Doodle Sheet – Unit 7: Protein Synthesis

(DNA/RNA/Protein Structure and Transcription & Translation)

Name _____

Day 1: Driving Question: How is DNA and RNA used to make Proteins?

A) **What do you know about DNA?** (**do not** worry about **DNA structure** yet)

Questions to consider: What is DNA? Where is DNA found? What does DNA do?
How is DNA related to chromosomes and genes?

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-
-
- Prepare to modify

B) **What do you know about DNA structure?**

-
-
-
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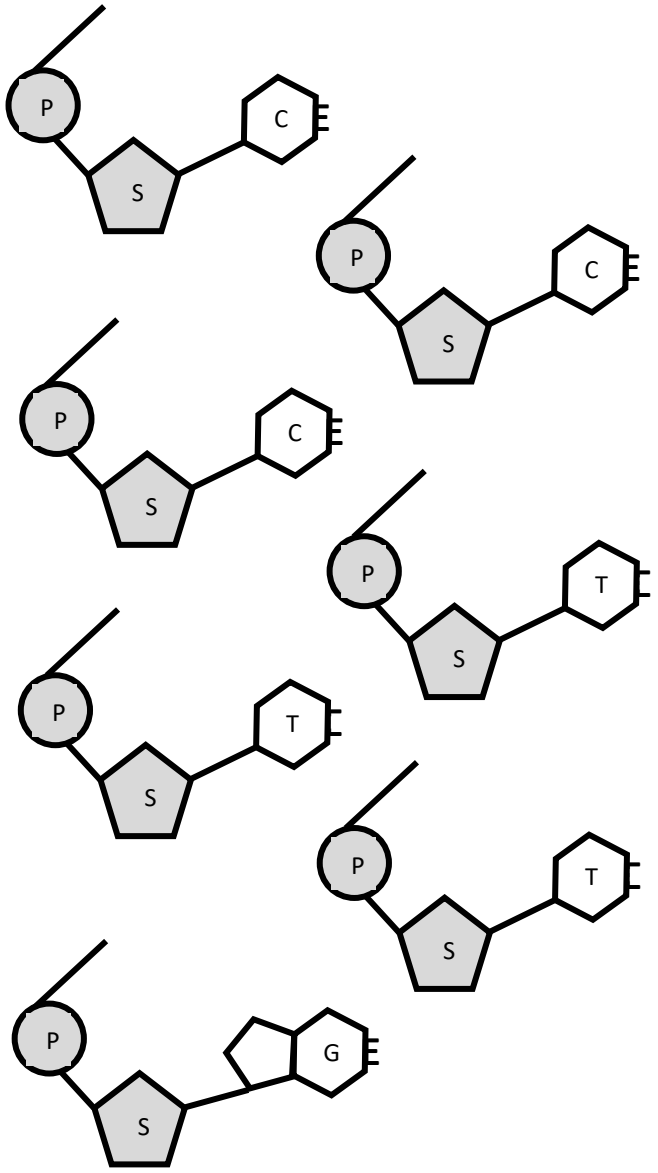
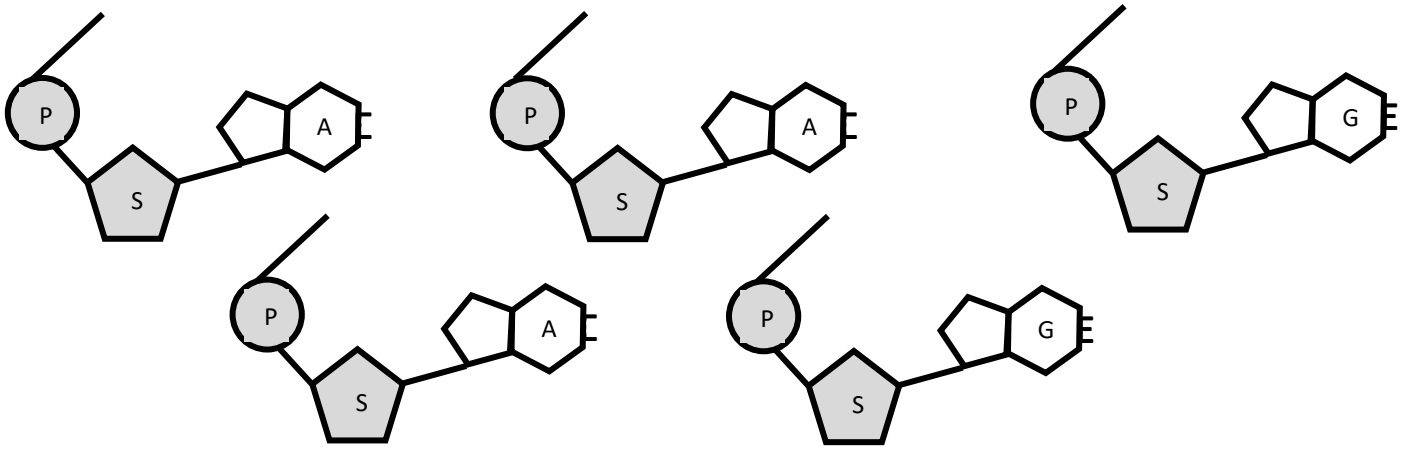
-
-
- Prepare to modify

Instructions: Create a DNA strand that consists of 6 base pairs.

- Carefully… Carefully, cut out all 12 nucleotides.
- Place all 12 nucleotides inside the dashed rectangular work area.
- **Correctly create a DNA strand that consists of 6 base pairs**
- The nucleotides may touch but there should be no overlap of the nucleotides.





Days 2, 3, 4: Driving Question: How is DNA and RNA used to make Proteins?

C) Go to the class website – Unit 7: view ***DNA Structure Presentation*** and ***DNA Structure Reading***.
https://sciencemathhelpcenter.weebly.com/unit-7---protein-synthesis.html

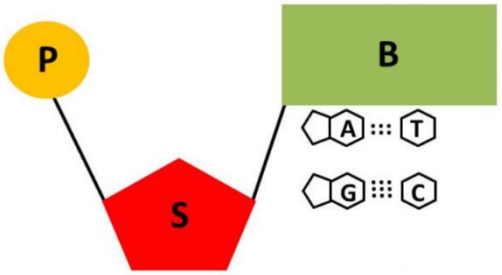
After completing your DNA model and after viewing the class website, what did you learn about DNA structure?

-
-
-
-
-
-
-
-
-
-
-
-
- Prepare to modify

Open space for students to take additional notes and draw diagrams…

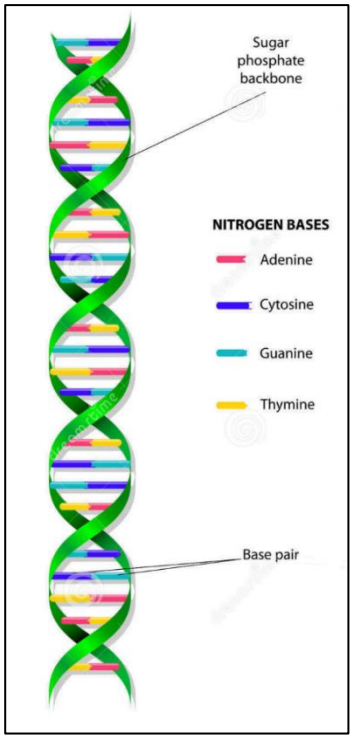
Nucleotide

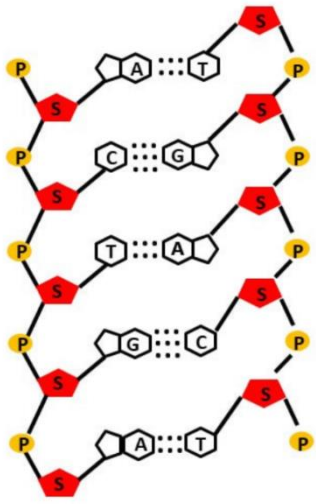
Monomer (building block) for
DeoxyriboNucleic Acids



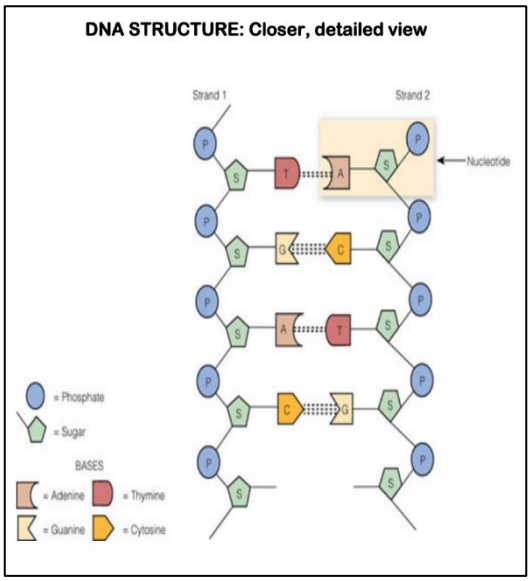
Purines Pyrimidines

Notes for Students

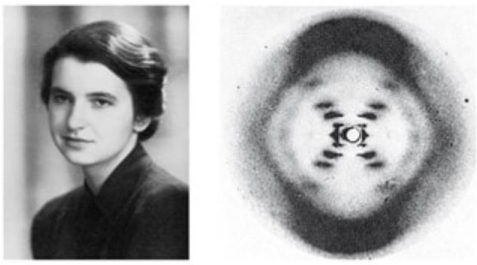




DNA is a double strand of nucleotides



Franklin produced a picture of the DNA molecule using this technique



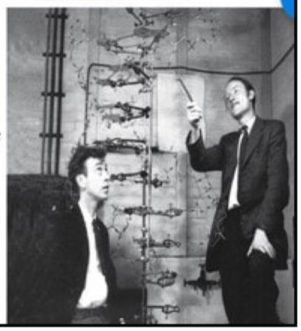
(a) Rosalind Franklin (b) Franklin's X-ray diffraction photograph of DNA

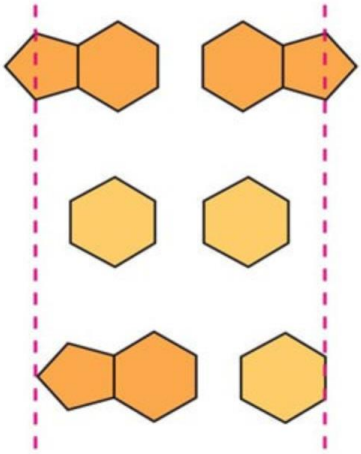
1952, Rosalind Franklin

1953, James Watson and Francis Crick

Franklin's X-ray crystallographic images of DNA enabled Watson and Crick to deduce that

1. DNA was helical
2. the width of the helix and the spacing of the nitrogenous bases
3. The pattern in the photo suggested that the DNA molecule was made up of two strands, forming a **double helix**



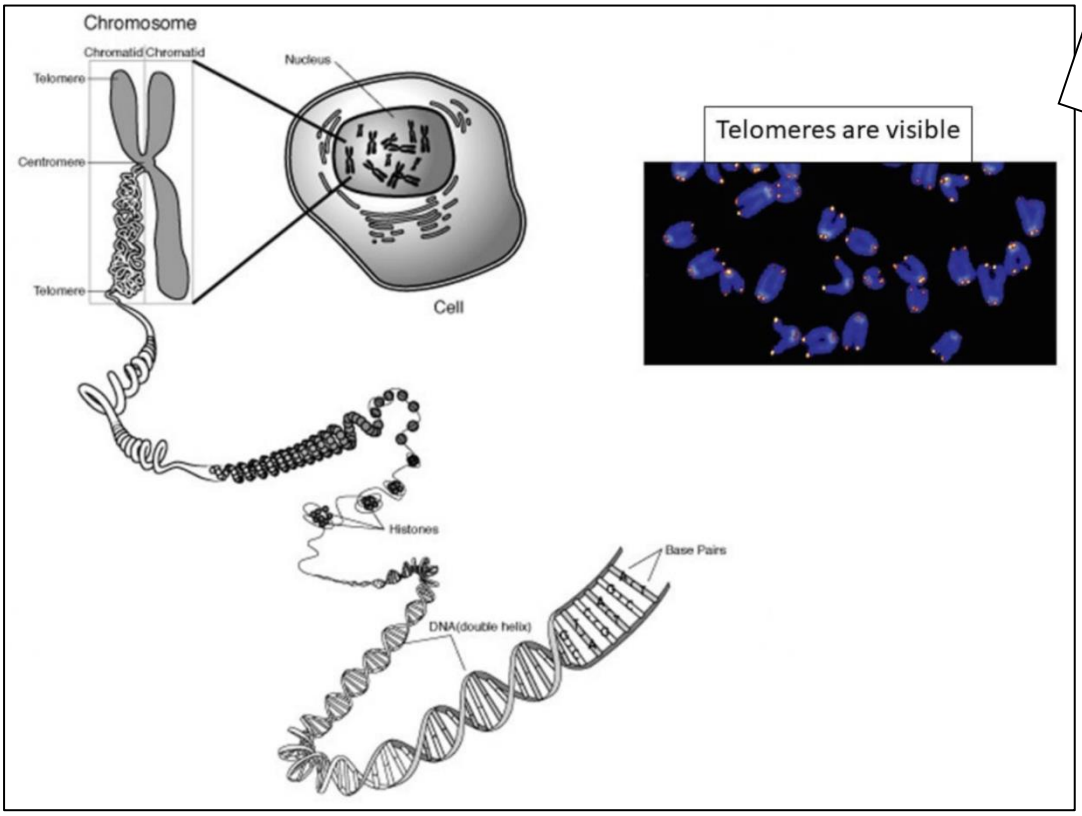


Purine + Purine: too wide

Pyrimidine + Pyrimidine: too narrow

Purine + Pyrimidine: width consistent with X-ray data

Notes for Students



Success Criteria – Teacher & Self-Assessment

Learning Target:

Construct a DNA molecule that contains 6 base pairs.

Use the white butcher block paper in front of room.

NO NOTES ---- NO PHONES ---- NO COMPUTERS

Success Criteria:

Graded as follows: (30 pts)

Creative – Accurate – Neat (6)
Show proper base pairing (6)
Show proper # of hydrogen bonds (6)
Show complete nucleotides (6)
Extra Credit: extra details and labeled helix

Labeled with the following:

Sugar-Phosphate backbone (2)
Purines vs Pyrimidines (2)
Hydrogen bonds (1)
Individual nitrogen bases (1)

Due at end of class

Rate your level of Understanding:

3 = Mastery/Expert 2 = Good Understanding 1 = Partial Understanding 0 = Very Little/No Understanding

Driving Question: How is DNA and RNA used to make Proteins?

D) Apply your knowledge of DNA structure to answer the following questions?

1) Assume 20% of the nitrogen bases of an organism's DNA consists of Adenine.
What percent of the nitrogen bases are Guanine?
What percent of the nitrogen bases are Thymine?
What percent of the nitrogen bases are Cytosine?

2) Assume 15% of the nitrogen bases of an organism's DNA consists of Guanine.
What percent of the nitrogen bases are Adenine?
What percent of the nitrogen bases are Thymine?
What percent of the nitrogen bases are Cytosine?

3) Assume 10% of the nitrogen bases of an organism's DNA consists of Thymine.
What percent of the nitrogen bases are Guanine?
What percent of the nitrogen bases are Adenine?
What percent of the nitrogen bases are Cytosine?

Success Criteria – Teacher & Self-Assessment

Learning Target: DNA structure

Assume 27% of the nitrogen bases of an organism's DNA consists of Thymine.
What percent of the nitrogen bases are Guanine?
What percent of the nitrogen bases are Adenine?
What percent of the nitrogen bases are Cytosine?

Rate your level of Understanding:
3 = Mastery/Expert 2 = Good Understanding 1 = Partial Understanding 0 = Very Little/No Understanding

Review Summary from Previous Unit

Terms	Concepts
DNA	**1. DNA has instructions (recipes) for making proteins.**
Gene	**2. A segment of DNA (gene) is responsible for a different protein or part of a protein.**
Proteins	**3. Proteins control all the functions in a cell**
	4. Every cell has a complete set of instructions for all proteins needed by the organisms
Mitosis	5. Growth occurs when cells divide by MITOSIS
	6. In mitosis, a cell divides to form 2 new cells with identical DNA. The DNA of the daughter cells is identical to that of the parent cell.
Gene Expression	7. Different genes are activated (expressed) in different cells as embryo develops. For each gene expressed, a different protein is made.
Cell Differentiation	8. Different proteins cause cells to develop different structures and different functions.

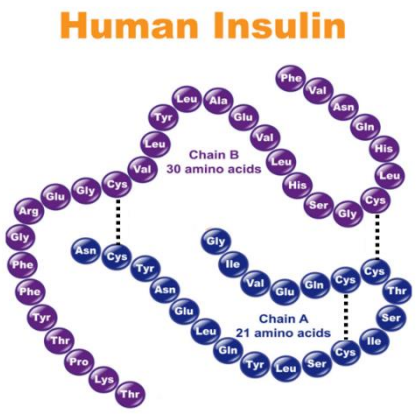
Day 5: Driving Question: How is DNA and RNA used to make Proteins?

E) Go to the class website – Unit 7: view ***DNA vs Protein Presentation*** … slides 1 thru 9.
https://sciencemathhelpcenter.weebly.com/unit-7---protein-synthesis.html

Look for a pattern between DNA size and Protein size for Example 1 and then do the same thing for Example 2.

Both of the Examples possess what pattern between DNA size and Protein size ???

F)



51 amino acids make up this protein.

After reviewing the two previous examples…

What would be needed for this insulin protein to be made?

Explain the meaning of the letters in the chart.

First Base	Second Base: T		Second Base: C		Second Base: A		Second Base: G		Third Base
T	TTT	Phenylalanine	TCT	Serine	TAT	Tyrosine	TGT	Cysteine	T
	TTC	Phenylalanine	TCC	Serine	TAC	Tyrosine	TGC	Cysteine	C
	TTA	Leucine	TCA	Serine	TAA	Stop	TGA	Stop	A
	TTG	Leucine	TCG	Serine	TAG	Stop	TGG	Tryptophan	G
C	CTT	Leucine	CCT	Proline	CAT	Histidine	CGT	Arginine	T
	CTC	Leucine	CCC	Proline	CAC	Histidine	CGC	Arginine	C
	CTA	Leucine	CCA	Proline	CAA	Glutamine	CGA	Arginine	A
	CTG	Leucine	CCG	Proline	CAG	Glutamine	CGG	Arginine	G
A	ATT	Isoleucine	ACT	Threonine	AAT	Asparagine	AGT	Serine	T
	ATC	Isoleucine	ACC	Threonine	AAC	Asparagine	AGC	Serine	C
	ATA	Isoleucine	ACA	Threonine	AAA	Lysine	AGA	Arginine	A
	ATG	Methionine (Start)	ACG	Threonine	AAG	Lysine	AGG	Arginine	G
G	GTT	Valine	GCT	Alanine	GAT	Aspartic Acid	GGT	Glycine	T
	GTC	Valine	GCC	Alanine	GAC	Aspartic Acid	GGC	Glycine	C
	GTA	Valine	GCA	Alanine	GAA	Glutamic Acid	GGA	Glycine	A
	GTG	Valine	GCG	Alanine	GAG	Glutamic Acid	GGG	Glycine	G

List of 20 Amino Acids

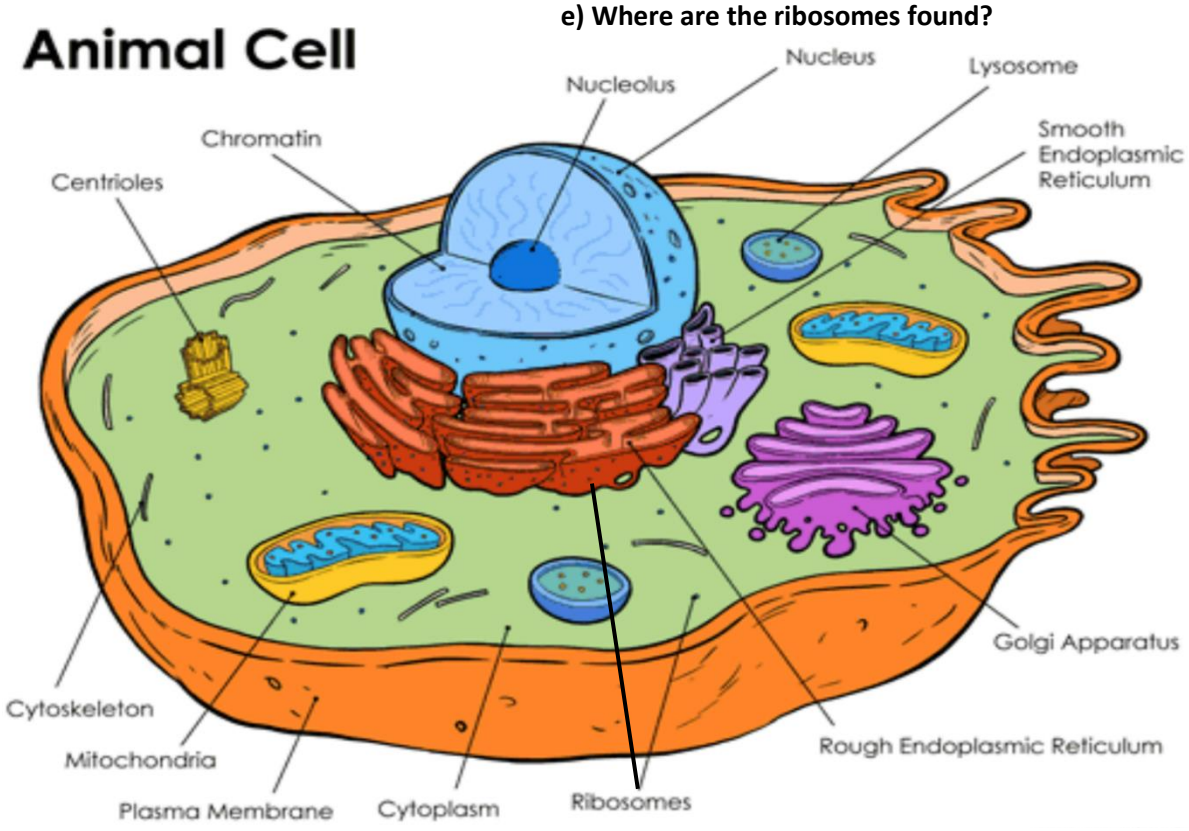
Phenylalanine
Leucine
Isoleucine
Methionine
Valine
Serine
Proline
Threonine
Alanine
Tyrosine
Histidine
Glutamine
Asparagine
Lysine
Aspartic Acid
Glutamic Acid
Cysteine
Tryptophan
Arginine
Glycine

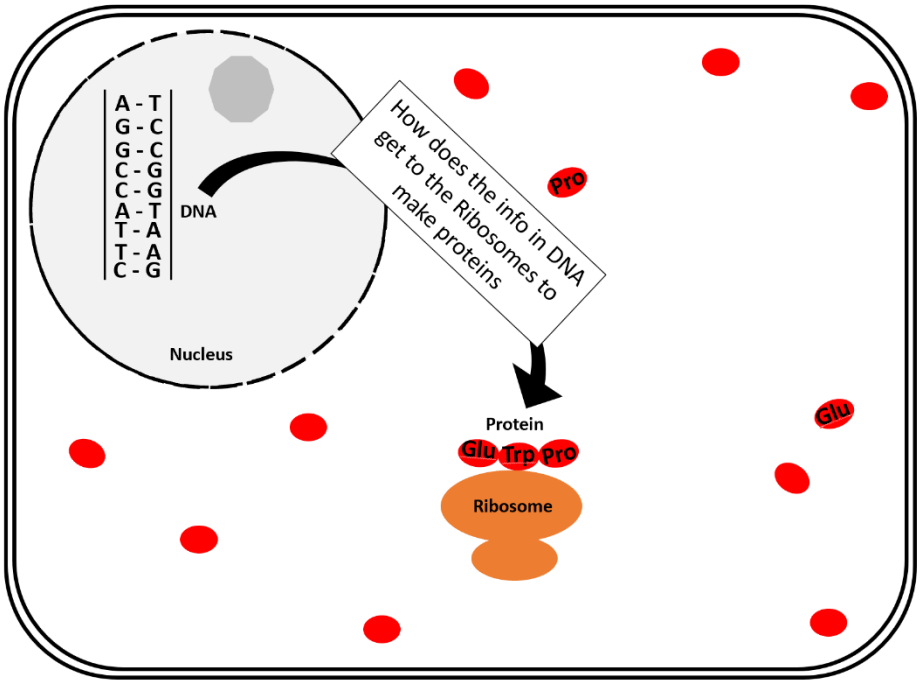
G) Small Groups **Explain the meaning of the letters in the chart?**

Day 6: Driving Question: How is DNA and RNA used to make Proteins?

Class Discussion Questions to consider:

a) The information to make proteins is found in which molecule?
b) Where in the cell is the DNA found?
c) Can DNA ever leave the nucleus?
d) Where are proteins made?
e) Where are the ribosomes found?





H) **How does the information found in DNA (that is trapped in the Nucleus) get to the Ribosomes to make proteins?**

Individual work:

How does the information found in DNA (that is trapped in the Nucleus) get to the Ribosomes to make proteins?

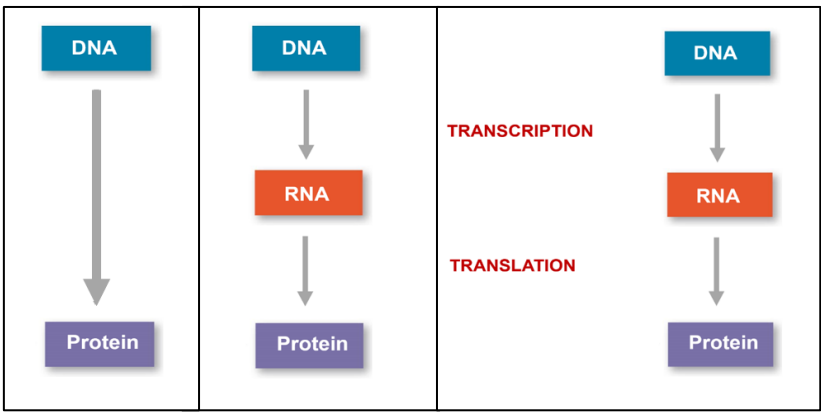
Small group work:

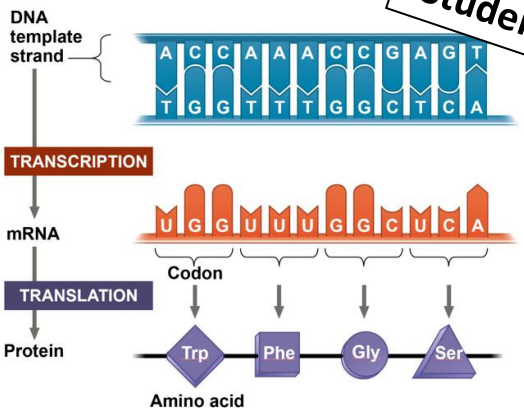
How does the information found in DNA (that is trapped in the Nucleus) get to the Ribosomes to make proteins?

I) Class Discussion:

Go to the class website – Unit 7: view ***DNA vs Protein Presentation*** … slides 18 thru 21.
https://sciencemathhelpcenter.weebly.com/unit-7---protein-synthesis.html

Notes for Students





J) Go to the class website – Unit 7: review the reading… ***RNA Structure Reading*** .
https://sciencemathhelpcenter.weebly.com/unit-7---protein-synthesis.html

Complete the chart…	**DNA**	**RNA**
Name of monomer		
phosphate group (Y or N)		
Name of 5-carbon Sugar		
Nitrogen Bases (list them)		
Overall structure		

List all the similarities between DNA and RNA structure.

Days 7 & 8: Driving Question: How is DNA and RNA used to make Proteins?

Before you work on the paper model of "RNA Synthesis",
Go to the class website – Unit 7: view ***DNA vs Protein Presentation*** … slides 23 thru 33 - Transcription.
https://sciencemathhelpcenter.weebly.com/unit-7---protein-synthesis.html

When you work on your paper model of 'RNA' synthesis, try to find answers to these questions…

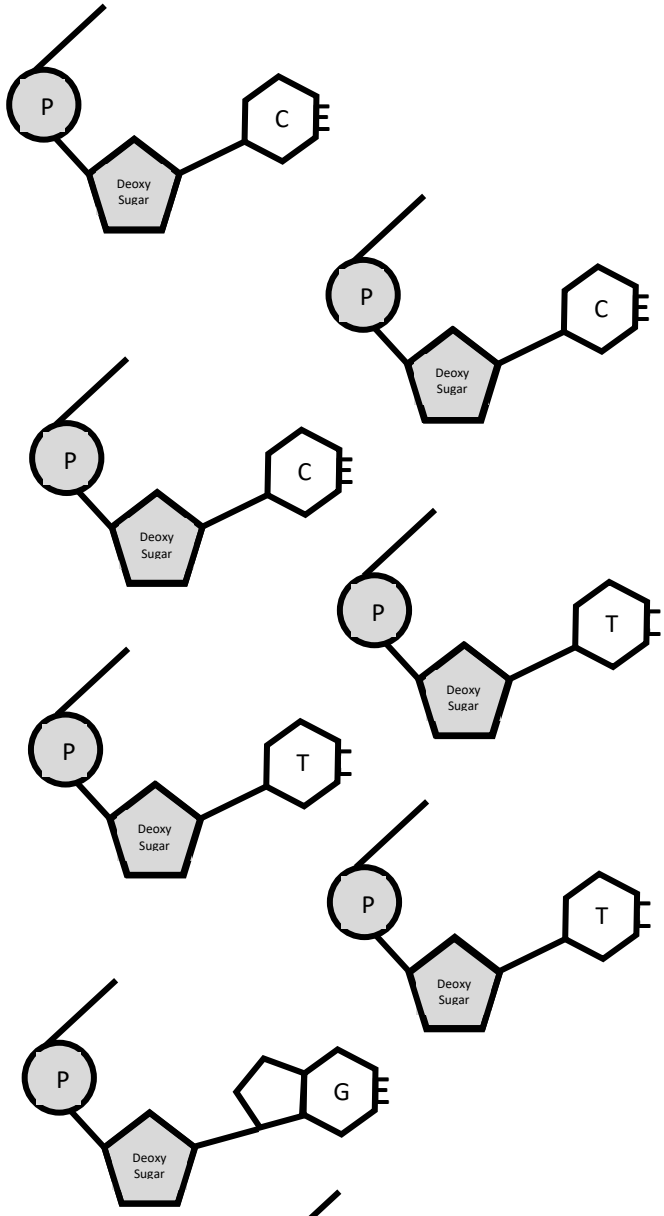
- What happens to the original DNA strand when you are done making RNA?
- What protein/enzyme is involved in this process and what are its 2 functions?

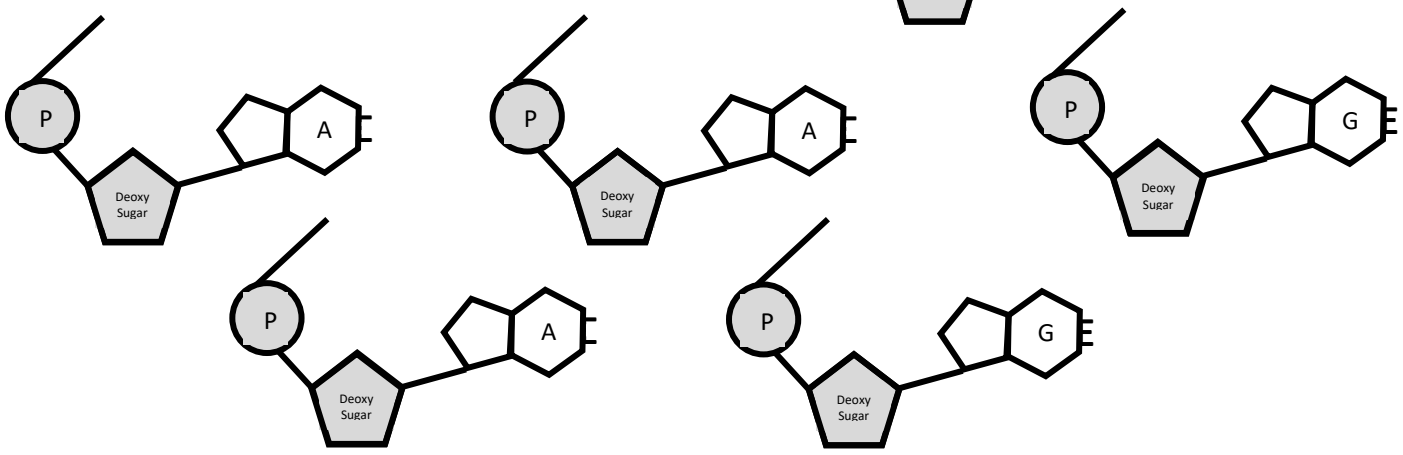
DNA Strand

Step 1

Instructions: Create a DNA strand that consists of 6 base pairs.

- Carefully… Carefully, cut out all 12 nucleotides.
- Place all 12 nucleotides inside the dashed rectangular work area.
- **Correctly create a DNA strand that consists of 6 base pairs**
- The nucleotides may touch but there should be no overlap of the nucleotides.



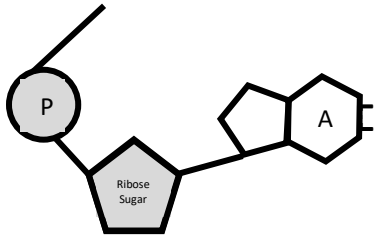


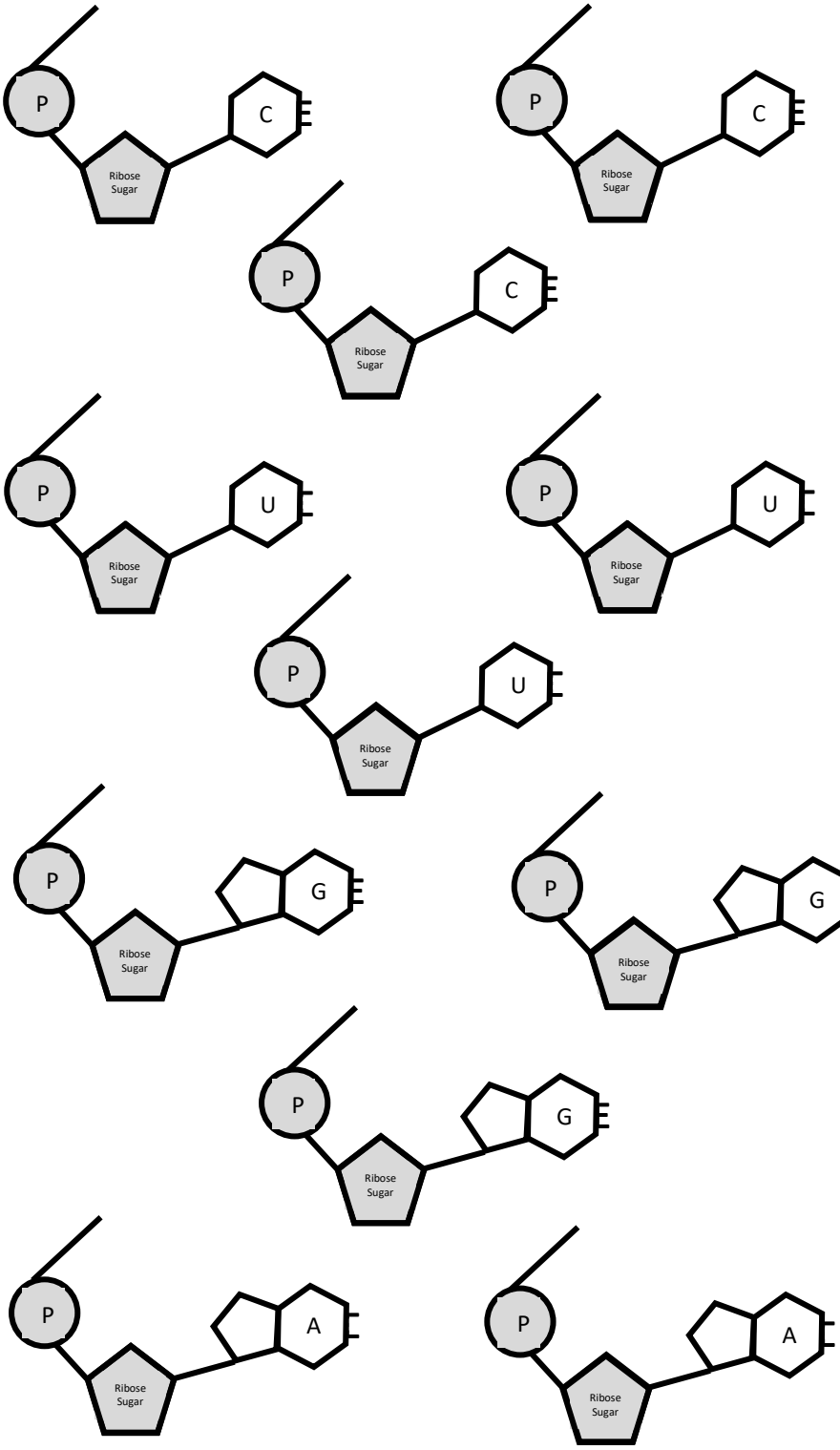
RNA Strand

Step 2

Instructions: Create an RNA strand that consists of 6 bases.

- Carefully… Carefully, cut out all 12 RNA nucleotides.
- Use the left side of the DNA strand from the previous page to construct an RNA strand using the RNA nucleotides below.
- Place your RNA strand inside the dashed rectangular work area.
- The RNA nucleotides may touch but there should be no overlap of the RNA nucleotides.



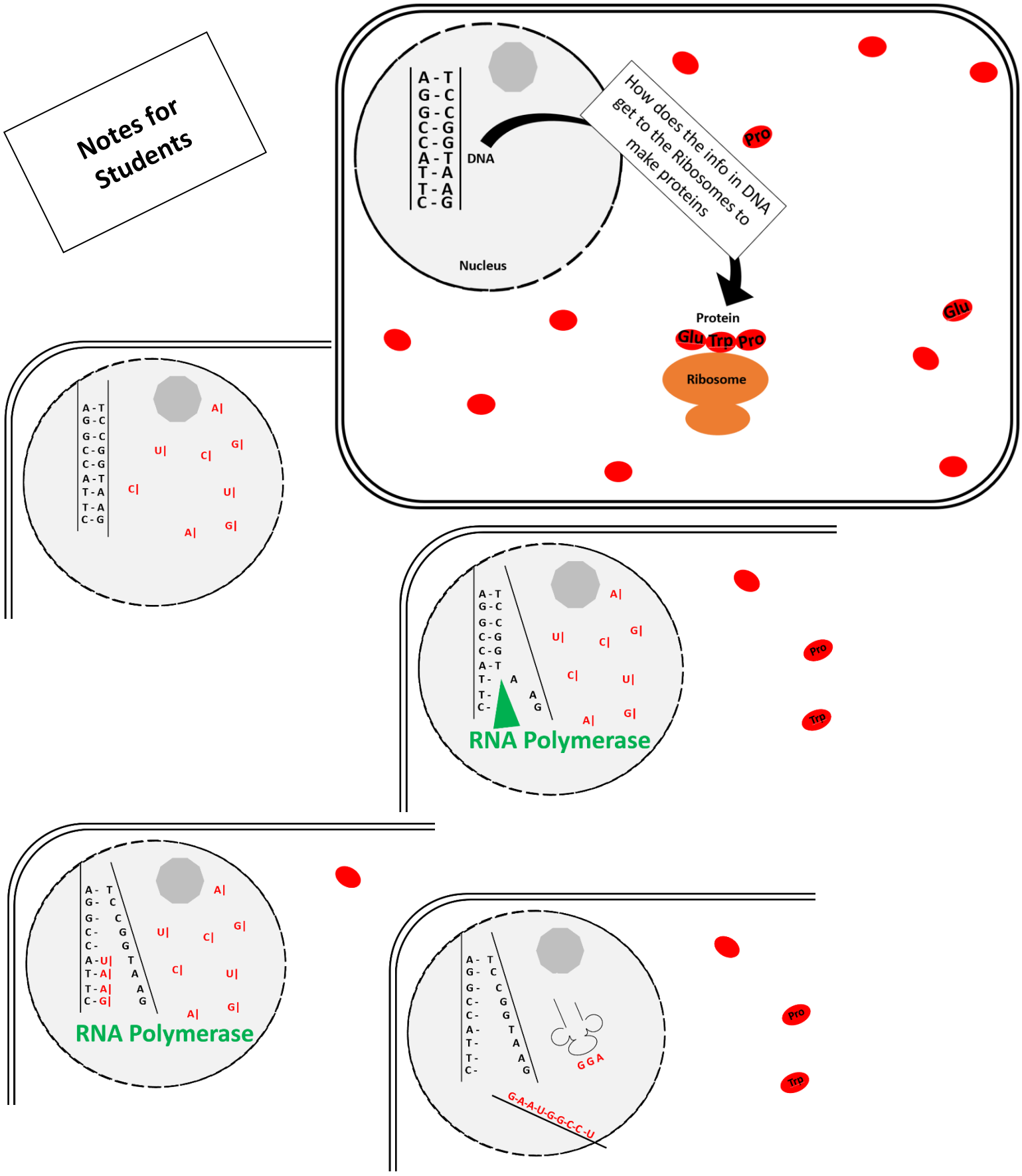


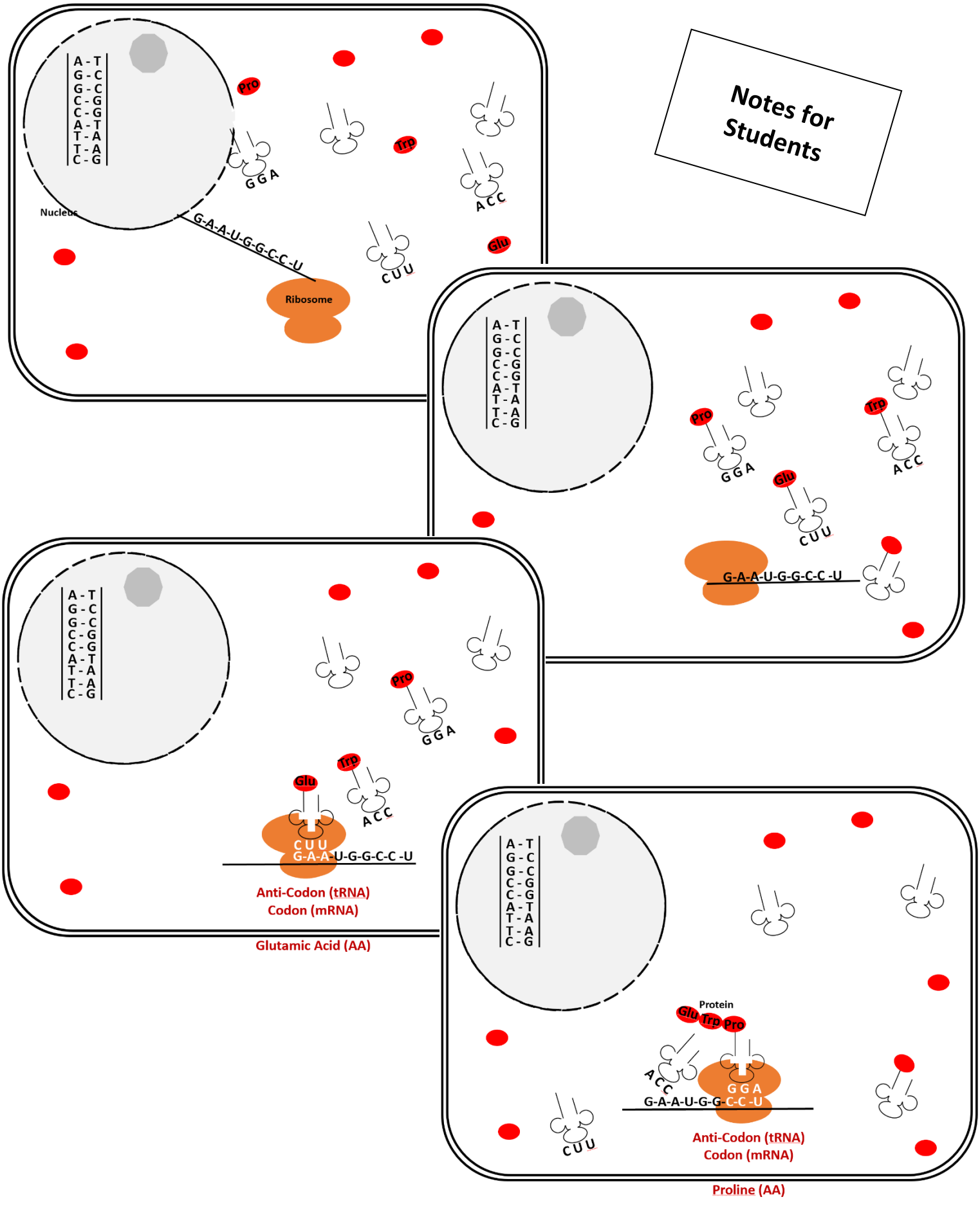
Before you proceed, you should view the remaining slides that focus on Transcription & Translation.

Go to the class website – Unit 7: view ***DNA vs Protein Presentation*** … slides 23 thru 33 - Transcription.

Go to the class website – Unit 7: view ***DNA vs Protein Presentation*** … slides 34 thru 53 - Translation.

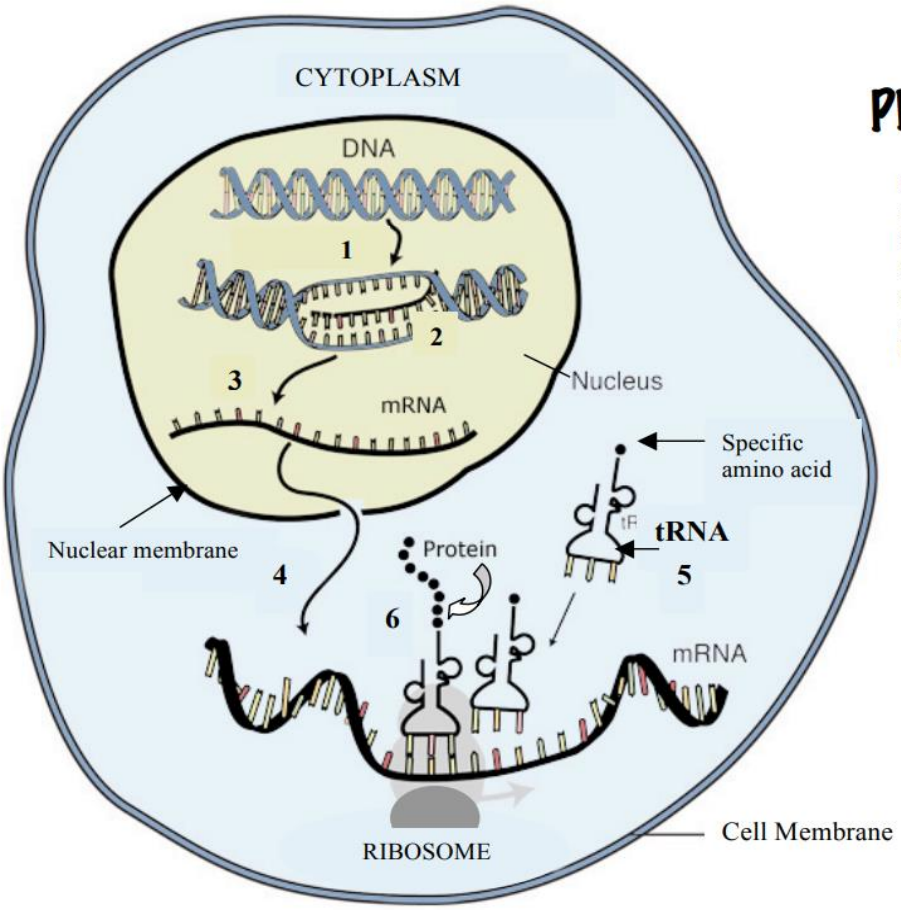
https://sciencemathhelpcenter.weebly.com/unit-7---protein-synthesis.html




Notes for Students
A - T
G - C
G - C
C - G
C - G
A - T
T - A
T - A
C - G
Nucleus
Pro
Trp
Glu
G G A
A C C
C U U
G-A-A-U-G-G-C-C -U
Ribosome
Anti-Codon (tRNA)
Codon (mRNA)
Glutamic Acid (AA)
Protein
Proline (AA)

Protein Scramble

Box K



PROTEIN SYNTHESIS

DIRECTIONS: The diagram shows the steps that occur when proteins are made following the "recipe" given in a DNA molecule. The steps below are in the wrong order. Write the correct step that goes with each number on the diagram in the spaces below.

Protein Synthesis in 6 steps – not in proper order

(A) tRNA molecules bring specific amino acids to the ribosome.

(B) mRNA separates from the DNA molecule.

(C) DNA molecule unzips to reveal the section coding for the protein needed.

(D) Amino acids join together to form the beginning of the new protein.

(E) mRNA molecule forms along the unzipped section of the DNA molecule

(F) mRNA leaves the nucleus and goes to the ribosome.

Protein Synthesis - Correct order

Step 1 on diagram: _____

Step 2 on diagram: _____

Step 3 on diagram: _____

Step 4 on diagram: _____

Step 5 on diagram: _____

Step 6 on diagram: _____

Day 9: Driving Question: How is DNA and RNA used to make Proteins?

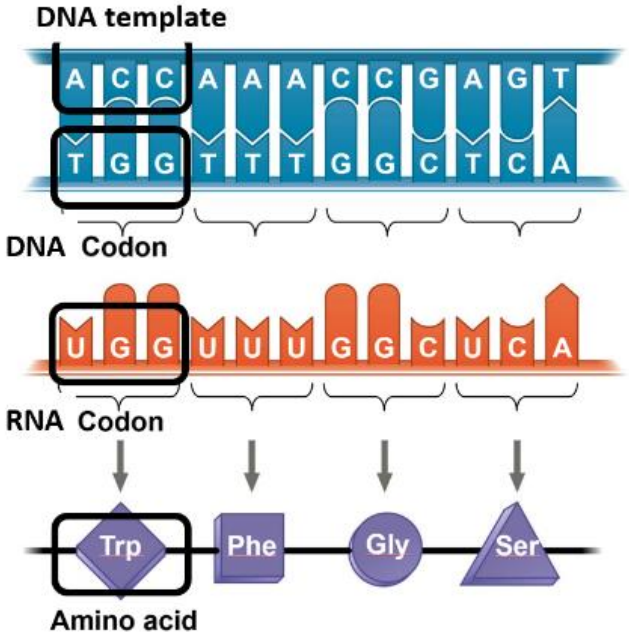
Box L Review: We now know that RNA has a role in protein synthesis.

Let's go back to Box G and dig deeper into the DNA codon and Amino acid chart.

- **What is different between these two charts?**
- **In which situation would each chart be used?**
- **Give each chart an appropriate title.**

First Base	Second Base: T		Second Base: C		Second Base: A		Second Base: G		Third Base
T	TTT	Phenylalanine	TCT	Serine	TAT	Tyrosine	TGT	Cysteine	T
	TTC	Phenylalanine	TCC	Serine	TAC	Tyrosine	TGC	Cysteine	C
	TTA	Leucine	TCA	Serine	TAA	Stop	TGA	Stop	A
	TTG	Leucine	TCG	Serine	TAG	Stop	TGG	Tryptophan	G
C	CTT	Leucine	CCT	Proline	CAT	Histidine	CGT	Arginine	T
	CTC	Leucine	CCC	Proline	CAC	Histidine	CGC	Arginine	C
	CTA	Leucine	CCA	Proline	CAA	Glutamine	CGA	Arginine	A
	CTG	Leucine	CCG	Proline	CAG	Glutamine	CGG	Arginine	G
A	ATT	Isoleucine	ACT	Threonine	AAT	Asparagine	AGT	Serine	T
	ATC	Isoleucine	ACC	Threonine	AAC	Asparagine	AGC	Serine	C
	ATA	Isoleucine	ACA	Threonine	AAA	Lysine	AGA	Arginine	A
	ATG	Methionine (Start)	ACG	Threonine	AAG	Lysine	AGG	Arginine	G
G	GTT	Valine	GCT	Alanine	GAT	Aspartic Acid	GGT	Glycine	T
	GTC	Valine	GCC	Alanine	GAC	Aspartic Acid	GGC	Glycine	C
	GTA	Valine	GCA	Alanine	GAA	Glutamic Acid	GGA	Glycine	A
	GTG	Valine	GCG	Alanine	GAG	Glutamic Acid	GGG	Glycine	G

First Base	Second Base: U		Second Base: C		Second Base: A		Second Base: G		Third Base
U	UUU	Phenylalanine	UCU	Serine	UAU	Tyrosine	UGU	Cysteine	U
	UUC	Phenylalanine	UCC	Serine	UAC	Tyrosine	UGC	Cysteine	C
	UUA	Leucine	UCA	Serine	UAA	Stop	UGA	Stop	A
	UUG	Leucine	UCG	Serine	UAG	Stop	UGG	Tryptophan	G
C	CUU	Leucine	CCU	Proline	CAU	Histidine	CGU	Arginine	U
	CUC	Leucine	CCC	Proline	CAC	Histidine	CGC	Arginine	C
	CUA	Leucine	CCA	Proline	CAA	Glutamine	CGA	Arginine	A
	CUG	Leucine	CCG	Proline	CAG	Glutamine	CGG	Arginine	G
A	AUU	Isoleucine	ACU	Threonine	AAU	Asparagine	AGU	Serine	U
	AUC	Isoleucine	ACC	Threonine	AAC	Asparagine	AGC	Serine	C
	AUA	Isoleucine	ACA	Threonine	AAA	Lysine	AGA	Arginine	A
	AUG	Methionine (Start)	ACG	Threonine	AAG	Lysine	AGG	Arginine	G
G	GUU	Valine	GCU	Alanine	GAU	Aspartic Acid	GGU	Glycine	U
	GUC	Valine	GCC	Alanine	GAC	Aspartic Acid	GGC	Glycine	C
	GUA	Valine	GCA	Alanine	GAA	Glutamic Acid	GGA	Glycine	A
	GUG	Valine	GCG	Alanine	GAG	Glutamic Acid	GGG	Glycine	G



Notes for Students

Box M Answer these 22 questions using the class website: Unit 7

Students should review the *DNA vs Protein Presentation – Slides 23 thru 53.*

Students can also review the *Reading on The Role of RNA* on the website.

https://sciencemathhelpcenter.weebly.com/unit-7---protein-synthesis.html

1. What is Transcription?

2. Which enzymes are used in Transcription?
   What is their function?

3. Where in the cell does Transcription take place?

4. What is the end result of Transcription?

5. Where do the RNA nucleotides come from?

6. How is DNA structurally different from RNA?

7. What are the different types of RNA that are transcribed?
   What are each of them used for?

8. What is the end result of Translation?

9. Where does Translation take place in the cell?

10. What is the monomer of proteins?

11. Where are excess protein monomers found in the cell?

12. How are the protein monomers bonded to each other? (Review: Unit 2 Carbs Fats Proteins Slides 48 54-61)

13. What is a "RNA codon"?

14. What is an "anti-codon"?

15. Where does mRNA come from and what's its function?

16. Where does tRNA come from and what's its function?

Box M continued…

17. The top of the following DNA strand would transcribe which RNA strand?

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

18. Using the top of this DNA strand, which two amino acids would result from Translation?

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

19. The mRNA segment UUA codes for Leucine. However, a point-mutation occurs during transcription and the mRNA segment is now UUU. What is the new amino acid?

	U		C		A		G		
U	UUU	Phenylalanine	UCU	Serine	UAU	Tyrosine	UGU	Cysteine	U
	UUC	Phenylalanine	UCC	Serine	UAC	Tyrosine	UGC	Cysteine	C
	UUA	Leucine	UCA	Serine	UAA	Stop	UGA	Stop	A
	UUG	Leucine	UCG	Serine	UAG	Stop	UGG	Tryptophan	G
C	CUU	Leucine	CCU	Proline	CAU	Histidine	CGU	Arginine	U
	CUC	Leucine	CCC	Proline	CAC	Histidine	CGC	Arginine	C
	CUA	Leucine	CCA	Proline	CAA	Glutamine	CGA	Arginine	A
	CUG	Leucine	CCG	Proline	CAG	Glutamine	CGG	Arginine	G
A	AUU	Isoleucine	ACU	Threonine	AAU	Asparagine	AGU	Serine	U
	AUC	Isoleucine	ACC	Threonine	AAC	Asparagine	AGC	Serine	C
	AUA	Isoleucine	ACA	Threonine	AAA	Lysine	AGA	Arginine	A
	AUG	Methionine (Start)	ACG	Threonine	AAG	Lysine	AGG	Arginine	G
G	GUU	Valine	GCU	Alanine	GAU	Aspartic Acid	GGU	Glycine	U
	GUC	Valine	GCC	Alanine	GAC	Aspartic Acid	GGC	Glycine	C
	GUA	Valine	GCA	Alanine	GAA	Glutamic Acid	GGA	Glycine	A
	GUG	Valine	GCG	Alanine	GAG	Glutamic Acid	GGG	Glycine	G

20. How will a mutation that results in a deletion of one mRNA nucleotide affect the amino acid sequence during Translation?

Skip this question for now

21. Why is Transcription and Translation necessary for the cell?

22. During which part of the cell cycle does Transcription take place?
… Why?

Day 10: Driving Question: How is DNA and RNA used to make Proteins

Occurs in nucleus	DNA → RNA
DNA molecule unzips to reveal the section coding for the protein needed.	tRNA molecules bring specific amino acids to the ribosome.
mRNA separates from the DNA molecule.	Amino acids form peptide bonds
mRNA molecule forms along the unzipped section of the DNA molecule.	Occurs in the cytoplasm at the ribosome.
RNA → protein	Protein is formed
mRNA attaches to ribosomes	mRNA leaves the nucleus

Box N	Transcription	Translation
What		
Where		
4 Steps in order		

Box O

	Main Ideas
I	
II	
III	
IV	
V	
VI	
VII	
VIII	
IX	
X	
XI	
XII	
XIII	
XIV	
XV	

Days 11 & 12: Driving Question: How is DNA and RNA used to make Proteins

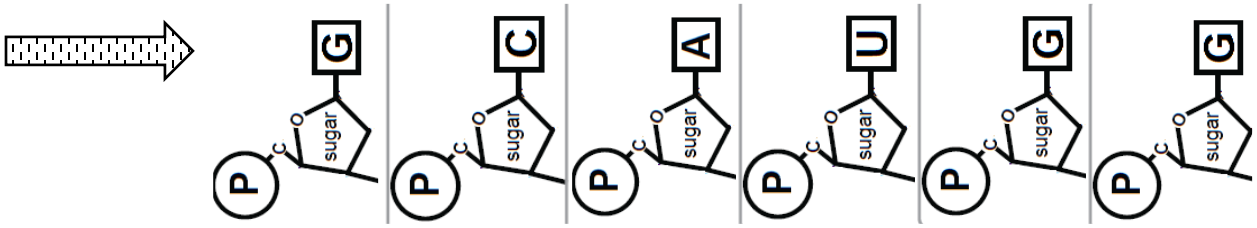
Box P

- Students will be assigned 1 of the 9 DNA strands
- Students will transcribe the message found in DNA onto mRNA
- Students will determine the anticodons found on tRNA
- Students will use the mRNA codons to determine the chain of Amino Acids (a protein)
- When finished, students should tape the DNA strand, RNA strand, and protein together. Put the Protein on top, the DNA strand on bottom, and the RNA in the middle when you tape them together. Put your name on the front near the first Amino Acid.
- Finally, get the teacher to check your answer and sign off in Box P

Modeling Transcription and Translation

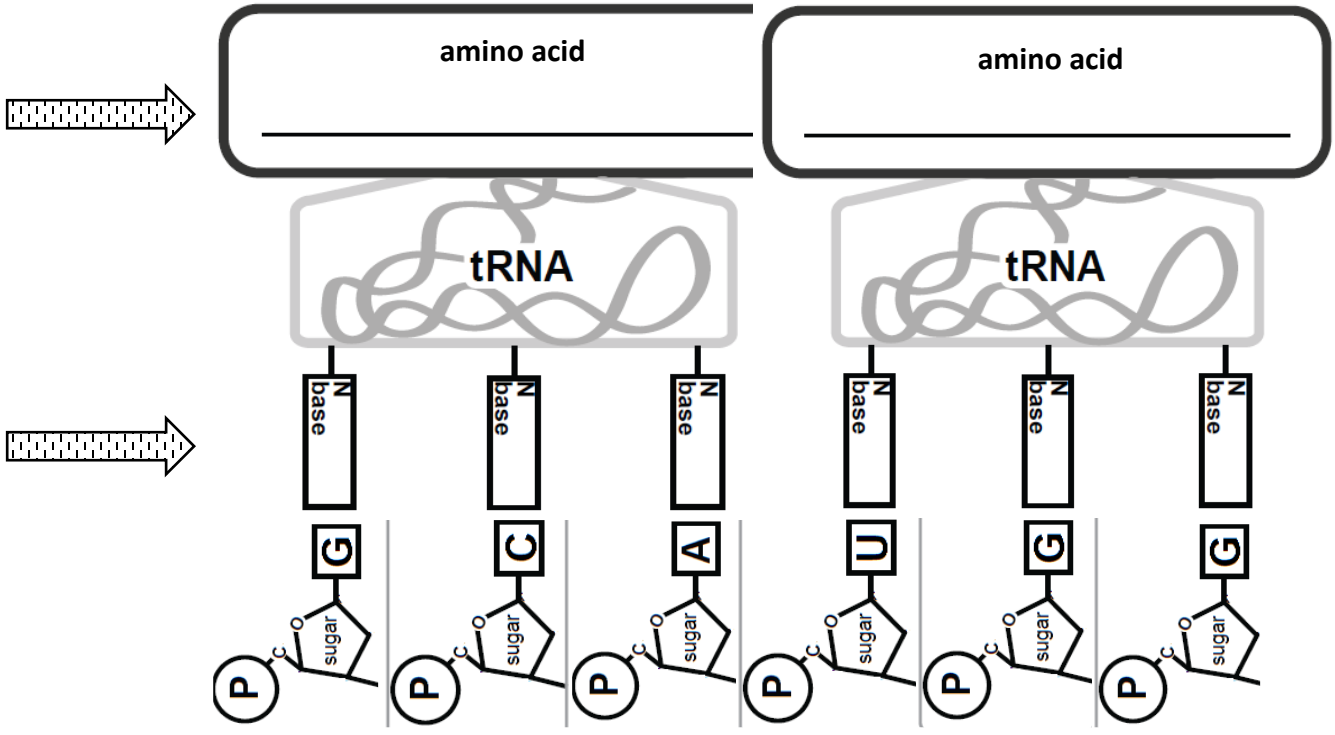
Introduction:
Every group will be assigned one of the nine DNA strands found on the first page. Cut out your DNA strand and throw the remaining DNA strands in the trash.

Transcription:
Using the TOP half of the assigned DNA strand as a template, each group will TRANSCRIBE the DNA information onto a mRNA segment. To complete this step, each group will have to cut out the mRNA nucleotides and tape them similar to the example below… IMPORTANT: Each nitrogen base on every RNA nucleotide will have to correctly filled in for credit.



You will have many extra mRNA nucleotides that you can throw away.

Translation:
Using the mRNA strand that you made in the previous step, each group will TRANSLATE the mRNA message into codons and anticodons to create a chain of amino acids (a polypeptide/protein). To complete this step, you will have to cut out enough tRNA diagrams found on the last few pages and place them above the mRNA strand – similar to the example below…



Finally, each group will have to fill out the blanks indicated by the arrows above. Each tRNA nitrogen base and each amino acid should be listed in the appropriate box. Use the mRNA codon chart on the last page for this step. When you are done, have the teacher check your work.

#1 DNA strand

TACCATTGAAAGCATATCGAATGATGGAATTAAGTGGGCAACAGC
ATGGTAACTTTCGTATAGCTTACTACCTTAATTCACCCGTTGTCG

#2 DNA strand

TACGGCGAATAGAAACATATAGAAGTCTGATGGAATTAGGTCAAAGAGGAAAGT
ATGCCGCTTATCTTTGTATATCTTCAGACTACCTTAATCCAGTTTCTCCTTTCA

#3 DNA strand

TACTGGGGGCATGTTTGATGCAAGGCTGTTGTGTGACATGTATAATGTAATAACAAA
ATGACCCCCGTACAAACTACGTTCCGACAACACACTGTACATATTACATTATTGTTT

#4 DNA strand

TACCATTGAAAGCACATCGAATGATGGGGCCATGTATAATGCAAGGCCGTCGTG
ATGGTAACTTTCGTGTAGCTTACTACCCCGGTACATATTACGTTCCGGCAGCAC

#5 DNA strand

TACTGGGGCGAGTAGTGGACAGCGCATATGTAGCATGTTTAGAAAGCGTGGGAA
ATGACCCCGCTCATCACCTGTCGCGTATACATCGTACAAATCTTTCGCACCCTT

#6 DNA strand

TACGCACTCTACTAATGGAATAACATATGAGCCTAAAGTAAGGCTATGGAG
ATGCGTGAGATGATTACCTTATTGTATACTCGGATTTCATTCCGATACCTC

#7 DNA strand

TACTGCAACCTTGAATGATGGAATTAGGTTTGTGGCAATAACAAG
ATGACGTTGGAACTTACTACCTTAATCCAAACACCGTTATTGTTC

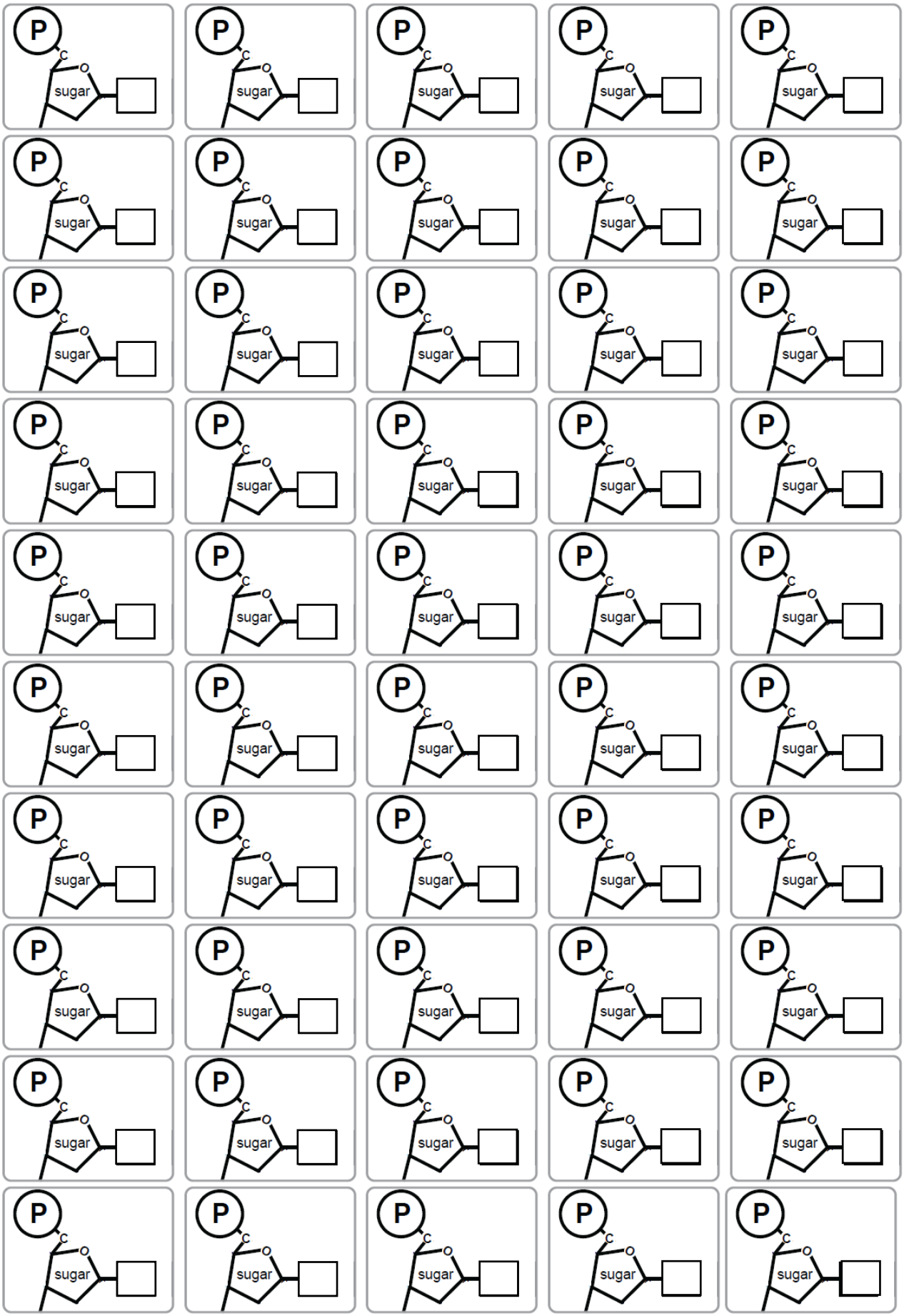
#8 DNA strand

TACTGTGCGAAGAAATGATTAGAATAGAAGGCCTGGGAAACA
ATGACACGCTTCTTTACTAATCTTATCTTCCGGACCCTTTGT

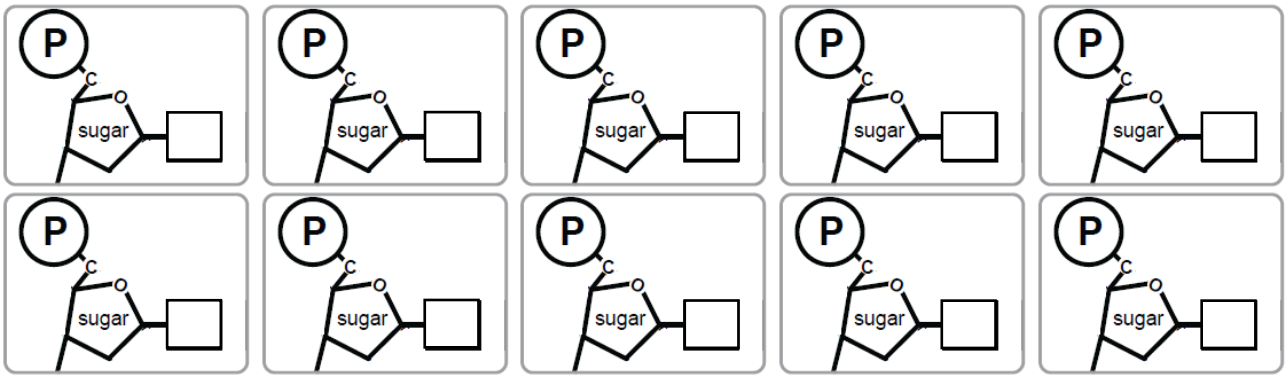
#9 DNA strand

TACTGGAACGACGCTTACTAGCATGTGTAATTCAATAATGAC
ATGACCTTGCTGCGAATGATCGTACACATTAAGTTATTACTG

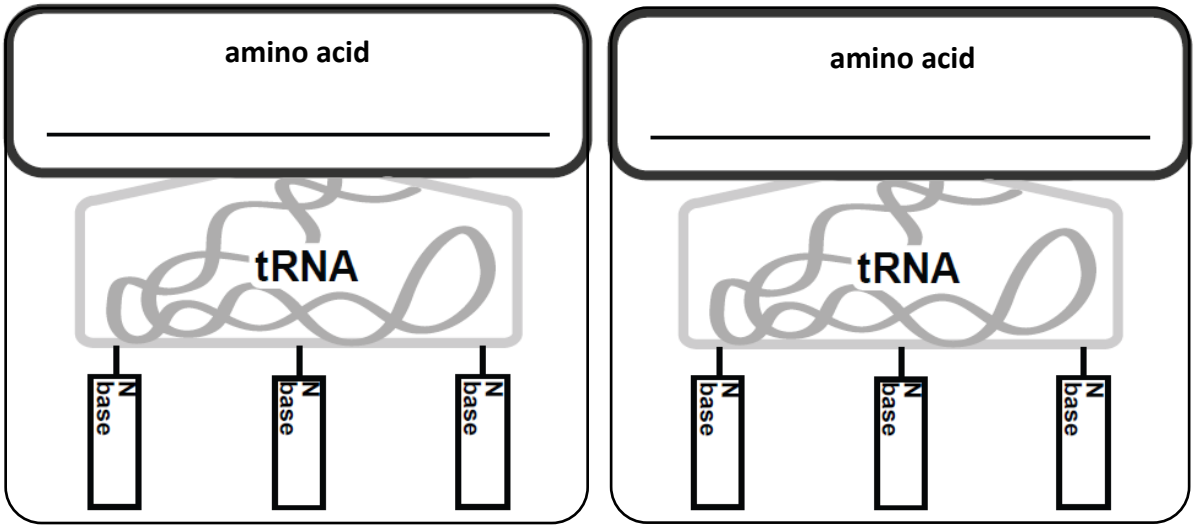
mRNA nucleotides

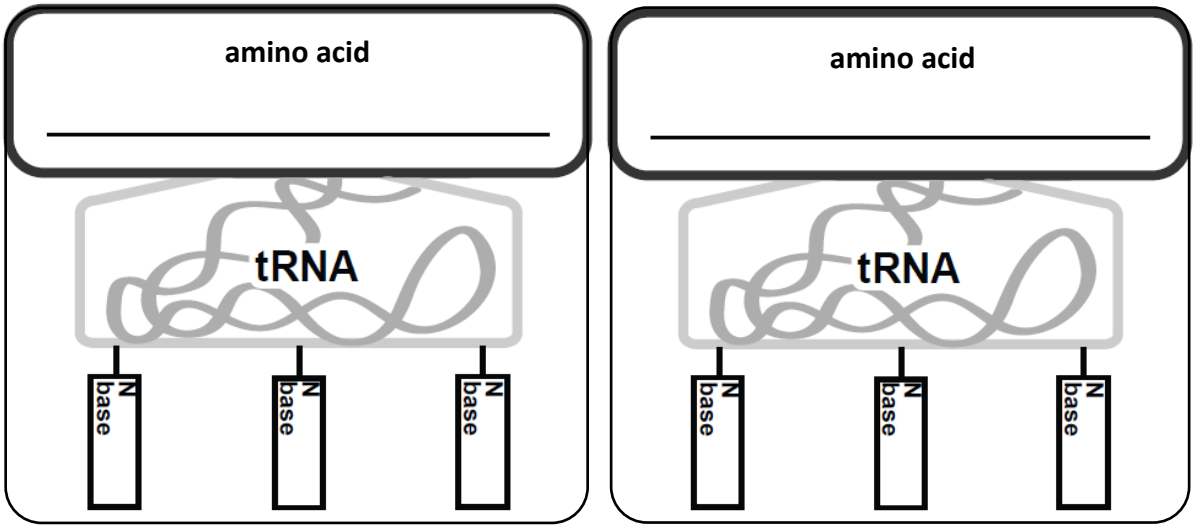


mRNA nucleotides

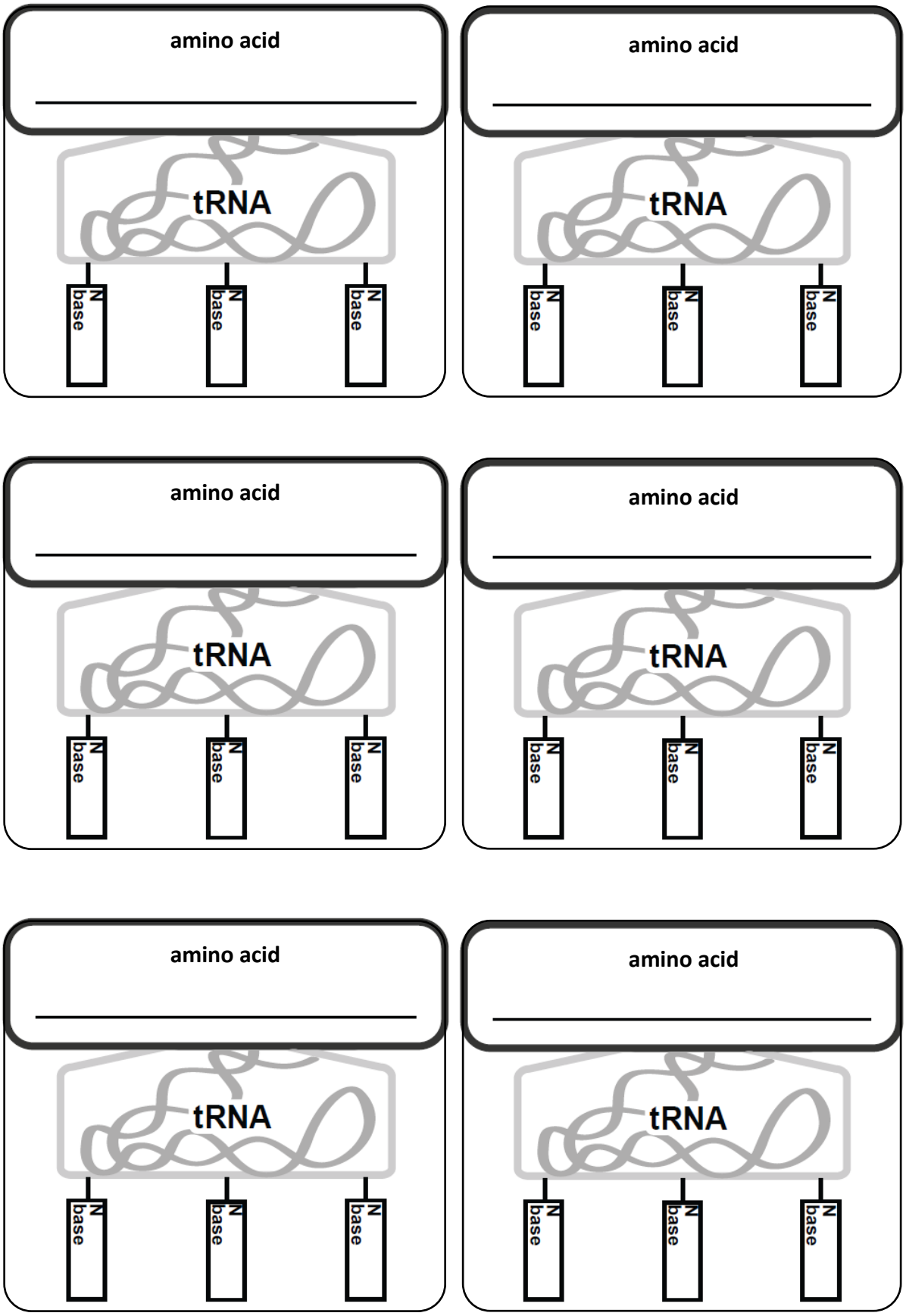


Anticodons and Amino Acids

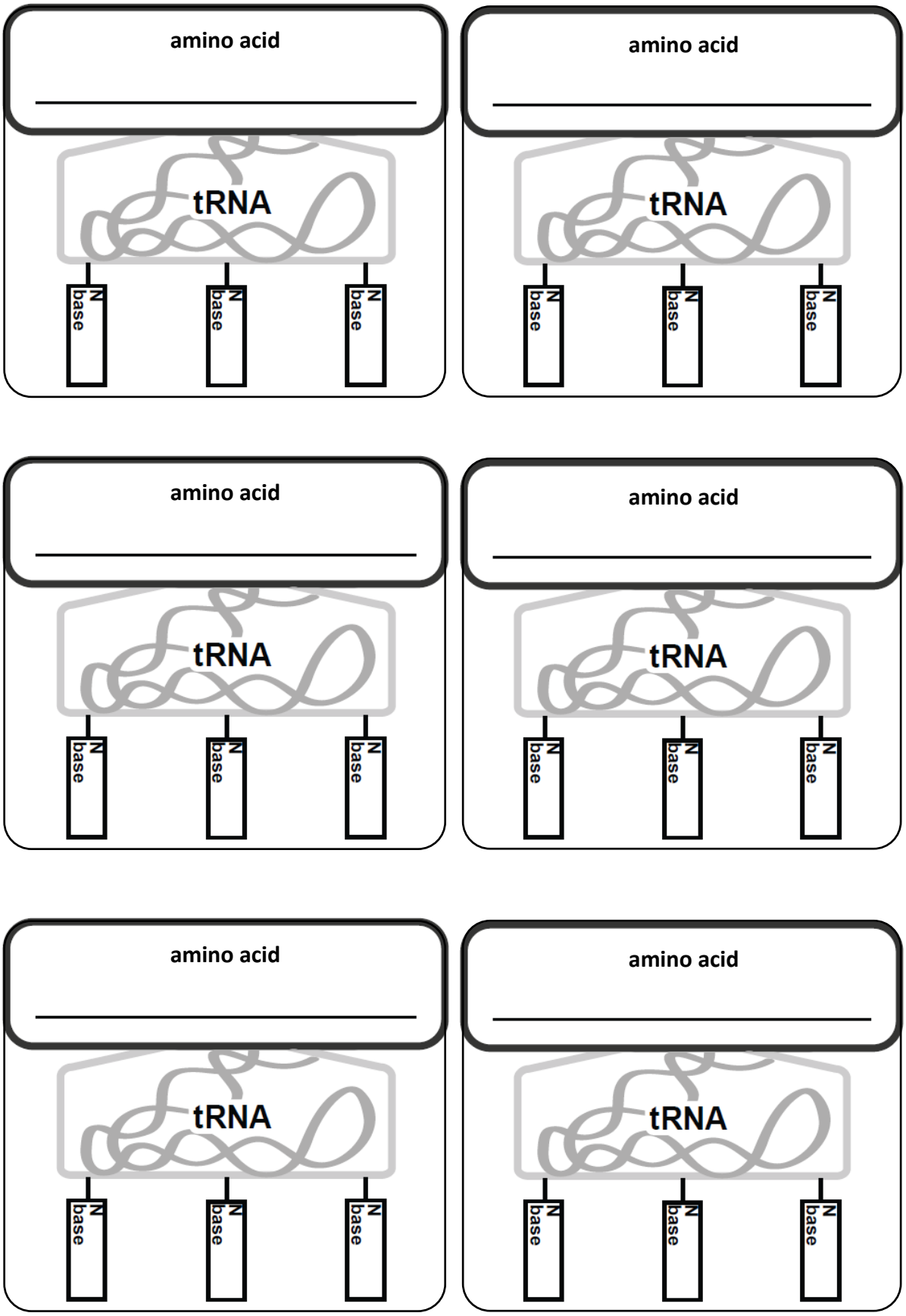




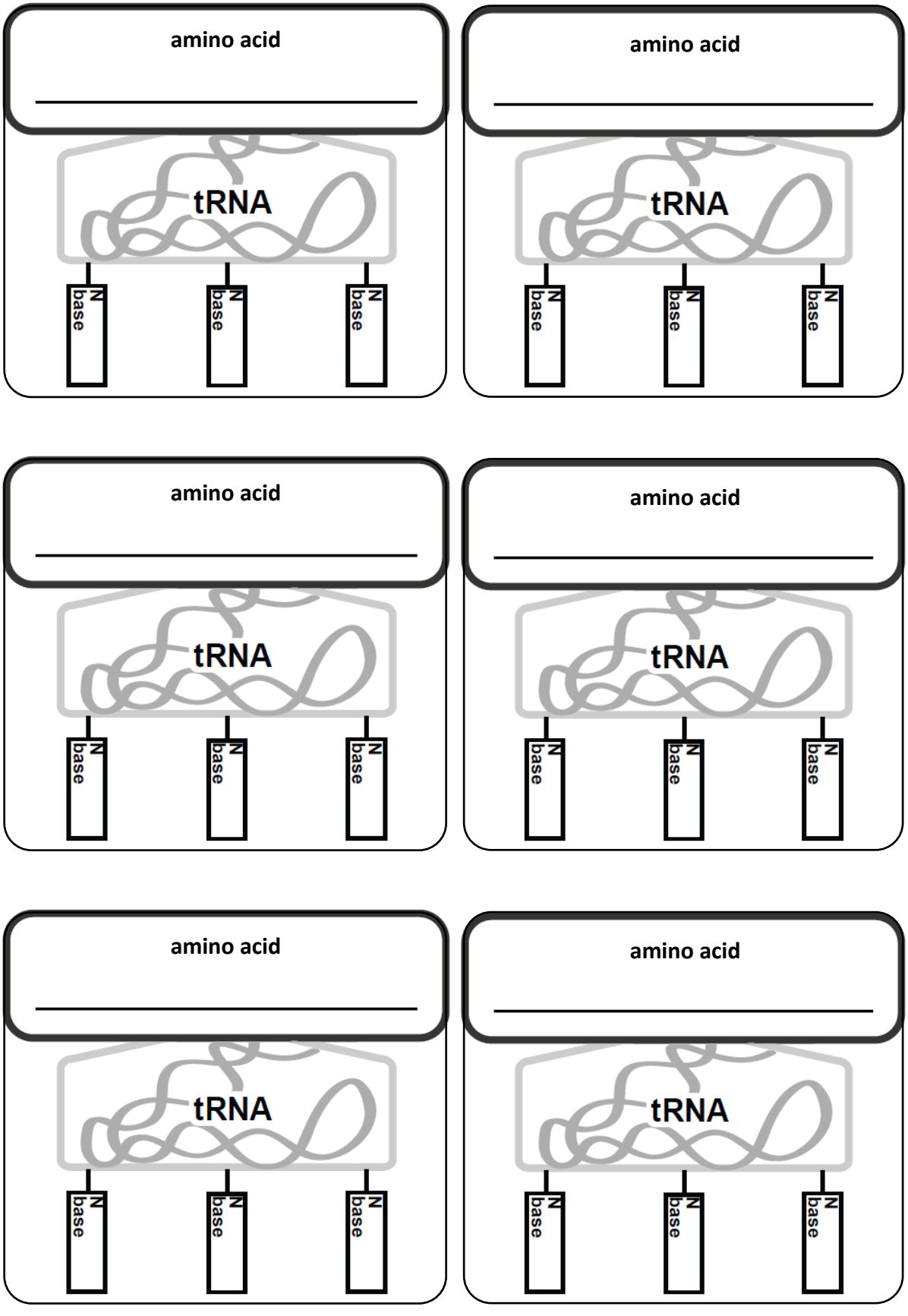
Anticodons and Amino Acids



Anticodons and Amino Acids



Anticodons and Amino Acids



mRNA Codon Chart

	U		C		A		G		
U	UUU	Phenylalanine	UCU	Serine	UAU	Tyrosine	UGU	Cysteine	U
	UUC	Phenylalanine	UCC	Serine	UAC	Tyrosine	UGC	Cysteine	C
	UUA	Leucine	UCA	Serine	UAA	Stop	UGA	Stop	A
	UUG	Leucine	UCG	Serine	UAG	Stop	UGG	Tryptophan	G
C	CUU	Leucine	CCU	Proline	CAU	Histidine	CGU	Arginine	U
	CUC	Leucine	CCC	Proline	CAC	Histidine	CGC	Arginine	C
	CUA	Leucine	CCA	Proline	CAA	Glutamine	CGA	Arginine	A
	CUG	Leucine	CCG	Proline	CAG	Glutamine	CGG	Arginine	G
A	AUU	Isoleucine	ACU	Threonine	AAU	Asparagine	AGU	Serine	U
	AUC	Isoleucine	ACC	Threonine	AAC	Asparagine	AGC	Serine	C
	AUA	Isoleucine	ACA	Threonine	AAA	Lysine	AGA	Arginine	A
	AUG	Methionine (Start)	ACG	Threonine	AAG	Lysine	AGG	Arginine	G
G	GUU	Valine	GCU	Alanine	GAU	Aspartic Acid	GGU	Glycine	U
	GUC	Valine	GCC	Alanine	GAC	Aspartic Acid	GGC	Glycine	C
	GUA	Valine	GCA	Alanine	GAA	Glutamic Acid	GGA	Glycine	A
	GUG	Valine	GCG	Alanine	GAG	Glutamic Acid	GGG	Glycine	G

Box Q

Central Dogma of Molecular Biology

Based upon what we have been learning the last 2 weeks, write one sentence or diagram that summarizes what you think is the Central Dogma of Molecular Biology?

This is extra practice for students that struggled on the model building.

Below and on the website is a link for students to practice Transcription and Translation if needed.

For practice:
https://learn.genetics.utah.edu/content/basics/transcribe/

To watch: DNA to Proteins (2:41)
https://www.yourgenome.org/video/from-dna-to-protein

To watch: Transcription and Translation (11:56)
https://www.youtube.com/watch?v=h3b9ArupXZg

Days 13 & 14: Driving Question: How is DNA and RNA used to make Proteins

Success Criteria – Teacher & Self-Assessment

Individual Writing Assignment – not a group effort.

Learning Target: If DNA is trapped in the nucleus, how does the information in DNA get used to make proteins in the ribosomes?

Word Bank:

1. nucleus
2. DNA molecule
3. RNA Polymerase
4. hydrogen bonds
5. unzip
6. RNA nucleotides
7. mRNA
8. tRNA
9. cytoplasm
10. ribosome
11. ER
12. amino acid
13. peptide bond
14. protein

Answer the question as thoroughly as you can.
Give a detailed answer that uses all the key terms provided below.
Use lined paper and work only in class.
You may use your notes and models – ***but not your phone or friends***.

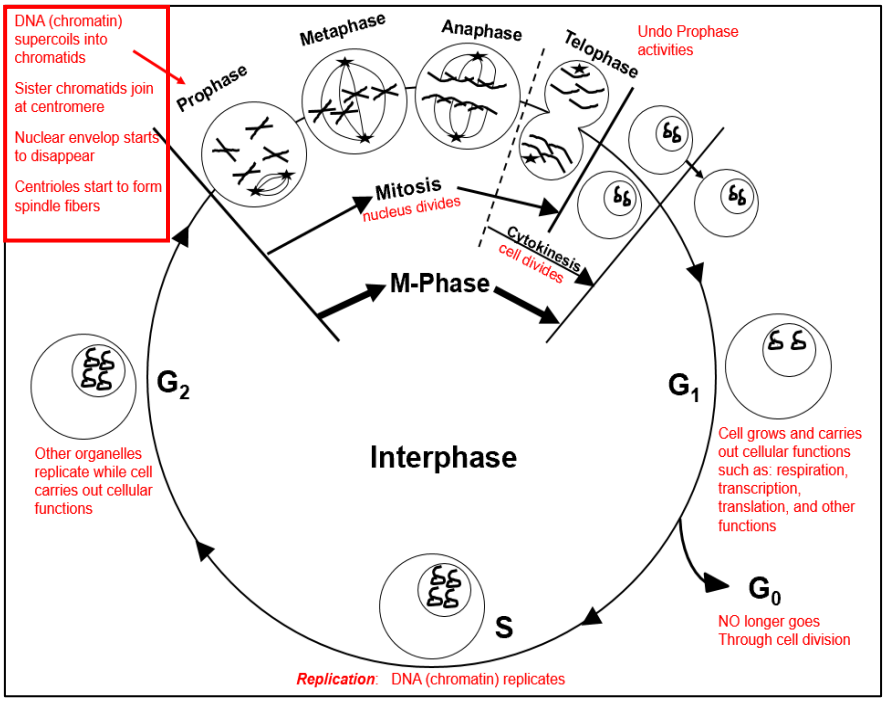
Grading will be based upon the following:

All terms in Word Bank were used accurately in context	_____	25 pts
Steps of Transcription were listed in the proper order	_____	30 pts
Steps of Translation were listed in the proper order	_____	30 pts
Proper sentence structure and spelling	_____	10 pts
Neatness (ease of reading)	_____	5 pts

You may have to do some extra research or ask some additional questions to get full credit.

Rate your level of Understanding:

3 = Mastery/Expert 2 = Good Understanding 1 = Partial Understanding 0 = Very Little/No Understanding



Unit 7 Study Guide

1) The following words and phrases help explain DNA structure, RNA structure, and Protein structure.
Please write ***DNA*** or ***RNA*** or ***PROTEIN*** next to the word or phrase that it corresponds to.
Some of the words and phrases below have two answers.

adenine		**amino acid**		**cytosine**	
deoxyribose sugar		**double helix**		**guanine**	
hydrogen bonds		**nucleotide**		**peptide bond**	
phosphate group		**polypeptide**		**purines**	
pyrimidines		**ribose sugar**		**single backbone**	
thymine		**uracil**			

2) The following words and phrases are associated with either Transcription or Translation.
Please write ***TC*** for Transcription or ***TL*** for Translation next to the word or phrase that it corresponds to.
Some of the words and phrases below have two answers.

amino acid		**break hydrogen bonds**		**polypeptide**	
DNA		**form peptide bonds**		**mRNA**	
nucleus		**codon : anti-codon**		**ribosome**	
tRNA		**RNA polymerase**		**RNA nucleotides join**	

3) Compare and contrast the backbone of DNA and the backbone of RNA.

Compare: **1)**

Contrast: **1)**

2)

4) Write a complete sentence using the following words/phrases:
ribosome amino acids translation polypeptide formation

5) Use the top half of the given DNA strand as a template and transcribe it onto RNA.
Use the new RNA strand and translate it to make the correct polypeptide/protein using the attached chart.

DNA strand

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

RNA strand

polypeptide/protein

	U		C		A		G		
U	UUU	Phenylalanine	UCU	Serine	UAU	Tyrosine	UGU	Cysteine	U
	UUC	Phenylalanine	UCC	Serine	UAC	Tyrosine	UGC	Cysteine	C
	UUA	Leucine	UCA	Serine	UAA	Stop	UGA	Stop	A
	UUG	Leucine	UCG	Serine	UAG	Stop	UGG	Tryptophan	G
C	CUU	Leucine	CCU	Proline	CAU	Histidine	CGU	Arginine	U
	CUC	Leucine	CCC	Proline	CAC	Histidine	CGC	Arginine	C
	CUA	Leucine	CCA	Proline	CAA	Glutamine	CGA	Arginine	A
	CUG	Leucine	CCG	Proline	CAG	Glutamine	CGG	Arginine	G
A	AUU	Isoleucine	ACU	Threonine	AAU	Asparagine	AGU	Serine	U
	AUC	Isoleucine	ACC	Threonine	AAC	Asparagine	AGC	Serine	C
	AUA	Isoleucine	ACA	Threonine	AAA	Lysine	AGA	Arginine	A
	AUG	Methionine (Start)	ACG	Threonine	AAG	Lysine	AGG	Arginine	G
G	GUU	Valine	GCU	Alanine	GAU	Aspartic Acid	GGU	Glycine	U
	GUC	Valine	GCC	Alanine	GAC	Aspartic Acid	GGC	Glycine	C
	GUA	Valine	GCA	Alanine	GAA	Glutamic Acid	GGA	Glycine	A
	GUG	Valine	GCG	Alanine	GAG	Glutamic Acid	GGG	Glycine	G

6) Complete the following chart:

Source of DNA	Cytosine	Guanine	Thymine	Adenine
Jackalope	**31%**			
Bigfoot				**3%**

7) Organize the following steps to correctly describe the Central Dogma of Molecular Biology.

a. The completed polypeptide is released from the ribosome
b. tRNA picks up the amino acid that corresponds to the anti-codon found on tRNA
c. RNA polymerase breaks hydrogen bonds in DNA
d. mRNA leaves the nucleus and goes to the ribosomes/tRNA leaves the nucleus and goes to the cytoplasm
e. The mRNA codon pairs with the tRNA anti-codon and peptide bonds are formed to join the amino acids together
f. RNA polymerase attaches new RNA nucleotides together based upon the order of DNA nucleotides
g. tRNA brings the amino acid to the ribosome

Step 1	
Step 2	
Step 3	
Step 4	
Step 5	
Step 6	
Step 7	

8) What is the role of mRNA?

What is the role of tRNA?

9) Use the top half of the given DNA strand as a template:

DNA strand

C A T
G T A

What is the RNA codon?

What is the RNA anti-codon?

What is the translated amino acid?

	U		C		A		G		
U	UUU	Phenylalanine	UCU	Serine	UAU	Tyrosine	UGU	Cysteine	U
	UUC	Phenylalanine	UCC	Serine	UAC	Tyrosine	UGC	Cysteine	C
	UUA	Leucine	UCA	Serine	UAA	Stop	UGA	Stop	A
	UUG	Leucine	UCG	Serine	UAG	Stop	UGG	Tryptophan	G
C	CUU	Leucine	CCU	Proline	CAU	Histidine	CGU	Arginine	U
	CUC	Leucine	CCC	Proline	CAC	Histidine	CGC	Arginine	C
	CUA	Leucine	CCA	Proline	CAA	Glutamine	CGA	Arginine	A
	CUG	Leucine	CCG	Proline	CAG	Glutamine	CGG	Arginine	G
A	AUU	Isoleucine	ACU	Threonine	AAU	Asparagine	AGU	Serine	U
	AUC	Isoleucine	ACC	Threonine	AAC	Asparagine	AGC	Serine	C
	AUA	Isoleucine	ACA	Threonine	AAA	Lysine	AGA	Arginine	A
	AUG	Methionine (Start)	ACG	Threonine	AAG	Lysine	AGG	Arginine	G
G	GUU	Valine	GCU	Alanine	GAU	Aspartic Acid	GGU	Glycine	U
	GUC	Valine	GCC	Alanine	GAC	Aspartic Acid	GGC	Glycine	C
	GUA	Valine	GCA	Alanine	GAA	Glutamic Acid	GGA	Glycine	A
	GUG	Valine	GCG	Alanine	GAG	Glutamic Acid	GGG	Glycine	G

10) Describe the structure of both the DNA nucleotide and the RNA nucleotide.

DNA nucleotide **RNA nucleotide** .

1)
2)
3)

1)
2)
3)

11) What are peptide bonds and hydrogen bonds used for?

Peptide bonds:

Hydrogen bond:

12) Which nitrogen bases are purines, and which are pyrimidines?

Purines:

Pyrimidines: