understanding DNA Replication

Background

In order to divide or form a gamete, the DNA of a cell must first be copied. How are identical copies of the DNA molecule formed before meiosis or mitosis? The base-pairing rule suggests a way for this to happen. Since the sequence of bases on one strand of the double helix accurately predicts the bases on the complementary strand, a chromosome could be copied using the parent stands as templates. This would result in two identical double-stranded molecules of DNA, each consisting of a parent strand and a copied "daughter" strand. This is what actually occurs.

1. In the nucleus, the two DNA strands of the double helix are unwound by helicase (an enzyme). The hydrogen bonds connecting the two strands are broken and the two strands separate.
2. Each separated parent strand serves as a template for the formation of the complementary daughter strand. DNA polymerase, traveling in the 5' to 3' direction (which is in the opposite direction on each parent strand), recognizes the nucleotides in the parent strand. Each parent nucleotide is paired with a complementary free nucleotide. The complementary nucleotides are connected together to form a daughter strand.
3. Finally, one parent strand and its complementary daughter strand wind together in one double helix. The other parent strand and its daughter strand also wind together, forming a second double helix.

Questions

Using the above background knowledge and the information from your textbook, answer the following.

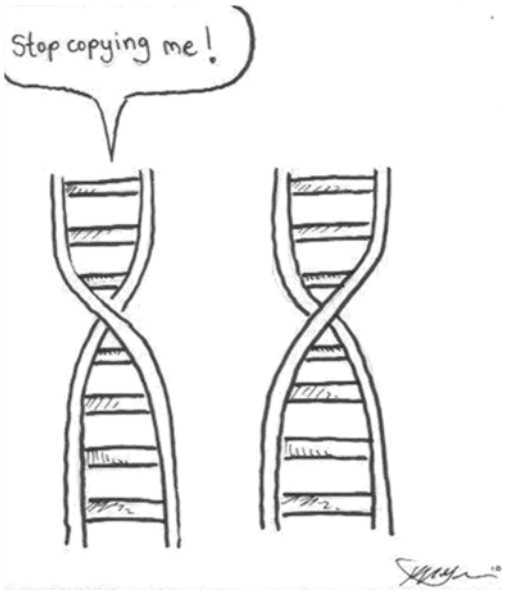
1. What type of bond exists between the …
   a. phosphate group and the pentose sugar? _____
   b. pentose sugar and nitrogenous base? _____
   c. nitrogenous bases on opposite parent strands? _____
   d. indicate weakest bond listed above by circling a, b, or c

2. The sequence of bases in a strand of DNA is GCAT. What would be the complementary DNA strand?

3. Where in the cell does DNA replication take place?

4. When do you think DNA replication occurs?
   A. after cell division
   B. before cell division
   C. during cell division

5. What is the goal of DNA replication?



6. Why is DNA replication referred to as being "semi-conservative"?

7. What would happen to the amount of cellular DNA when cells divide if DNA replication did not occur? Include a description of what would happen to the cell itself.

8. Why is the specific sequence of DNA important to living organisms? *Hint: think about what DNA is coding for*.

9. In <u>your own words</u> and in point form, list the steps of DNA replication.
   Include, and **underline**, the following terms:
   - daughter strand
   - DNA polymerase
   - helicase
   - lagging strand
   - leading strand
   - ligase
   - Okazaki fragments
   - parent strand