

Name _____ Period _____ Date _____

DNA MODEL

Your objective is to design and build a 3D model of a DNA molecule. The model is can NOT be built using an available “kit.” You may work alone or with ONE partner

Blueprint of Model (10 points)

Due Date _____

The first component of the project is creating a ONE PAGE “blueprint” of your planned DNA model. The blueprint is a drawing of your planned model that:

1. Has correct base pairing (A-T and C-G) for at least 10 nucleotide pairs
2. Depicts that the bases are on the “inside” and the double stranded sugar-phosphate backbone is on the “outside”
3. Shows a consistent diameter backbone (doesn’t zig-zag)
4. Depicts the bases radiating from the sugar in the nucleotides
5. Includes the sequence of DNA to be modeled. Sequence has A, T, C and G all present. You can either make up a sequence or model the actual sequence of a gene (see below for directions)
6. Includes the estimated full size scale of the model (between 6 inches and 4 feet)
7. Notes how the model will be displayed (on a stand, hanging, self-supporting, internal or external frame)
8. Lists materials to be used to build the model
9. Is completed on unlined, white paper. The blueprint should not be sloppy, and it should be clear that some effort went into drawing it. Blueprints can be drawn by hand or on a computer.

Class time will not be provided for working on or photocopying the blueprints. If you are working with a partner, you may turn in the same blueprint (either printed twice or photocopied). However, **both partners must turn in a blueprint and it must have both partners names listed.**

Completed DNA Model (50 points)

Due Date _____

Completed model are due at the beginning of class. Class time will not be provided for working on the DNA models. Do not procrastinate!

The models can be built to varying complexity. However, the following are **REQUIRED COMPONENTS** for the model:

- The model is sturdy enough to be handled and touched without breaking. 2 points
- The model is between 6 inches and 4 feet long. 2 points
- The DNA molecule depicts all four types of nucleotides (A, T, C and G). 4 points
- The DNA bases are arranged in complementary pairs (A-T, C-G). 4 points
- The sugar phosphate “backbone” of the two helices is on the “outside”, bases are on “inside.” 4 points
- The bases radiate from the sugar. 3 points
- There are at least 10 nucleotide pairs. 2 points
- The diameter of the double helix backbone is consistent. 1 point
- There is a key to the parts of the DNA shown in the model. 3 points

Completing just the REQUIRED COMPONENTS will earn a score of 25 points out of 50 points possible. To earn the other 25 points (or more), select as little or as much as you like from the following menu of **OPTIONAL FEATURES**.

There are a potential 80 points from OPTIONAL FEATURES. There is absolutely no expectation that students are completing all of the optional features. Rather, it’s a chance for students to pick and choose what to include in the model they build. Aim for about 25-30 of the optional points, and you can earn a 100% on the assignment.

Points Possible	DNA Model Optional Features
3	Number of nucleotide pairs <ul style="list-style-type: none"> 11-24 (score 2) or 25 or more (score 3)
2	The blueprint matches completed product <ul style="list-style-type: none"> The blueprint sequence, scale and appearance match the completed model (score 2) <i>Either</i> the sequence, scale or appearance aren't the same (score 1)
5	10 nucleotide pairs per complete helix turn <ul style="list-style-type: none"> The model has 10 pairs per turn on its own, without being twisted by hand (score 5) The model has to be twisted by hand to get its correct shape (score 3)
2	Correct number of hydrogen bonds between bases <ul style="list-style-type: none"> There are 2 between A and T and 3 between C and G (score 2) The key has the correct number of bonds, but the model itself doesn't (score 1)
5	The two complementary strands are antiparallel <ul style="list-style-type: none"> Both strands are correct and labeled (sugar end is 3', phosphate end is 5') (score 5) Both strands are correct, but they are not labeled (score 2)
10	The shape of purines and pyrimidines in model mimic chemical shape <ul style="list-style-type: none"> The molecular structure of each base is clear and very detailed. <u>Each atom</u> (including hydrogens) of the molecule has been modeled (score 10) The molecular structure of each base has been depicted, BUT each atom is not <i>modeled</i> (score 6) I can tell the number of "rings" in each base, but not the exact molecular structure (score 5) The molecular structure has been depicted for only one purine & pyrimidine or as part of the key (score 3) I can tell that one is bigger than the other, but not the number of rings or the molecular structure (score 2)
8	The deoxyribose molecule chemical shape is depicted <ul style="list-style-type: none"> The molecular structure of each sugar, with each atom, is clear and very detailed (score 8) The molecular structure of each sugar has been depicted, BUT each atom is not <i>modeled</i> (score 5) The molecular structure has been depicted for only one deoxyribose molecule or as part of key (score 1)
5	The phosphate molecule chemical shape is depicted <ul style="list-style-type: none"> The molecular structure of each phosphate, with each atom, is clear and detailed (score 5) The molecular structure of each phosphate has been depicted, BUT each atom is not <i>modeled</i> (score 3) The molecular structure has been depicted for only one phosphate molecule or as part of key (score 1)
10	Twist of helix shows two strands in parallel rotating around a central axis
10	Strands of the model can be separated or partially separated. <ul style="list-style-type: none"> The strands easily separate and come back together (score 10) It is hard to separate the bases or they do not go back together easily (score 3)
5	Model has artistic merit. It is striking, colorful, unique, and dramatic. <ul style="list-style-type: none"> The model obviously took a lot of time, effort and creativity. It is one of the best I've seen (score 5) It is nicely built and looks nice, but it isn't that unique (score 3)
5	Model is made of materials that can be recycled or composted <ul style="list-style-type: none"> Every single part of the model will be reused or easily recycled or composted (score 5) Some (but not all) of the model will be reused, recycled or composted (score 3)
10	Model depicts an actual DNA sequence (ask for specific directions) <ul style="list-style-type: none"> All the information in step 2 of the directions is included, is accurate, understandable and nicely presented (score 10) Most of the information in step 2 of the directions is included, is accurate, understandable and nicely presented (score 7) Some of the information in step 2 of the directions is included. Or, some of the information is inaccurate, confusing or unclearly presented 7 (score 3)
10	Description of the protein and disease associated the actual DNA sequence modeled (ask for specific directions) <ul style="list-style-type: none"> All the information in step 4 of the directions is included, is accurate, understandable and nicely presented (score 10) There is a description of the protein and/or disease, but it looks like it was copied and/or you can't verbally explain what it means (score 3) The name of the protein and disease the gene codes for is given, but no description is provided (score 2)