# Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**DNA to Protein** … What is DNA?

a. DNA consists of a \_\_\_\_\_ helix of \_\_\_\_\_ strands.

Each nucleotide subunit of DNA consists of a \_\_\_\_\_ \_\_\_\_\_, a \_\_\_\_\_ group, and a \_\_\_\_\_ base.

The nitrogenous bases can be either a \_\_\_\_\_ like \_\_\_\_\_ and \_\_\_\_\_ or a \_\_\_\_\_\_\_\_\_\_\_\_\_\_ like \_\_\_\_\_ and \_\_\_\_\_.

b. Make a sketch of the 4 possible DNA nucleotide subunits:

c. Two strands of DNA are held together by \_\_\_\_\_ bonds between the \_\_\_\_\_ base pairs.

Adenine (A) only bonds with \_\_\_\_\_ (T). Cytosine (C) bonds only with \_\_\_\_\_ (G). The specificity in base pairing means that the strands are \_\_\_\_\_ This will allow one strand to act as a \_\_\_\_\_ for the synthesis of a new strand during DNA \_\_\_\_\_.

d. The two DNA strands run in \_\_\_\_\_ directions. In other words, the two strands are \_\_\_\_\_. The entire molecule is twisted into a \_\_\_\_\_ \_\_\_\_\_.

2. **What is DNA?**

a. The structure of a DNA molecule is a \_\_\_\_\_ \_\_\_\_\_, much like a \_\_\_\_\_ twisted into a \_\_\_\_\_ shape.

b. \_\_\_\_\_ are found in pairs (making up the rungs of the ladder).

c. DNA bases generally pair \_\_\_\_\_ (\_\_\_\_\_) with \_\_\_\_\_ (\_\_\_\_\_) and \_\_\_\_\_ (\_\_\_\_\_) with \_\_\_\_\_ (\_\_\_\_\_). *Fill in the names of the nitrogen bases using the previous information*.

d. Draw a sketch of the four nucleotides below, showing the nitrogen bases (G, C, A, T), the ribose sugar (pentagon shape), the Phosphate group (P) and hydroxide group (OH) as in the simulation:

3. “**Transcribe and Translate a Gene**.”

a. Complete the transcription. Write down your “nitrogen base” sequence ABOVE the letters:

# A T T A C G A T C T G C A C A A G A T C C T

b. The DNA that makes up the human [\_\_\_\_\_\_\_\_\_](javascript:glossary('genome');) can be subdivided into information bytes called [\_\_\_\_\_\_\_\_\_](javascript:glossary('gene');) . Each gene encodes a unique [\_\_\_\_\_\_\_\_\_](javascript:glossary('protein');) .

c. Cells use the two-step process of [\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_](javascript:glossary('transcription');) and [\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_](javascript:glossary('translation');) to read each gene and produce the string of [\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_](javascript:glossary('amino%20acids');) that makes up a protein.

d. Define “transcription”:

e. Define “translation”:

f. Fill in the following:

In the \_\_\_\_\_\_\_\_\_\_\_\_\_\_, the cell’s machinery copies the gene sequence into \_\_\_\_\_\_\_\_\_\_\_\_\_\_ RNA (mRNA).

mRNA is similar to DNA in that it possess four \_\_\_\_\_\_\_\_\_\_\_\_\_\_ bases. However, mRNA has \_\_\_\_\_\_\_\_\_\_\_\_\_\_ instead of \_\_\_\_\_\_\_\_\_\_\_\_\_\_.

Notice the DNA nucleotide sequence and the corresponding mRNA sequence. Complete it:

DNA: A T G G C T G T T C A G

mRNA:

The mRNA travels from the \_\_\_\_\_\_\_\_\_\_\_\_\_\_ to the \_\_\_\_\_\_\_\_\_\_\_\_\_\_.

Part 2

Use Chapter 9 or class notes to answer the following questions:

1. Name the four major parts of a nucleotide:



6. How many strands of nucleotides make up a DNA molecule? \_\_\_\_\_\_\_\_\_ How do these strands align themselves?
7. What shape does the DNA molecule take on? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
8. Which parts of the nucleotide make up the sides of the DNA “ladder”?
9. Which parts of the nucleotide make up the “rungs” of the DNA “ladder”?
10. Which nitrogen bases are Purines?
11. Which nitrogen bases are Pyrimidines?
12. Which bases pair together in a DNA molecule to hold the two sides of the “ladder” together?
13. What holds the nitrogen bases together?
14. Make a sketch of a DNA strand using the nucleotide sequence: G G T C A A T C as the “sense” strand. (1) show the complimentary strand, (2) show the bonds between the nitrogen bases.

Sense Strand Template Strand

G C

G

T

C

A

A

T

C

Answer Key

“What is DNA?”

a. **DNA** consists of a **double** helix of **two** strands.

Each nucleotide subunit of DNA consists of a **deoxyribose sugar**, a **phosphate** group, and a **nitrogenous** base.

The nitrogenous bases can be either a **purine base** like **adenine** and **guanine** or a **pyrimidine base** like **cytosine** and **thymine**.

b. Make a sketch of the nucleotide subunit:

c. Two strands of DNA are held together by **hydrogen** bonds between the **nitrogenous** base pairs.

Adenine (A) only bonds with **thymine** (T). Cytosine (C) bonds only with **guanine** (G). The specificity in base pairing means that the strands are **complementary**. This will allow one strand to act as a **template** for the synthesis of a new strand during DNA **replication**.

d. The two DNA strands run in **opposite** directions. In other words, the two strands are **anti-parallel**. The entire molecule is twisted into a **double helix**.

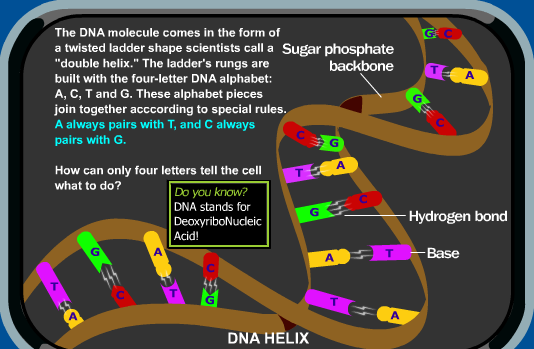
2. DNA molecule

a. The structure of a DNA molecule is a **double helix**, much like a **ladder** twisted into a **spiral** shape.

b. **Nitrogenous bases** are found in pairs (making up the rungs of the ladder).

c. DNA bases generally pair **G** (**guanine**) with **C** (**cytosine**) and **A** (**adenine**) with **T** (**thymine**). Click on the “base pairs” to name each base.

d. Draw a sketch of the four nucleotides below, showing the nitrogen bases (G, C, A, T), the ribose sugar (pentagon shape), the Phosphate group (P) and hydroxide group (OH) as in the simulation:



Nitrogen Base

3. “Transcribe and Translate a Gene.”

a. Complete the transcription. Write down your “nitrogen base” sequence above the letters:

##### T A A T G C T A G A C G T G T T C T A G G A

# A T T A C G A T C T G C A C A A G A T C C T

b. The DNA that makes up the human [**genome**](javascript:glossary('genome');) can be subdivided into information bytes called [**genes**](javascript:glossary('gene');). Each gene encodes a unique [**protein**](javascript:glossary('protein');).

c. Cells use the two-step process of **[transcription](javascript:glossary('transcription');)** and [**tra****nslation**](javascript:glossary('translation');) to read each gene and produce the string of [**amino acids**](javascript:glossary('amino%20acids');) that makes up a protein.

d. Define “transcription”:

**the process of building an RNA copy of a DNA sequence**

e. Define “translation”:

the process of matching amino acids to corresponding sets of three bases (codons) and linking them into a protein

f. Fill in the following:

In the **nucleus**, the cell’s machinery copies the gene sequence into **messenger** RNA (mRNA).

mRNA is similar to DNA in that it possess four **nitrogenous** bases. However, mRNA has **uracil** instead of **thymine**.

Notice the DNA nucleotide sequence and the corresponding mRNA sequence.

DNA: A T G G C T G T T C A G

mRNA: U A C C G A C A A G U C

#### The mRNA travels from the **nucleus** to the **cytoplasm**.

Part 2

1. Name the four major parts of a nucleotide:

**Phosphate Group**

**Deoxyribose Sugar**

**Nitrogen Base**

**Hydroxyl Group (OH)**

1. How many strands of nucleotides make up a DNA molecule? \_\_\_**2**\_\_\_\_\_ How do these strands align themselves?

**The strands align themselves oppositely (going in opposite directions)**

1. What shape does the DNA molecule take on? \_\_\_**Double Helix**\_\_\_
2. Which parts of the nucleotide make up the sides of the DNA “ladder”?

**Phosphate Group & Sugar**

1. Which parts of the nucleotide make up the “rungs” of the DNA “ladder”?

**Nitrogen Bases with Hydrogen Bonds**

1. Which nitrogen bases are Purines? **Adenine & Guanine**
2. Which nitrogen bases are Pyrimidines? **Thymine & Cytosine**
3. Which bases pair together in a DNA molecule to hold the two sides of the “ladder” together?

**G ≡ C A = T**

1. What holds the nitrogen bases together? **Hydrogen Bonds**
2. Make a complementary strand of a DNA strand using the nucleotide sequence: G G T C A A T C as the “sense” strand. (1) show the complimentary strand, (2) show the bonds between the nitrogen bases.

Sense Strand Template Strand

G C

G **C G ≡ C has three H bonds**

T **A**

C **G**

A **T A = T has two H Bonds**

A **T**

T **A**

C **G**