Name: Key
Date: ____________
Period: ____________

DNA Unit: DNA Webquest

Part 1 - History, DNA Structure, DNA Replication

DNA History
https://www.dnaftb.org/dnafortb/1/concept/index.html

Read the text and answer the following questions.
1. What have people wondered since the beginning of human history? How traits are inherited
2. Who discovered that individual traits are passed on from one generation to the next? Gregor Mendel, 1865

3. When was DNA discovered as a major chemical of the nucleus of cells? 1865

4. In the early 1900s what molecule was considered to be a better candidate to transmit hereditary information from one generation to the next? Protein

5. Why was protein considered to be a better candidate than DNA? Proteins have specific known functions as enzymes and structural components whereas no specific function has been found for DNA. The 20 amino acids used to make proteins can be arranged into unique information carrying structures.

6. What was the conclusion made by Beadle & Tatum? What year was this? One gene carries the directions for making one protein. 1941

7. What did Oswald Avery's team of scientists conclude from their experiments? In what years? A gene is made up of DNA not protein. 1940s

8. What did earlier work on DNA show? DNA is composed of nucleotides consisting of deoxyribose sugar, a phosphate group, and one of four nitrogenous bases (A, T, C, G). Phosphates and sugars of adjacent nucleotides link together. Ratios of A-T and C-G are constant.

9. Who won the race to show the 3-dimensional structure of DNA? James Watson + Francis Crick

10. What year was this? 1953

Click on animation at the bottom of your screen (step through the animation and answer the following questions

11. What makes up a nucleotide? Phosphate group linked to deoxyribose sugar + one of four nitrogenous bases (A, T, C, G).

12. How could DNA be an "intelligent molecule" (carry hereditary information)? The order of the nucleotides is not the same, it changes.

13. What was Erwin Chargaff's contribution to the DNA puzzle? He found that the amount of adenine = amount of thymine, and the amount of cytosine = amount of guanine in DNA

14. What important tool did Linus Pauling use to determine the structure (shape) of proteins? X-ray crystallography

15. How was this tool used to help discover the shape of DNA? Used to make DNA X-ray diffraction patterns, from which calculations were made of the basic dimensions of the DNA molecule.

16. Name the two scientists that made the x-ray diffraction patterns that Watson & Crick used? Rosalind Franklin + Maurice Wilkins

17. The distinctive "X" meant the DNA had what pattern? Helix
Go to the DNAi website:  [http://www.dnai.org/a/index.html](http://www.dnai.org/a/index.html)
Click on “Finding the Structure” at the bottom of the page, then click on “putting it together” at the top of the new page. Click on the picture next to “base pairing interactive”. Go through the steps to determine how the nitrogen bases pair, and how the sugar phosphate backbone is formed. Draw your results in the box below using the diagram at the end of the module.

DNA Replication
Go to [http://www.stolof.edu/people/giannini/flashanimat/molgenetics/dna-rna2.swf](http://www.stolof.edu/people/giannini/flashanimat/molgenetics/dna-rna2.swf)
Answer the following questions as you move through the animation of DNA replication.

**Before clicking**
1. What class of proteins are the molecules with -ase endings? enzymes
2. Draw a portion of the DNA molecule on the screen.

Click on the large arrow once. (total of one click)
3. Draw the portion of DNA that has “unzipped”

More DNA Replication
Click on the large arrow again (total of 2 clicks).
4. What begins to happen on one of the “unzipped” strands?
   complementary bases are attaching to one of the unzipped strands

Click several more times slowly and study what happens.
4. What do you think the molecules are with the -ase endings on them? 

proteins or enzymes

5. Can you hypothesize what function they could have in this process? 

speeds up the process of replication

6. Explain in your own words & draw a diagram of the process of DNA replication (include what you start and end with & what happens in between)

[Diagram of DNA replication]

Explanation
- DNA helix unwinds as hydrogen bonds break between complementary bases between two strands (Helicase is the enzyme involved)
- each strand of DNA serves as a template
- new DNA nucleotides pair up by complementary base pairing with each template strand (A with T and C with G)
- adjacent nucleotides will bond together with a covalent bond forming between the sugar of one nucleotide and the phosphate of another nucleotide to form the sugar-phosphate backbones (DNA polymerase is the enzyme that catalyzes this reaction)

Go to the DNAi website: http://www.dnai.org/a/index.html

Click on "Copying the Code" at the bottom of the page, then click on "putting it together" at the top of the new page. Select "replication". Watch the animation

1. What is the job of the blue helicase enzyme? uninds the double helix into two strands 

2. How fast does it unwind DNA? as fast as a jet engine
Part 2 - RNA, Transcription, Translation

RNA

Go to http://www.dnaftb.org/dnaftb/21/concept/index.html

Read the text and answer the following questions

1. Where is RNA commonly found? cytoplasm

2. Describe what is meant by the "central dogma" in biology.
   RNA must copy the DNA message in the nucleus and carry it out to the cytoplasm where proteins are synthesized. An adapter molecule reads the genetic code and selects appropriate amino acids to add to a growing polypeptide chain. Flow of genetic information from DNA to RNA to protein.

3. Name the 3 types of RNA and the general roles they play in the making of protein.
   - mRNA messenger RNA
   - tRNA transfer RNA
   - rRNA ribosomal RNA

Click on the animation button below. Step through the animation and compare and contrast the structure of RNA to DNA. Use the Venn diagram to compare and contrast. Then do a sketch of an RNA molecule (at least 10 nucleotides long using all the appropriate bases at least twice).
Transcription (DNA → RNA)
Go to http://www.stolaf.edu/people/giannini/flashanimat/molgenetics/transcription.swf
Answer the following questions as you move through the animation of Transcription

Before clicking
1. The diagram represents what type of molecule? DNA

Click once
2. What type of molecule is the RNA polymerase? enzyme

Click again
3. What function does the RNA polymerase have? unwinding DNA and adding RNA nucleotides to DNA template
4. Where in the cell do you think this is taking place? nucleus
5. Explain how the mRNA molecule forms.
   * One strand of DNA is template for transcription.
   * RNA nucleotides will bind to the template strand by complementary base pairing.
   * Adjacent nucleotides will bond together to form a sugar phosphate backbone.
   * RNA polymerase is the enzyme that catalyzes the synthesis of mRNA.

Go to the DNAi website: http://www.dna.org/a/index.html
Click on "Copying the Code" at the bottom of the page, then click on "putting it together" at the top of the new page. Select "transcription". Watch the animation
1. What does the blue molecule do? reads the gene, it's unzipping the double helix & copying one of the two strands
2. What is the yellow chain? RNA
3. What is T replaced with in RNA? U

Translation (mRNA → protein)
Go to http://www.stolaf.edu/people/giannini/flashanimat/molgenetics/translation.swf
Answer the following questions as you move through the animation of Translation

Before clicking
1. The diagram represents what type of molecule? mRNA

Click once
2. Where in cell in this taking place? cytoplasm

Click again
3. What type of molecule is the tRNA (transfer RNA) bringing to the mRNA? amino acid
4. Explain (in terms of nitrogen bases) how the tRNA docks on the mRNA?
   * The anticodon of the tRNA is complementary to the codon on the mRNA and hydrogen bonds

Click until the end watching the process of translation
5. As the tRNAs dock on the mRNA bringing amino acids with them what type of molecule is created protein

Start the animation over
6. What are the 3 nitrogen bases on the tRNA carrying the amino acid "Met"? UAC
7. What are the 3 nitrogen bases on the mRNA that the "Met"-tRNA docks upon? AUG
8. Check out the next tRNA with its 3 nitrogen bases and see where it docks on the mRNA. Can you detect a pattern. If there are 20 amino acids then what is the minimum number of tRNAs that must exist. 20

Go to the DNAi website: http://www.dna.org/a/index.html
Click on "Reading the Code" at the bottom of the page, then click on "putting it together" at the top of the new page. Select "interactive".
9. Practice translation using the computer animation, and write down the final amino acid sequence here:
   Met-Ser-Thr-Ala-Gln-Tyr