DNA: The Double Helix: Read and Highlight/Annotate Name _____

Recall that the nucleus is a small spherical, dense body in a cell. It is often called the "control center" because it controls all the activities of the cell including cell reproduction, and heredity. Chromosomes are microscopic, threadlike strands composed of the chemical **DNA** (short for deoxyribonucleic acid). In simple terms, DNA controls the production of proteins within the cell. These proteins in turn, form the structural units of cells and control all chemical processes within the cell. *Think of proteins as the the building blocks for an organism,* proteins make up your skin, your hair, parts of individual cells. How you look is largely determined by the proteins that are made. The proteins that are made is determined by the sequence of DNA in the nucleus.

Chromosomes are composed of genes, which is a segment of DNA that codes for a particular protein which in turn codes for a trait. Hence you hear it commonly referred to as the gene for baldness or the gene for blue eyes. Meanwhile, DNA is the chemical that genes and chromosomes are made of. DNA is called a nucleic acid because it was first found in the nucleus. We now know that DNA is also found in organelles, *the mitochrondria* and *chloroplasts,* though it is the DNA in the nucleus that actually controls the cell's workings.

In 1953, James Watson and Francis Crick along with Roselyn Franklin's help established the structure of DNA. The shape of DNA is a double helix, which is like a twisted ladder. The sides of the ladder are made of alternating sugar and phosphate molecules. The sugar is deoxyribose. **Color all the phosphates pink (one is labeled with a "P"). Color all the deoxyriboses blue (one is labeled with a "D")** .

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 that 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.)

Key

Color the thymines orange.

Color the adenines green.

Color the guanines purple.

Color the cytosines yellow.

***Note** that that the bases attach to the sides of the ladder at the sugars and not the phosphate. Thymine and Adenine form double hydrogen bonds. Cytosine and Guanine form triple hydrogen bonds.*

The DNA helix is actually made 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. Note that the *pyrimidines are single ringed and the purines are double ringed.* Color the nucleotides using the same colors as you colored them in the double helix.

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**.

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. These regions of DNA that do not code for proteins are called "introns", or sometimes "junk DNA". The sections of DNA that do actually code from proteins are called "exons".

Directions: Answer the questions below and find the passage from the text above and put the number of the question to where you found the answer in the text.

1. Write out the full name for DNA. _____

2. What is a gene? _____

3. Where in the cell are chromosomes located?
_____

4. DNA can be found in what two organelles?
_____

5. A nucleotide is composed of what three parts?_____ _____
_____

6. What is the shape of DNA? _____

7. What are the sides of the DNA ladder made of? _____

8. What are the "rungs" of the DNA ladder made of?
_____

9. What sugar is found in DNA? _____

10. How do the bases bond: Adenine bonds with _____ Guanine bonds with _____

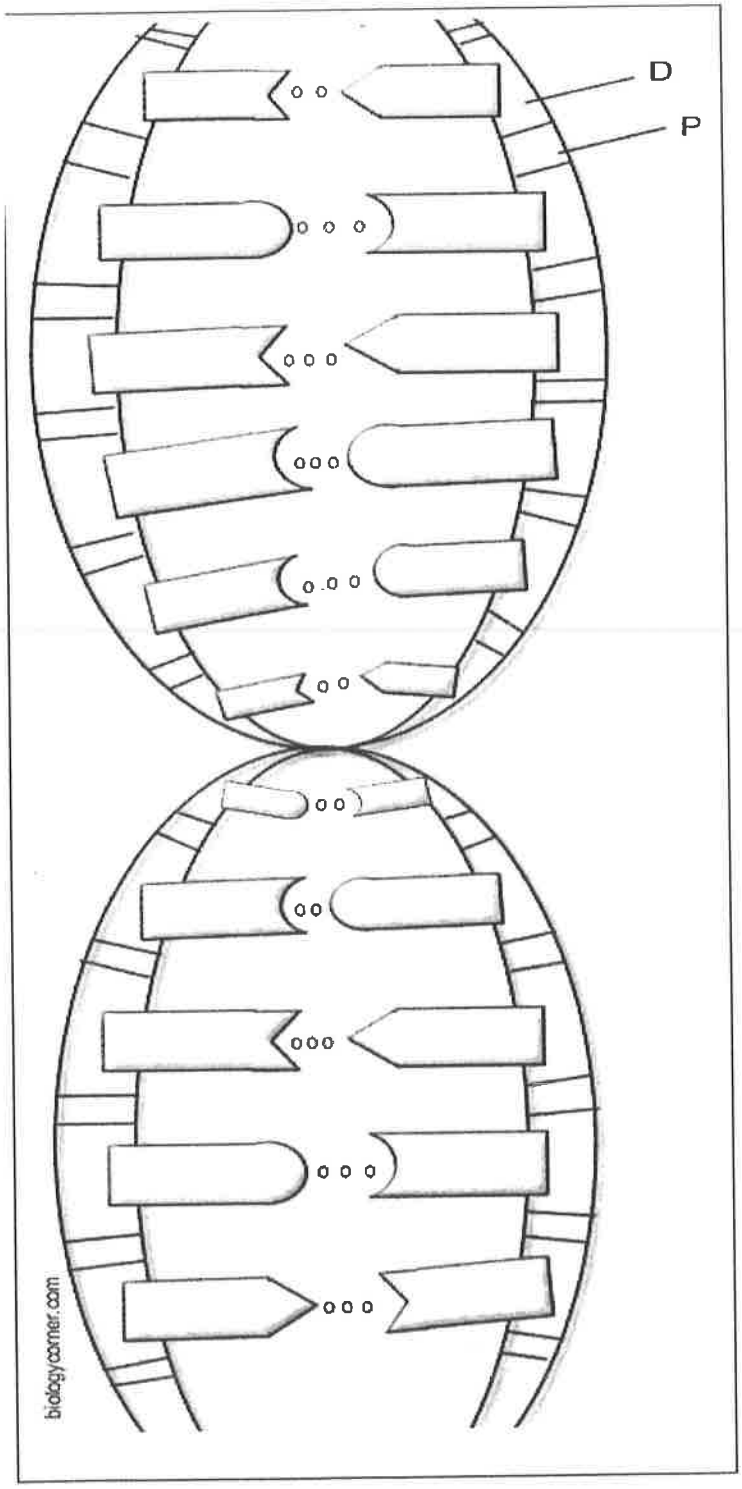
11. The two purines in DNA are _____ , and _____
two pyrimidines are _____, and _____.

12. DNA is made of repeating units called
_____

13. All the nitrogen bases are held together by what type of bonds?_____

14. Adenine and Thymine form _____ bonds, while cytosine and thymine form _____ bonds.

DNA: The Double Helix



Key

D = _____

P = _____ group

oo/ooo = _____ bonds

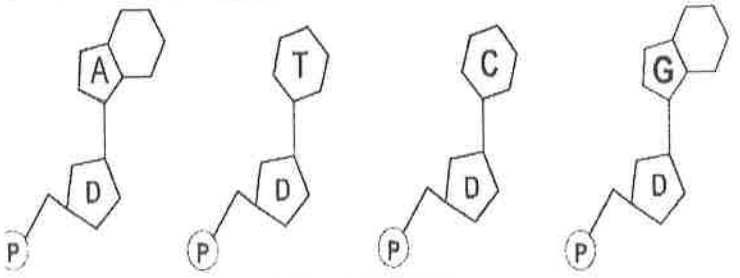
_____ = _____

_____ = _____

_____ = _____

_____ = _____

bases

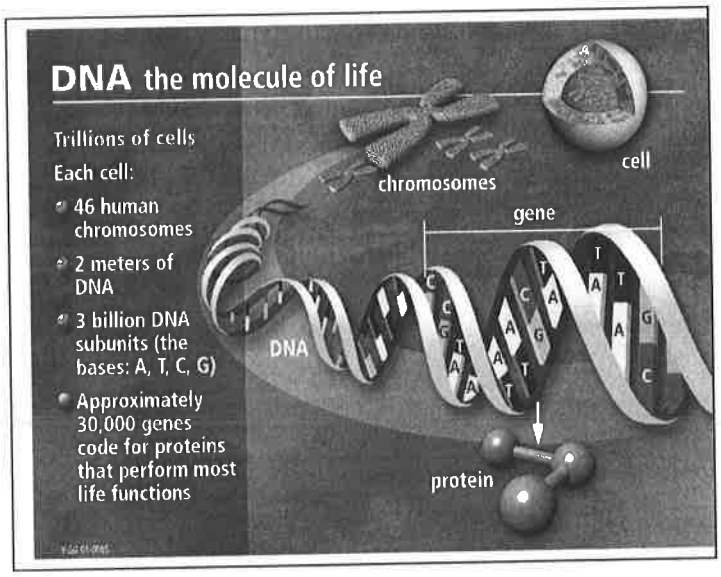


NUCLEOTIDES

Handout E DNA Structure and Replication Review

Name _____ Period _____

DIRECTIONS: Answer the following questions about DNA replication



1. Why does DNA replicate?

2. Is DNA replication describe as conservative or semi-conservative? Why?

3. What 2 enzymes are used during DNA replication? Describe what each does during replication.

4. When does DNA replication occur in a cell?

5. Where does DNA replication occur in a cell?

True/False – If the statement is false, correct the statement.

T or F - Cytosine, guanine, thymine and adenine are referred to as phosphates.
T or F – DNA is in the shape of a helix.
T or F – A nucleotide is made up of a sugar, phosphate and two nitrogen bases.
T or F – Replication is performed prior to cell division.
T or F – Adenine always pairs with guanine.
T or F – Complementary base pairing matches up complementary sugars.
T or F – The sides of the DNA molecule are made up of repeating nitrogen bases and sugars.
T or F – The letters that make up the DNA molecule code for genes.
T or F – Replication results in two strands of DNA, each of which has half of the original strand.
T or F – Covalent bonds hold nitrogen bases together, forming the rings of the DNA ladder.

Sentence Arrange – Put the steps of DNA replication in order by writing a number in the space before each statement.

_____ Two new molecules of DNA are created.
_____ DNA polymerase attach the free-floating nucleotides to the exposed nitrogen bases.
_____ Helicase begins to break the hydrogen bonds between nitrogen bases.
_____ Free floating nucleotides pair up with exposed nitrogen bases.

Complete the statement

_____, guanine, cytosine, and thymine are the four nitrogen bases.
In DNA, _____ always forms triple hydrogen bonds with guanine.
The sequence of _____ carries the genetic information of an organism
The process of _____ produces a new copy of an organism's genetic information.
The double coiled shape of DNA is called a _____.