

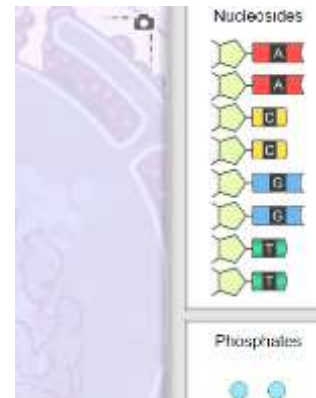
Name: \_\_\_\_\_ Date: \_\_\_\_\_

## Student Exploration: Building DNA

**Vocabulary:** double helix, DNA, enzyme, mutation, nitrogenous base, nucleotide, replication

**DNA** is an incredible molecule that forms the basis of life on Earth. DNA molecules contain instructions for building every living organism on Earth, from the tiniest bacterium to a massive blue whale. DNA also has the ability to **replicate**, or make copies of itself. This allows living things to grow and reproduce.

The *Building DNA* Gizmo™ allows you to construct a DNA molecule and go through the process of DNA replication. Examine the components that make up a DNA molecule.



1. When a nucleoside is joined to a phosphate, it is called a **nucleotide**. What are the **three** components of a nucleotide shown in the Gizmo (hint: a “nucleoside” contains two parts - a pentagonal sugar (deoxyribose) and a **nitrogenous base**).

\_\_\_\_\_

2. How many different nitrogenous bases do you see? \_\_\_\_\_

Note: The names of these nitrogenous bases are adenine (red), cytosine (yellow), guanine (blue), and thymine (green).

### Question: What is the structure of DNA?

1. **Build:** Follow the steps given in the Gizmo to construct a molecule of DNA. (Note: For simplicity, this DNA molecule is shown in two dimensions, without the twist.)

Stop when the hint reads: “The DNA molecule is complete.” In the spaces at right, list the sequence of nitrogenous bases on the left-hand side of the DNA molecule and the right-hand side.

Left side

Right side

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

2. **Explain:** Describe the structure of the DNA molecule you made.

A. What two parts make up the sides (or backbone) of the DNA molecule?

\_\_\_\_\_

B. What makes up the inside “rungs” of the DNA molecule?

\_\_\_\_\_

3. **Fill in:** Write the name of the nitrogenous base that joins to each of the bases below:

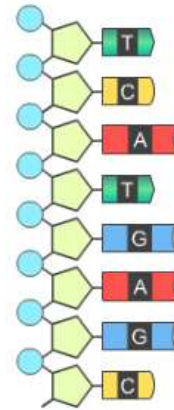
Adenine (A) joins to \_\_\_\_\_

Thymine (T) joins to \_\_\_\_\_

Cytosine (C) joins to \_\_\_\_\_

Guanine (G) joins to \_\_\_\_\_

4. **Practice:** The left side of a DNA molecule is shown. Write the complementary right side DNA sequence of the molecule.



5. **Challenge:** The DNA strand shown above consists of eight pairs of nitrogenous bases (16 total nucleotides). What is the percentage of each nitrogen base that makes up the entire molecule? ( $\% = \frac{\text{\#nitrogen base}}{\text{total nucleotides}} \times 100$ ) (Hint: Count both strands.)

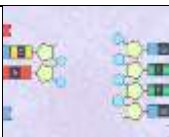
- Adenine \_\_\_\_\_
- Thymine \_\_\_\_\_
- Cytosine \_\_\_\_\_
- Guanine \_\_\_\_\_

6. **Observe:** Describe any patterns you observe in these percentages..

\_\_\_\_\_  
\_\_\_\_\_

7. **Observe:** Where in the cell is this DNA molecule being stored? \_\_\_\_\_



<b>Activity B:</b>  <b>DNA replication</b>	<u>Get the Gizmo ready:</u> <ul style="list-style-type: none"> <li>Be sure the hint reads: "The DNA molecule is complete." If not, click <b>Reset</b> and build a new DNA molecule.</li> </ul>	
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**Question: How does DNA make a copy of itself?**

- Observe: An **enzyme** is a protein that facilitates certain cell processes. Click **Release enzyme** to release **DNA helicase**. What does this enzyme do to the DNA molecule?

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- Observe: Click **Release enzyme** to release **DNA polymerase**.

A. Notice that two groups of **nucleotides** appear on the right. What are the *three* parts of a nucleotide? \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_

B. Drag one of the nucleotides to a complementary nitrogenous base on one of the two strands. What is the role of DNA polymerase in this process?

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- Build: Complete the two molecules of DNA by dragging nucleotides to their corresponding locations. When you have finished, compare the two completed "daughter" DNA molecules.

What do you notice about the two molecules? \_\_\_\_\_

How do these molecules compare to the original? \_\_\_\_\_

- Think and discuss: When in the cell cycle does DNA replication take place, and why is it such an important process?

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- Extend your thinking: Sometimes errors called **mutations** occur during DNA replication. How might mutations affect future daughter DNA molecules? Will they also contain the mutation? Explain your answer.

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- Summarize: What **two** characteristics of the DNA molecule make it possible to self-replicate, produce copies of itself, and serve as the molecule of heredity?

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