Chemistry of Living Systems (Life Sciences)

- 6. Principles of chemistry underlie the functioning of biological systems. As a basis for understanding this concept:
 - a. *Students know* that carbon, because of its ability to combine in many ways with itself and other elements, has a central role in the chemistry of living organisms.
 - b. *Students know* that living organisms are made of molecules consisting largely of carbon, hydrogen, nitrogen, oxygen, phosphorus, and sulfur.
 - c. Students know that living organisms have many different kinds of molecules, including small ones, such as water and salt, and very large ones, such as carbohydrates, fats, proteins, and DNA.

The Blueprint of Life

Every cell in your body has the same "blueprint" or the same DNA. Like the blueprints of a house tell the builders how to construct a house, the DNA "blueprint" tells the cell how to build the organism. Yet, how can a heart be so different from a brain if all the cells contain the same instructions? Although much work remains in genetics, it has become apparent that a cell has the ability to turn off most genes and only work with the genes necessary to do a job. We also know that a lot of DNA apparently is nonsense and codes for nothing.

- 1. Write out the full name for DNA. _____
- 2. What is a gene? _____

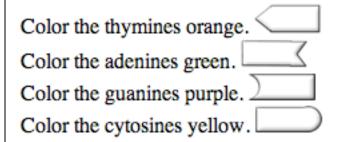
3. Where in the cell are chromosomes located?	
4. What two scientists established the structure of DNA?	
5. What is the shape of DNA?	
6. What are the sides of the DNA ladder made of?	
7. What are the "rungs" of the DNA ladder made of?	
8. What sugar is found in DNA?	_
9. How do the bases bond together? A bonds with10. Why is DNA called the "Blueprint of Life"?	G bonds with

11. Why is carbon the backbone of living things? Write 3 sentences and show the carbon structure

12. Show drawings of the following: water and salt , Carbohydrates, fats, proteins

13. Color the structure of DNA attached. Label the parts DNA Structure Coloring Instructions

The rungs of the ladder are pairs of 4 types of nitrogen bases. The bases are known by their coded letters A, G, T, C. These bases always bond in a certain way. Adenine will only bond to thymine. Guanine will only bond with cytosine. This is known as the "Base-Pair Rule". The bases can occur in any order along a strand of DNA. The order of these bases is the code the contains the instructions. For instance ATGCACATA would code for a different gene than AATTACGGA. A strand of DNA contains millions of bases. (For simplicity, the image only contains a few.)



Note that that the bases attach to the sides of the ladder at the sugars and not the phosphate. The DNA helix is actually made of repeating units called nucleotides. Each nucleotide consists of three molecules:

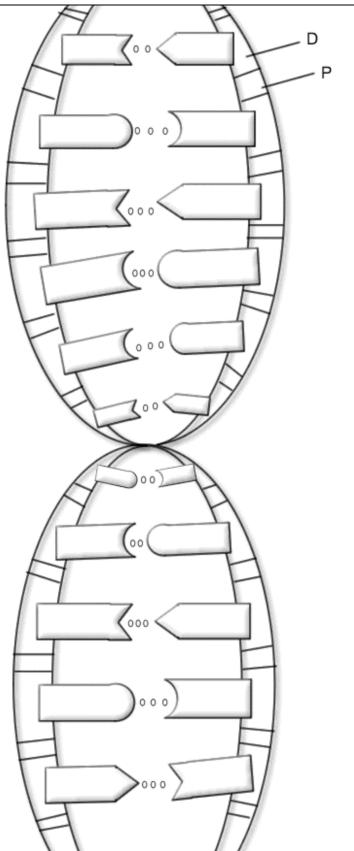
a sugar (deoxyribose),

a phosphate which links the sugars together, and then one of the four bases.

Two of the bases are purines - adenine and guanine. The pyrimidines are thymine and cytosine.

The two sides of the DNA ladder are held together loosely by hydrogen bonds. The DNA can actually "unzip" when it needs to replicate - or make a copy of itself. DNA needs to copy itself when a cell divides, so that the new cells each contain a copy of the DNA. Without these instructions, the new cells wouldn't have the correct information. The hydrogen bonds are represented by small circles.

Color the hydrogen bonds grey.



Coloring Elements Found in Living Things

