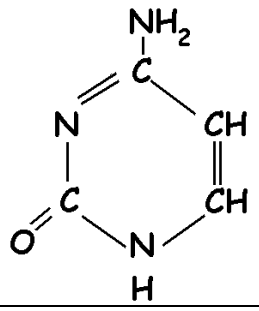
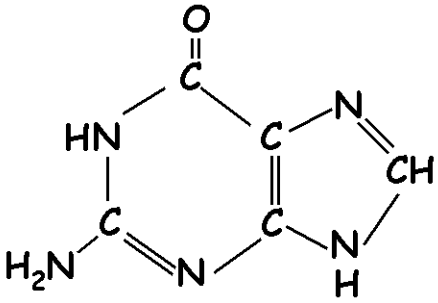
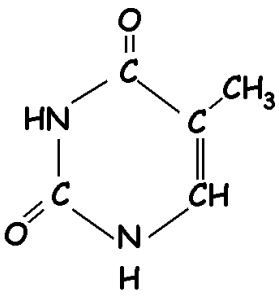
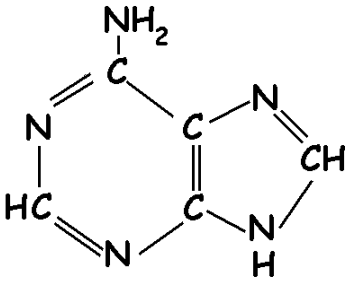
AP BIOLOGY
MOLECULAR GENETICS
ACTIVITY #1

NAME_____

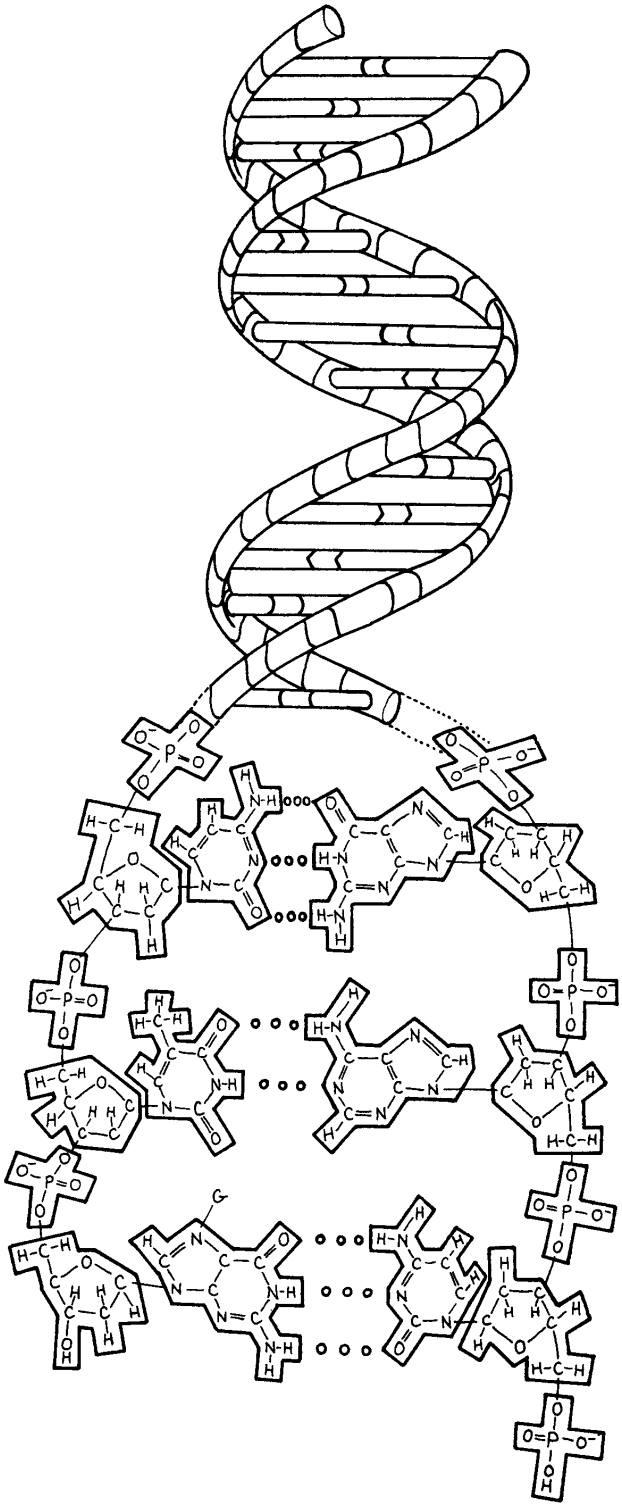
DATE_____HOUR_____

DNA STRUCTURE AND REPLICATION

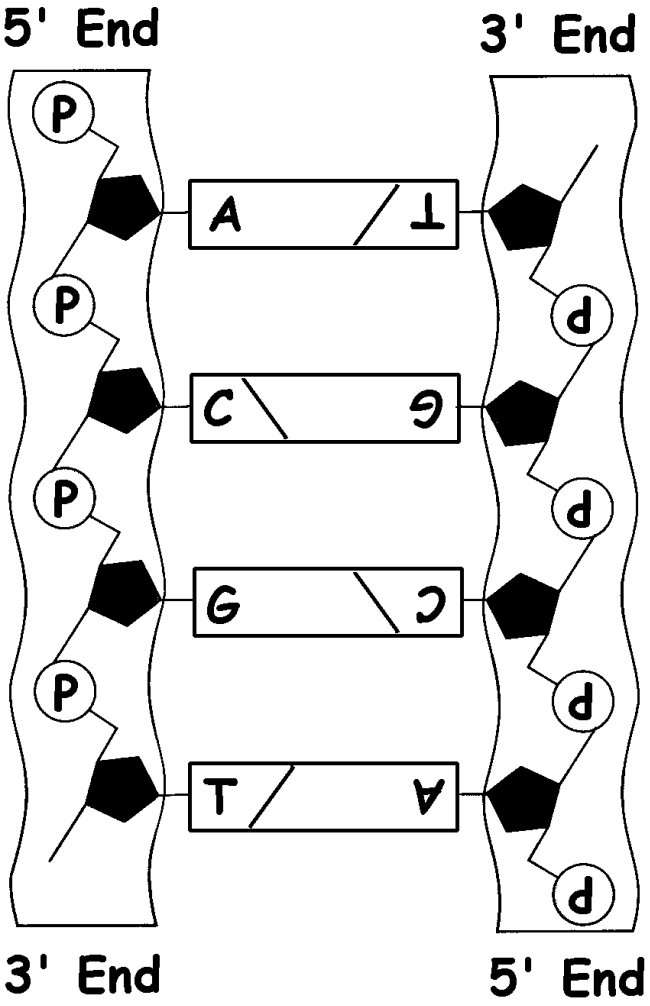
BUILDING BLOCKS OF DNA:

NITROGENOUS BASES	
PYRIMIDINES	**PURINES**
	
	

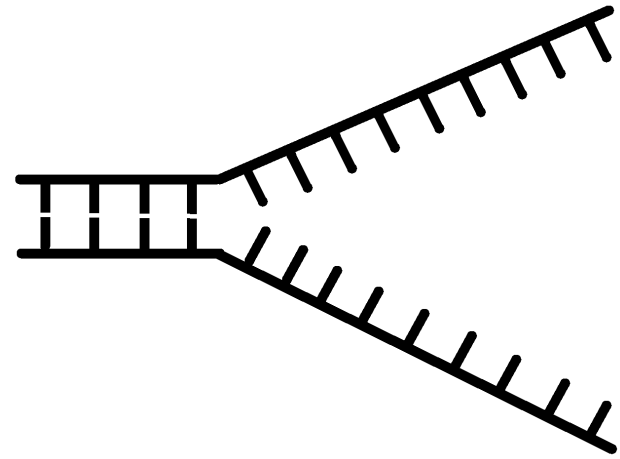
DNA STRUCTURE

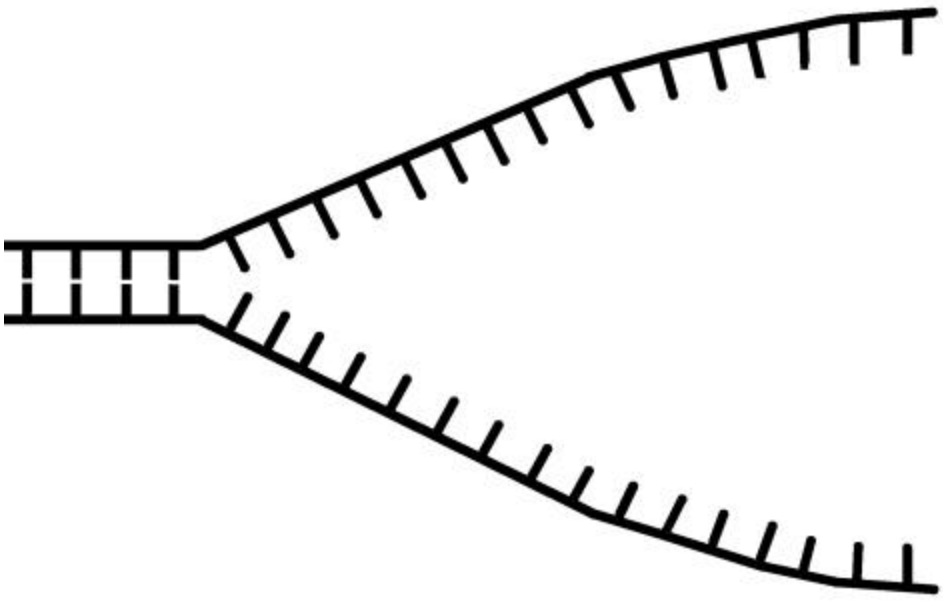


ANTIPARALLEL STRANDS



DNA REPLICATION





QUESTIONS

1. The following questions refer to the experiments performed by Griffith.

   a. What organism(s) did he use in his experimentation?_____

   b. What are the two strains of pneumococcus and the distinguishing characteristics of each strain?

STRAIN	Distinguishing Characteristics

   c. How did Griffith determine that the S strain and not the R strain was pathogenic?

_____

_____

_____

   d. In one experiment, Griffith injected heat-killed S strain bacteria into mice.

   What was he trying to determine by conducting this experiment?

_____

   What were the results of this experiment?

_____

   What conclusion did he reach based on these results?

_____

   e. In another experiment, he mixed heat-killed S strain with live R strain bacteria and injected the mixture into mice.

   What were the results of this experiment?

_____

What strain of the bacteria was found in blood samples from the experiment mice?

_____

What conclusion did he reach based on the results of this experiment?

_____

_____

2. The following questions refer to the experiments performed by Avery, McCarty, and MacLeod.

   a. Avery, McCarty, & MacLeod continued the experimentation begun by Griffith. Their experimentation tried to identify what substance in the heat-killed S strain transformed the R strain into S strain bacteria. They isolated protein, carbohydrates, RNA, and DNA from samples of heat-killed S strain bacteria. They then mixed each of the isolates with R strain bacteria and looked for transformation.

      Only one isolate, when mixed with the live R strain bacteria, resulted in transformation. What was that isolate?

      _____

   b. What conclusion did they reach based on the results of their experiments?

      _____

3. The following questions refer to the experiments of Hershey & Chase (Blender Experiment).

   a. What are bacteriophages?_____

   b. Describe the composition of the T2 bacteriophage.

      _____

   c. What effect does the T2 phage have one E. coli?

      _____

d. In one experiment, they grew T2 phages and E. coli in media with radioactive sulfur (^{35}S).

Into what phage component was the ^{35}S incorporated?_____

The phages with the ^{35}S were then allowed to infect E. coli free of ^{35}S. After a period of time, the culture was blended, centrifuged, and analyzed to determine where the location of the ^{35}S in the mixture.

Where was the ^{35}S located in the centrifuged mixture?_____

What conclusion did they reach based on these results?

_____

e. In another experiment, they grew T2 phages and E. coli in media with radioactive phosphorus (^{32}P). After a period of time, the culture was blended, centrifuged, and analyzed to determine where the location of the ^{32}P in the mixture.

Where was the ^{32}P located in the centrifuged mixture?_____

What conclusion did they reach based on these results?

_____

f. Hershey's & Chase's experimentation provided evidence that:

_____

4. State Chargaff's rule.

_____

_____

5. What two scientists worked out the structure of the DNA molecule?

_____

_____

6. The building blocks of DNA are called:_____

What are the three components of these building blocks?

_____

7. The nitrogenous bases found in DNA are classified in to two groups. Identify each of the following examples and/or characteristics as true of **purines** or **pyrimidines**.

_____ 6-membered ring of carbon and nitrogen atoms
_____ 5-membered ring fused with a 6-membered ring
_____ guanine
_____ adenine
_____ cytosine
_____ thymine

8. How many hydrogen bonds are formed between:

a. cytosine and guanine when they base pair?_____

b. thymine and adenine when they base pair?_____

9. Why does adenine pair with thymine and not cytosine?

_____

10. DNA replication is semiconservative. What does this mean?

_____

_____

_____

11. Listed below are the steps in DNA replication. Put the steps in the correct order.

_____ DNA polymerase adds nucleotides to the exposed bases

_____ DNA ligase joins the Okazaki fragments on the lagging strand

_____ Primase synthesizes the RNA primer

_____ Helicases unwind the DNA double helix

_____ Single-stranded proteins stabilize the unwound DNA

12. Match the role/function with the correct molecule.

A. DNA ligase
B. DNA polymerase
C. Helicases
D. Okazaki fragments
E. Primase
F. RNA primer
G. Single-strand binding proteins

_____ Unwind and unzip DNA

_____ Keep DNA strands separated

_____ Adds DNA nucleotides to exposed bases

_____ Produces the RNA primer

_____ Short RNA segment needed to start DNA replication

_____ Fuses the Okazaki fragments

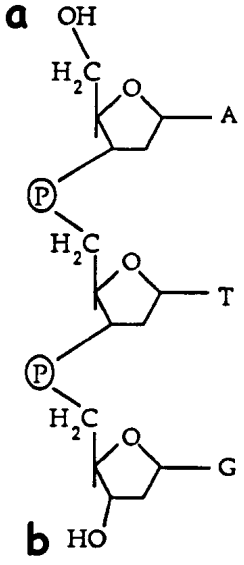
_____ Replication fragments of the lagging strand

13. How does the synthesis of the leading strand differ from that of the lagging strand?

_____

_____

14. Use the diagram at the right to answer the following questions.



a. Which letter (a, b, c, or d) indicates the 5' end of the DNA strand?

_____

b. At which letter (a, b, c, or d) would the next nucleotide be added?

_____

15. In what direction is DNA synthesized?

_____