

## Unit 9: DNA & PROTEIN SYNTHESIS PACKET

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This packet is designed to help you understand several concepts about **DNA & PROTEIN SYNTHESIS**.

As you practice the exercises on each handout, you will be able to:

**HS-LS1-1 DNA & PROTEIN SYNTHESIS**: Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells. (11.1.2)

- ***HS10-LS1-1.1*** Know that in all organisms, DNA provides the instructions for specific characteristics.
- ***HS10-LS1-1.3*** Describe the structure of DNA.
- ***HS10-LS1-1.4*** Describe the process of DNA Replication.
- ***HS10-LS1-1.5*** Know that a gene is a segment of DNA with a specific nucleotide sequence that determines a sequence of amino acids in a protein .
- ***HS10-LS1-1.6*** Describe the structure of RNA.
- ***HS10-LS1-1.7*** Decode and analyze a genetic sequence from transcription to translation resulting in an amino acid sequence.

Record this packet in the Table of Contents for Unit 9.  
This will be the next “HANDOUT.”

Contained in this Packet:

1. Introduction to DNA Questions
2. Homemade Monomer/Polymer PART #1
3. Homemade Monomer/Polymer PART #2
4. Replication Questions
5. Introduction to RNA Questions
6. Transcription Questions
7. Translation Questions
8. Protein Synthesis Worksheet



**UNIT 9: DNA & PROTEIN SYNTHESIS**  
**INTRODUCTION TO DNA Questions**

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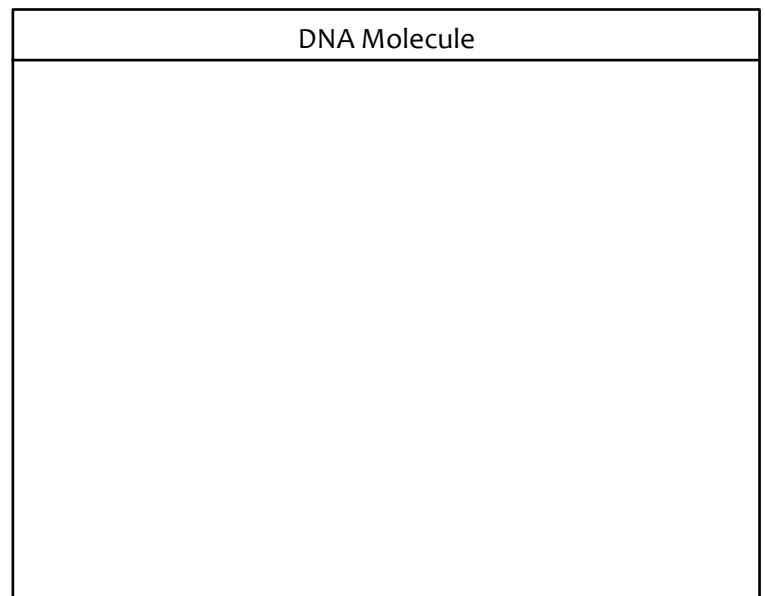
The purpose of this handout is to address the following learning targets:

- Know that in all organisms, DNA provides the instructions for specific characteristics. (*HS10-LS1-1.1*)
  - Describe the structure of DNA. (*HS10-LS1-1.3*)
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1. What does DNA stand for?
  
2. What is DNA?
  
3. In order to be considered alive, all living things must contain DNA. Why is DNA important for all living things?
  
4. What are the building blocks of nucleic acids such as DNA?
  
5. Are building blocks considered monomers or polymers?
  
6. What connection can you make between DNA, monomers and polymers?
  
7. **Draw** a simple example of a nucleotide. **Label** the following items:
  - 5-carbon sugar (deoxyribose)
  - nitrogen bases
  - phosphate functional group

| DNA Nucleotide |
|----------------|
|                |

8. What are the names of all the nitrogen bases that can be found in DNA?
9. Which nitrogen bases in question #8 are purines?
10. Which nitrogen bases in questions #8 are pyrimidines?
11. Which nitrogen bases pair with one another in a DNA molecule?
12. What connection can you make between which nitrogen bases pair and whether these bases are purines or pyrimidines?
13. Which base can only be found in DNA and NOT RNA?
14. When DNA nucleotides chemically bond to make a DNA molecule, these nucleotides will only bond in a specific way to create a specific structure. Knowing this, **draw** and **describe** the structure/orientation of a DNA molecule.



15. THINK ABOUT THIS!!  
Prokaryotes and Eukaryotes are different from one another in several key characteristics. Do Prokaryotes and Eukaryotes both contain DNA?





**UNIT 9: DNA & PROTEIN SYNTHESIS**  
**Homemade Monomer/Polymer: PART #2**

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**Objectives:**

The purpose of this activity is to provide practice so that students can:

1. Know that in all organisms, DNA provides the instructions for specific characteristics. (**HS10-LS1-1.1**)
2. Describe the structure of DNA. (**HS10-LS1-1.3**)

**Directions:**

**BUILDING MONOMERS**

1. Build nucleotides from the materials provided (there will be enough to build 4). Tape 1 example of a water molecule and nucleotide on the paper (SAVE the other 3 nucleotides). Label the following identifying characteristics:
  - phosphate functional group
  - 5-carbon sugar (deoxyribose)
  - nucleotide
  - nitrogenous base
  - water molecule

2. What does dehydration synthesis have to do with the process of building the monomer in question #1? (**CER**)

**BUILDING POLYMERS**

1. Build a single strand of DNA (polymer) from the 3 nucleotides saved from Part #1 using the process of dehydration synthesis. Have this single strand inspected (**GET INITIALS**).
2. **AFTER** inspection, **DRAW** and **LABEL** a simplified version of the polymer made in step #1.
  - a) Use the following code:
    - P = phosphate functional group
    - A = adenine
    - G = guanine
    - D = deoxyribose (5 carbon sugar)
    - C = cytosine
    - T = thymine
  - b) Label the following identifying characteristics:
    - 5' end & 3' end
    - polymer
    - sugar/phosphate backbone
    - monomer
    - nucleotide

3. Build 1 more nucleotide so that each nitrogenous base is represented. You should now have 4 nucleotides total. Use these nucleotides to build a double strand of DNA using dehydration synthesis. **BEFORE** taping, have this double strand inspected (**GET INITIALS**).
4. **AFTER** inspection, tape an example of a double strand of DNA on paper. Identify the following parts:
  - nucleotide
  - nucleic acid
  - monomer
  - polymer
  - 5' end & 3' end
  - sugar/phosphate backbone

5. Briefly describe the process of dehydration synthesis (this can be a definition).

6. DNA is often described as aligning “anti-parallel”. What does ‘anti-parallel’ mean **AND** why is it necessary for DNA to line up in this way? (**CER**)



**UNIT 9: DNA & PROTEIN SYNTHESIS**  
**DNA REPLICATION Questions**

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The purpose of this handout is to address the following learning targets:

- Describe the process of DNA Replication. (**HS10-LS1-1.4**)
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1. When does Replication occur?
  
2. What is the purpose of Replication?
  
3. Where does Replication occur?
  
4. What is the 1<sup>st</sup> step in Replication?
  
5. What is the 2<sup>nd</sup> step in Replication?
  
6. What is the name of a very important enzyme involved in Replication?
  
7. Which direction is the NEW strand made during Replication?
  
8. What is produced when Replication is complete?



**UNIT 9: DNA & PROTEIN SYNTHESIS**  
**INTRODUCTION TO RNA Questions**

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The purpose of this handout is to address the following learning targets:

- Describe the structure of RNA. (**HS10-LS1-1.6**)
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1. RNA is a monomer / polymer that is made from monomers / polymers called \_\_\_\_\_.
2. Draw a simple example of a RNA nucleotide and label the identifying characteristics.

|                |
|----------------|
| RNA Nucleotide |
|                |

3. What is dehydration synthesis?
4. What are 3 major differences between DNA and RNA?
5. What are the 4 bases used in RNA?
6. What are the RNA nitrogenous bases that are purines?
7. What are the RNA nitrogen bases that are pyrimidines?
8. Which RNA bases pair with one another?
9. What is the purpose of RNA?
10. Name 3 types of RNA AND the function of each.



**UNIT 9: DNA & PROTEIN SYNTHESIS**  
**TRANSCRIPTION Questions**

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The purpose of this handout is to address the following learning targets:

- Know that a gene is a segment of DNA with a specific nucleotide sequence that determines a sequence of amino acids in a protein. (**HS10-LS1-1.5**)
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1. What is the purpose of RNA?
2. What is the purpose of Transcription?
3. Where does Transcription occur?
4. What is the 1<sup>st</sup> step in Transcription?
5. What is the 2<sup>nd</sup> step in Transcription?
6. What is the name of the main enzyme used during Transcription? What does this enzyme do? (use the enzyme name to determine the function)
7. What is produced during Transcription?
8. What is the purpose of mRNA?



**UNIT 9: DNA & PROTEIN SYNTHESIS**  
**TRANSLATION Questions**

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The purpose of this handout is to address the following learning targets:

- Know that a gene is a segment of DNA with a specific nucleotide sequence that determines a sequence of amino acids in a protein. **(HS10-LS1-1.5)**
  - Decode and analyze a genetic sequence from transcription to translation resulting in an amino acid sequence. **(HS10-LS1-1.7)**
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1. What is the purpose of RNA?
2. What is the purpose of Translation?
3. Where does Translation occur?
4. What is a codon?
5. What is the purpose of a codon?
6. Where can codons be found?
7. What is the purpose of rRNA in Translation?
8. What is the purpose of tRNA in Translation?
9. What is a peptide bond?
10. What is another name for a polypeptide chain?





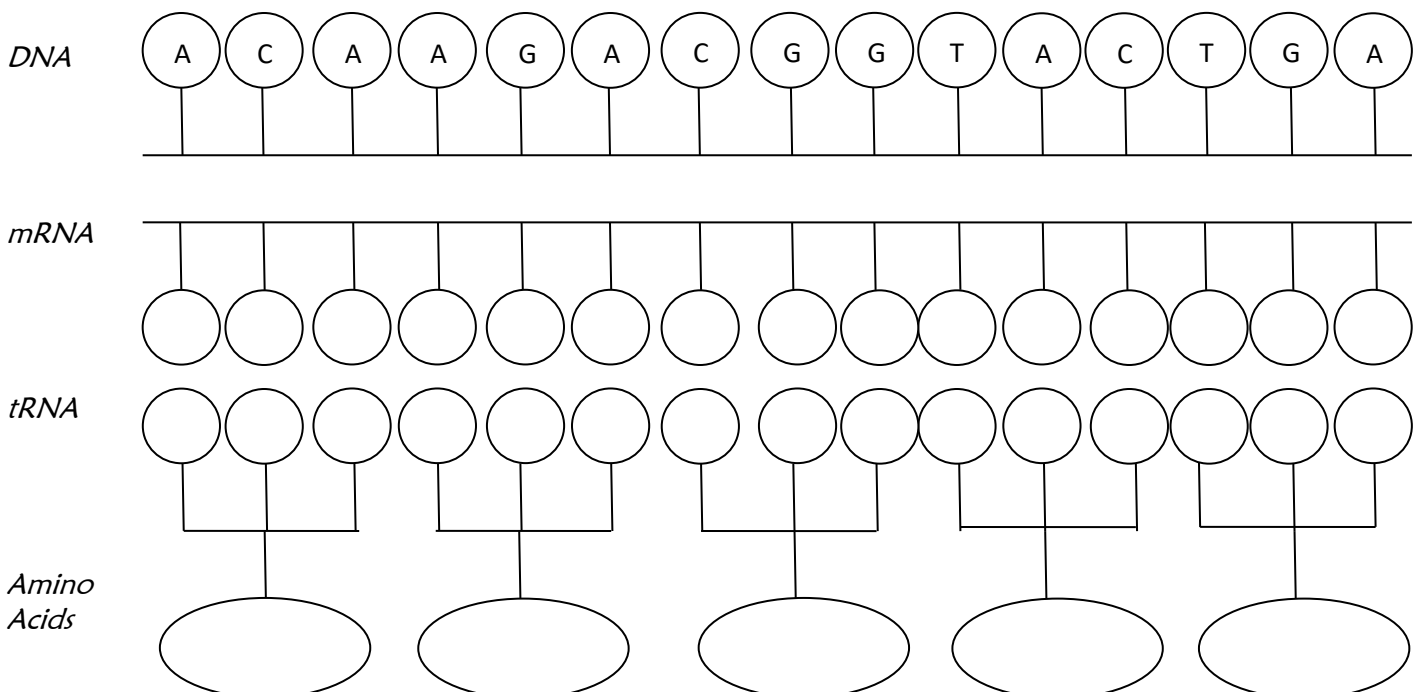
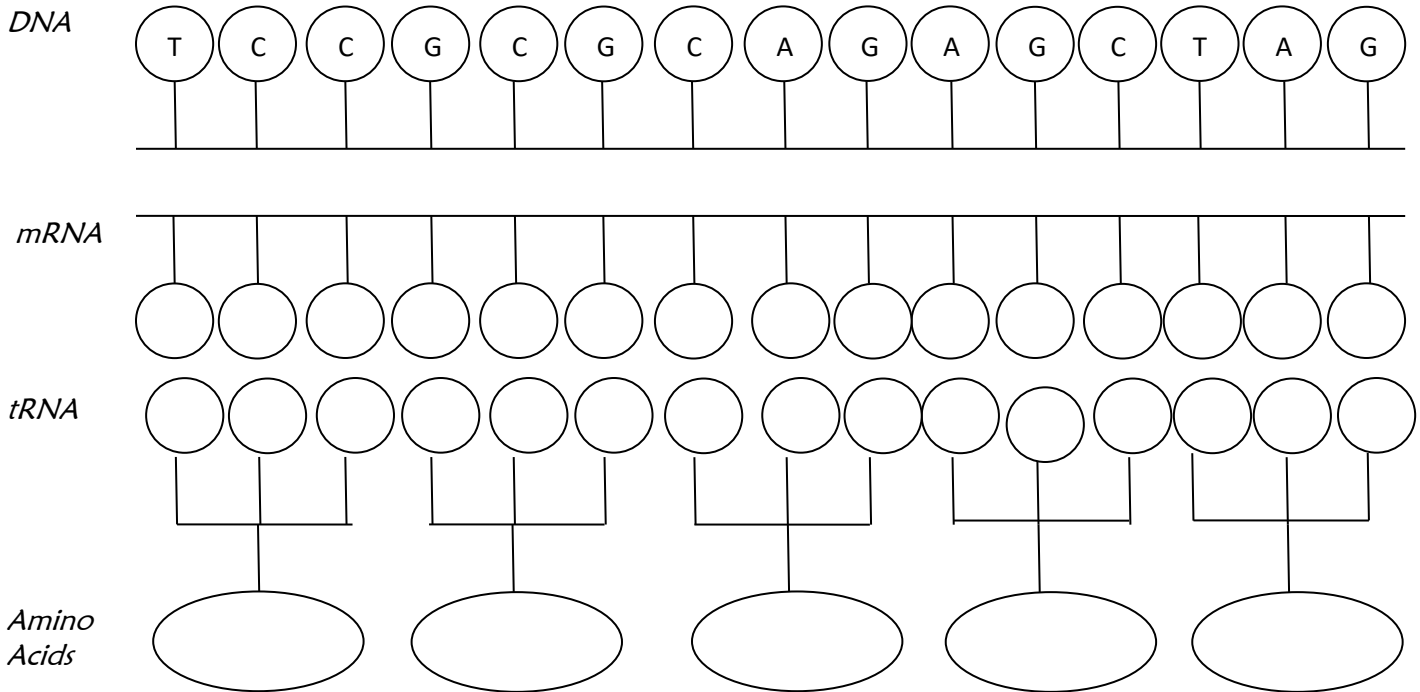
Unit 9: DNA & Protein Synthesis  
Protein Synthesis Worksheet

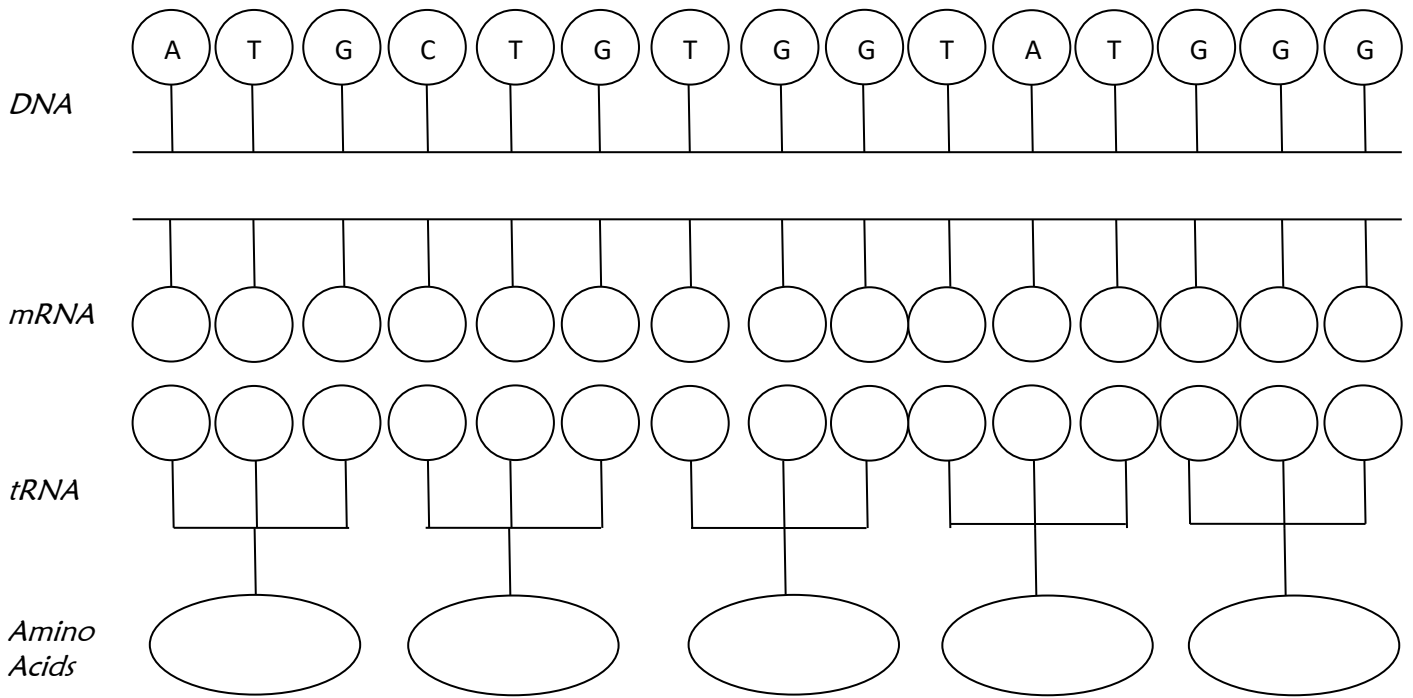
The purpose of this handout is to address the following learning targets:

- Know that a gene is a segment of DNA with a specific nucleotide sequence that determines a sequence of amino acids in a protein. **(HS10-LS1-1.5)**
- Decode and analyze a genetic sequence from transcription to translation resulting in an amino acid sequence. **(HS10-LS1-1.7)**

**Directions:**

- Transcription:
  - Use the DNA strand to create an mRNA strand.
- Use a green colored pencil to identify & label codons.
- Use a blue colored pencil to identify & label anti-codons.
- Translation:
  - Use the mRNA codons to determine the appropriate tRNA anti-codons.
  - Use the mRNA codons & the Codon Wheel to determine the amino acid sequence.





**Answer the following questions in complete sentences using CER.**

1. A mutation was identified in the middle of a DNA template strand used in Transcription. This mutation resulted in a change in an mRNA codon from UAC to UAG. With this mutation, how will the protein be affected? (CER)
  
2. A mutation was identified in the middle of a DNA template strand used in Transcription. This mutation resulted in a change in an mRNA codon from UGA to GGA. With this mutation, how will the protein be affected? (CER)