Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Use notes and text to complete the worksheet.

**Purpose** To observe the process of DNA transcription and RNA translation in order to synthesize a protein molecule.

**Procedures & Calculations and Data**

1. Protein synthesis includes two major processes:

a. The processes of \_\_\_\_\_ and \_\_\_\_\_ describe the flow of information from \_\_\_\_\_ to \_\_\_\_\_ and ultimately to a \_\_\_\_\_ strand.

b. Transcription is the process wherein a molecule of \_\_\_\_\_ is synthesized along template strand of \_\_\_\_\_. DNA is actively \_\_\_\_\_ in the region of the nucleus called the \_\_\_\_\_.

c. Transcription begins with a \_\_\_\_\_, a sequence of DNA nucleotides (15-300 base pairs long) that serves as the site where \_\_\_\_\_ \_\_\_\_\_ binds.

d. RNA \_\_\_\_\_ II is an enzyme responsible for locating the starting point where the \_\_\_\_\_ helix will unwind.

e. RNA contains the nitrogenous base: \_\_\_\_\_ instead of thymine in the DNA molecule which is complementary to the nitrogenous base: \_\_\_\_\_. Sketch the RNA molecule being transcribed above the DNA template:

T A C T C G

f. RNA uses a \_\_\_\_\_ sugar rather than the deoxyribose sugar in DNA.

g. The “pre-RNA” is the strand taken directly from the DNA template. It needs to be processed (at its ends) to form the mRNA that will travel in the cytoplasm and find the ribosome for the next step in protein synthesis (translation).

h. Non-coding segments of mRNA are called \_\_\_\_\_. These do not take part in the coding of proteins. The \_\_\_\_\_ are segments of coding sequences.

2. \_\_\_\_\_ is the synthesis of a \_\_\_\_\_ strand (protein) using the genetic information present in the \_\_\_\_\_ molecule. It is during the translation process that the \_\_\_\_\_ language is \_\_\_\_\_ into \_\_\_\_\_ \_\_\_\_\_.

a. A \_\_\_\_\_ is an organelle composed of protein and \_\_\_\_\_ (ribosomal RNA). Ribosomes are the physical site of \_\_\_\_\_.

b. The \_\_\_\_\_ transcript leaves the nucleus through the nuclear pore in its membrane. The initiation of translation begins as the mRNA comes together at the ribosome with \_\_\_\_\_ (transfer RNA). The tRNA carries the first \_\_\_\_\_ \_\_\_\_\_ of the polypeptide. The tRNA attaches to the codon of the mRNA.

c. Every three nucleotides of the mRNA represents a \_\_\_\_\_ for a particular \_\_\_\_\_ \_\_\_\_\_. The incoming \_\_\_\_\_ contains an \_\_\_\_\_ which complements the codon. \_\_\_\_\_ bonds hold the codon (mRNA) and anticodon (tRNA) nucleotides together.

d. The nucleotide sequence of two or more tRNA anticodons are bonded together using \_\_\_\_\_ bonds which will form a polypeptide (protein). Through the process of hydrolysis (addition of water to break apart the molecules) a chain of polypeptides is formed.

3. Label the diagram below using the following terms: DNA, mRNA, nuclear membrane, tRNA, ribosome, polypeptide chain (protein)

3. Define the following terms and state what molecules are involved (*Use your textbook*).

Transcription 🡪

Codon 🡪

Anticodon 🡪

Translation 🡪

Answer Key

1. Protein synthesis includes two major processes:

a. The processes of **transcription** and **translation** describe the flow of information from **DNA** to **RNA** and ultimately to a **polypeptide** strand.

b. Transcription is the process wherein a molecule of **mRNA** is synthesized along template strand of **DNA**. DNA is actively **transcribed** in the region of the nucleus called the **nucleolus**.

c. Transcription begins with a **promoter**, a sequence of DNA nucleotides (15-300 base pairs long) that serves as the site where **RNA polymerase** binds.

d. RNA **polymerase** II is an enzyme responsible for locating the starting point where the **DNA** helix will unwind.

e. RNA contains the nitrogenous base: **uracil** instead of thymine in the DNA molecule which is complementary to the nitrogenous base: **adenine**. Sketch the RNA molecule being transcribed above the DNA template:

**A U G A G C**

T A C T C G

f. RNA uses a **ribose** sugar rather than the deoxyribose sugar in DNA.

g. The “pre-RNA” is the strand taken directly from the DNA template. It needs to be processed (at its ends) to form the mRNA that will travel in the cytoplasm and find the ribosome for the next step in protein synthesis (translation).

h. Non-coding segments of mRNA are called **introns**. These do not take part in the coding of proteins. The **exons** are segments of coding sequences.

2. **Translation** is the synthesis of a **polypeptide** strand (protein) using the genetic information present in the **mRNA** molecule. It is during the translation process that the **nucleotide** language is **translated** into **amino acids**.

a. A **ribosome** is an organelle composed of protein and **rRNA** (ribosomal RNA). Ribosomes are the physical site of **translation**.

b. The **mRNA** transcript leaves the nucleus through the nuclear pore in its membrane. The initiation of translation begins as the mRNA comes together at the ribosome with **tRNA** (transfer RNA). The tRNA carries the first **amino acid** of the polypeptide. The tRNA attaches to the codon of the mRNA.

c. Every three nucleotides of the mRNA represents a **codon** for a particular **amino acid**. The incoming **tRNA** contains an **anticodon** which complements the codon. **Hydrogen** bonds hold the codon (mRNA) and anticodon (tRNA) nucleotides together.

d. The nucleotide sequence of two or more tRNA anticodons are bonded together using **peptide** bonds which will form a polypeptide (protein). Through the process of hydrolysis (addition of water to break apart the molecules) a chain of polypeptides is formed.

3. Label the diagram below using the following terms: DNA, mRNA, nuclear membrane, tRNA, ribosome, polypeptide chain (protein)

3. Define the following terms and state what molecules are involved.

Transcription 🡪 **the process in which DNA is transcribed by mRNA (in the nucleolus of the nucleus) for transfer to the ribosomes (in the cytoplasm) for protein synthesis**

Codon 🡪 **the site of the three-nucleotide base sequence on the mRNA molecule that will transfer the DNA transcripted message to the tRNA molecule along the ribosome.**

Anticodon 🡪 **the site of the three-nucleotide base sequence on the tRNA molecule which complements the codon of the mRNA. The anticodon carries the message for a specific amino acid as part of the polypeptide chain en route to protein synthesis**

Translation 🡪 **the process in which mRNA translates the DNA transcripted message to the tRNA at the ribosome.**