In-class assignment: Discovering the structure of DNA

Your role during this assignment: The molecular structure (shape) of DNA is linked with its role (function) in gene expression, heredity, and pathologies, like cancer. You and your partners will create a 2D model of DNA using the materials in the bag provided by the teacher. As you construct your model, you will also answer questions that will help you understand the building blocks of DNA, and how these interact to make a polymer. On the opposite side of this document, you will answer the questions and submit this to the teacher.

A. Identify the parts of a nucleotide: As you identify the monomers of a nucleic acid, answer the following questions:

1. What are the three components of a nucleotide?
2. Which component is central to the entire nucleotide?
3. With a dry-erase pen, number the carbons (one through five) on the molecule from #2.
4. Which component is bound to the 5' carbon of the molecule from #2?
5. Which component is bound to the 1' carbon of the molecule from #2?
6. What chemical group is bound to the 3' carbon of the molecule from #2?
7. Which images correspond to a purine? Which to a pyrimidine? Label them.

B. Create a single-stranded polynucleotide: As you can tell, there are attachment sites for adjacent nucleotides and the bases. Create four nucleotides: one with a purine base and three with pyrimidine bases. Answer the following questions:

1. What portions of the nucleotide make up the "backbone" of DNA?
2. What chemical reaction occurs when two nucleotides bond together?
3. What is the name of the bond that is formed between the nucleotides in #2?
4. What chemical groups are removed from the nucleotides and from where?
5. What do the chemical groups in #4 produce?

With a dry-erase marker, identify adenine, thymine, and two cytosines among the four bases you collected by writing their abbreviation (A, T, or C) on the appropriate purine or pyrimidine token.

C. Create a double-stranded DNA molecule with the help of Photo 51: Answer the following questions below before making a double-stranded DNa molecule: Collect and examine Photo 51, and use it to create the following DNA strand:

1. Identify the 5' end of your daughter strand (use the dry-erase marker).
2. Identify the 3' end of your daughter strand (use the dry-erase marker).
3. Create a second polynucleotide strand composed of four nucleotides according to the following information:

5' - A T C C - 3'

3' - T A G G - 5'

4. Where would you expect to find hydrogen bonds in your DNA strand?
5. Is the following statement true or false? If false, change the word in bold to make the statement true:

The individual hydrogen bonds found between the nitrogenous bases on opposing daughter strands vary in **strength**

C. Discussion (10 pts): **Bag no.:** **Names:**

Questions:	Answers:
1. Which of the following descriptors correctly describes the daughter strands of a DNA molecule: identical or complementary? Explain your answer. (2 pts).	Circle your choice: **Identical** or **Complementary** Explanation:
2. An enzyme called RNA polymerase can pull apart the two daughter strands of a DNA molecule. Which stretch of DNA would this molecule have greater difficulty pulling apart: **AAAACGTTAT** or **GGGCGATCCG**? Explain your answer. (2 pts.)	Stretch of DNA: Explanation:
3. a) DNA has a three-dimensional structure, not a 2D structure. According to the picture on the right, DNA is asymmetrical along its longitudinal axis. Explain how this could affect its structure (i.e. shape). (1 pt) b) Proteins interact with DNA all the time, but proteins require space along the DNA in order to interact with it properly. Where along DNA's shape are proteins **more likely to interact**? Circle the area on the picture. Explain your answer. (2 pts)	 a) b)
4. a) At the time, proteins and DNA were well understood. What molecule was missing to complete the central dogma of biology? In what ways does this molecule contribute to the central dogma? Name two. (1 pt) b) If protein is the house and DNA is the only copy of the blueprint, how does mRNA fit into this analogy? (1 pt)	a) b)
5. Francis Crick and James Watson would go on to win the Nobel prize in 1962. The stolen data used to help discern the molecular structure of DNA was collected from Rosalind Franklin, whom never received any prizes for her work during her lifetime. Do you think it's important to credit every contribution to a discovery, no matter how big or small? Explain. (1pt)	