DNA LAB

Name:_____

Period: _____Date:_____

Background:

The DNA molecule, which takes the shape of a double helix, is composed of repeating units called nucleotides. Each nucleotide is made of a phosphate group, a sugar specifically called deoxyribose, and a nitrogen base. There are four types of bases; two purines being adenine and guanine, & two pyridimines, being thymine and cytosine. They have the letters A, G, T, C. When replication occurs the base pairing rules state that A will pair with T, while C will pair with G and vice-a-versa.

The four bases form the "alphabet" from which the DNA code "words" are formed. There may be thousands of bases on a DNA strand, which may occur in any order, however, it is not the single base that is important, rather a group of three bases called a triplet **codon**. These codons represent a "word". There are 64 different three-letter words possible. Each of these codons determines the sequence of the amino acids making up a protein. Each DNA word always codes for the same amino acid however the words may be in a different order, thus giving rise to many different proteins.

Introduction:

DNA is found in the cells of all living things. One strand of DNA can be millions of bases long. If one strand of DNA is an entire instruction manual, then the genes located on that DNA would be the chapters. Genes are long sequences of codons located along the length of the DNA that each code for the production of one protein. Those proteins then assemble and operate the cell. Scientists know how chromosomes duplicate themselves and transfer genetic information to new cells. They also understand the way that DNA directs the activity of protein synthesis within the cell. We will deal with all of these issues in upcoming lessons and labs.

Purpose:

In this investigation, you will examine the structure of DNA by building your own model and explore how mRNA is produced.

Materials:

One DNA model kit

Procedure: examine your model kit and make sure you have all of the following:

12 black 3-prong (deoxyribose)	10 red two-prong (phosphate)	3 red straws (Adenine)	3 blue straws (Thymine)
3 green straws (Cytosine)	3 gray straws (Guanine)	3 white straws (Uracil)	6 white two-prong (hydrogen bond
20 yellow straws (covalent phosphate bond)	1 long gray straw, 3 long green straws, 1 gray -prong (stand)		

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Part I.

1. Construct the stand first. Attach the long gray straw to the gray 4-prong center. Next attach the 3 long green straws to support the gray straw. When finished set aside.

2. Construct the individual nucleotides. Attach a black 3-prong sugar to a red 2-prong phosphate using a yellow straw. Then attach any of the straws representing the four bases to a black prong deoxyribose using the colored straws, ie. blue is thymine. When you are done you will have 3 A, C, G, and T nucleotides for a total of 12.

Stop here and wait for your teacher to check you work and sign off. _____

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3. Construct a chain of 6 nucleotides in the following order A, T, G, T, C, and G as read from top down. The nucleotides join with yellow straws connecting deoxyribose (black prong) and phosphate (red prong) from separate nucleotides. This will represent the **left** side of the helix. *You will have pieces left over.*

4. Attach 6 white 2-prong hydrogen bonds to the open end of each nitrogen base. The colored straws (green, gray, red, blue)

5. Build the **complimentary** DNA strand using the base pairing rules discussed in class. Then attach your complimentary strand to complete the double stranded molecule.

Stop here and wait for your teacher to check you work and sign off. _____

6. Place the constructed segment on the stand, with the long gray straw passing through each hydrogen bond. Gently twist the molecule to create the double helix shape. Be sure you place the 'G' end (gray) on the bottom of the stand.

Note that a replicating DNA strand does not take its new parts from an existing DNA strand. As you just illustrated, in the nucleus are extra pieces of nucleotides that are used to form new DNA molecules. These were leftover from step 3.

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Analysis: Answer all in complete sentences

1. What is the general structure (shape) of the DNA molecule?

_____

_____

2. Name the two molecules that alternate to make the side portions or 'backbone' of a DNA model, double helix, or ladder shaped object just created.

_____

_____

3. Name the molecules or parts of a nucleotide, which join by a hydrogen bond during replication.

_____

_____

4. If there are four thymine bases on your model, how many adenine bases will there be?

_____

_____

5. If you were to open the entire molecule along the white prong hydrogen bonds (replication), what bases would the left side attach to? The right side? Please list them from the top down.

L - _____

R – _____

6. Would the 2 new DNA molecules contain the same base pairs?

_____

_____

7. Would the 2 DNA molecules be exact copies of each other? Explain.

_____

_____

Separate your DNA into individual strands (break apart the hydrogen bonds down the center). Save and use the **complimentary** strand you created from step 5 above for part II.

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Part II - Transcription

1. Break apart the **original** DNA strand made from step 3, back into individual nucleotides. These will represent the free nucleotides in the nucleus.

2. Replace the thymine with uracil (white straws) and then create a 2-codon mRNA strand from the remaining DNA strand as would happen in transcription.

3. Using these RNA nucleotides, construct the mRNA strand that would be created by your DNA. The DNA strand should begin with a Thymine.

4. Determine which amino acids are created from your mRNA strand. Remember to read from the A base down on the mRNA strand. Complete number 11 with that response, using page 303 in your textbook.

Analysis: Answer all in complete sentences.

8. Based upon the information in this lab what is the order of the messenger RNA nucleotides you selected for part 2 of the lab?

_____

_____

9. A base sequence of Adenine, Guanine, Adenine (A, G, A) in mRNA could only be created by what sequence of DNA?

_____

10. What are the two amino acids coded for by your mRNA strand?

_____

_____