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

**DNA Model Kit – Student Guide** Graded \_\_\_\_\_\_/14 points

DNA (deoxyribonucleic acid) is found in the chromosomes of all living things. It is the chemical of which genes are composed. With an understanding of this all important molecule, scientists know how chromosomes can duplicate during division and transfer genetic information to new cells. They also understand the functioning of DNA instructions sent out to direct the activity of protein formation within the cell. In this investigation you will examine the structure of DNA by building your own model.

Each group will receive a packet of model consisting of the following.

|  |  |
| --- | --- |
| 12 3-prong “deoxyribose” centers (Black) | 6 Hydrogen bond centers (white) |
| 12 2- prong “phosphoric acid” centers (red) | 24 Connectors (yellow) |
| 3 “Adenine” straws (red) | 1 4-prong base attachment (black) |
| 3 “Thymine” straws (blue) | 1 20cm Stand (grey) |
| 3 “Guanine” straws (grey) | 3 5cm “legs” for the stand (green) |
| 3 “Cytosine” straws (green) |  |

The DNA molecule is in the shape of a double helix (spiral). The molecules making up DNA are deoxyribose, phosphoric acid and a nitrogen base of which there are four: adenine, thymine, cytosine and guanine. This is called a NUCLEOTIDE. The base units are called purines (adenine and guanine) and pyrimidines (thymine and cytosine). They are known by their code letters A,G,T,C. There is a specific manner in which they bond, A only bonds with T and C only bonds with G. (**A**ll **T**eacher **G**o **C**razy).

If the base sequence in one DNA chain is : G G C A T A C T T C C A G

(1pt) What would its complementary sequence be on the other portion?

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

Part I Structure of DNA

Procedure:

The DNA model can be constructed by using the materials listed previously.

1. Separate the components and construct a nucleotide be attaching a phosphate center to a deoxyribose center with the yellow bond straw and add the red Adenine bond as in Fig. 1



1. Do the same for all the remaining nitrogen bases.
2. Once these are completed, construct the double helix by using the hydrogen bond connector (white) and the remaining yellow connector bonds. When completed it should appear as in Fig.2

Fig.2

1. Place on the base by attaching to the 4 prong black center with the 3 “legs” and twist the helix to form the spiral structure.

Assessment Questions:

1. (1 pt) What is the general structure of the DNA molecule? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. (1 pt) Name the two molecules which alternate to make the upright or side portion of a DNA molecule. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. (1pt) What is the name of the specific molecule to which each nitrogenous base is attached? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. (1 pt) Name the molecules or parts of a nucleotide which join by a hydrogen bond to attach the double strand of DNA. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. (2 pts) If there are four thymine bases on your model, how many adenine will there be? Explain why? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

PART II Chromosome and DNA Replication

Procedure:

Your DNA model represents only a short portion of DNA in a chromosome, which is usually composed of thousands of nucleotides. Although your model is only a short portion, its replication is the same as that of an entire chromosome during mitosis and meiosis.

1. Working with your partner (the person sitting next to you. See me if your partner is absent.) The first person should remove the model from the stand and flatten it out and “unzip the DNA” molecule simulating the process of DNA replication.
2. The second person should remove the model from the stand and flatten it out and dismantle the model leaving the nucleotides intact.
3. Using the “free floating” nucleotides, complete the process of DNA replication and place the completed model on the stands.

Assessment Questions:

1. (1 pt) What is the base sequence found on the right side of your DNA molecule? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(1 pt) Based on the above information, what is the base sequence found on the left side. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. (5 points) Explain the process of DNA replication. Compare and contrast the final copies. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_