

Skills Worksheet

Directed Reading

Section: Identifying the Genetic Material

Read each question, and write your answer in the space provided.

1. What was Griffith trying to accomplish by injecting mice with pneumonia-causing bacteria?

2. Why were the *S* bacteria but not the *R* bacteria virulent?

3. Why were the heat-killed *S* bacteria harmless?

4. Why was the mixture of heat-killed *S* bacteria and *R* bacteria virulent?

5. What did Griffith discover as a result of his experiments?

6. How did Avery discover that the material responsible for transformation was DNA?

Directed Reading *continued*

Complete each statement by underlining the correct term or phrase in the brackets.

7. Viruses that infect bacteria are called [bacteriophages / rough].
8. A virus is made of DNA and a [protein coat / cell wall].
9. Hershey and Chase showed that when a phage attacks a bacterium, the [protein coat / DNA] remains outside the bacterium.
10. Radioactive sulfur was used to label the [DNA / protein] in the viruses.
11. Radioactive phosphorus was used to label the [DNA / protein] in the viruses.
12. Hershey and Chase discovered that most of the radioactive sulfur was found in the layer containing [bacteria / phage].
13. Hershey and Chase discovered that after the ³²P-labeled phages infected the bacteria, most of the radioactive phosphorus was found in the layer containing [bacteria / phage].

Complete each statement by writing the correct term or phrase in the space provided.

14. Hershey and Chase removed the phages from the surface of the bacteria by using a(n) _____.
15. Hershey and Chase separated the phages from the bacteria by using a(n) _____.
16. Hershey and Chase concluded that the _____ of the virus was injected into the bacteria.

Skills Worksheet

Directed Reading

Section: The Structure of DNA

In the space provided, write the letter of the description that best matches the term or phrase.

- | | |
|------------------------|---|
| _____ 1. double helix | a. a five-carbon sugar |
| _____ 2. nucleotides | b. type of bond that holds the double helix together |
| _____ 3. deoxyribose | c. one of three parts of a nucleotide made of one or two rings of carbon and nitrogen atoms |
| _____ 4. DNA | d. subunits that make up DNA |
| _____ 5. hydrogen bond | e. one of two pyrimidines used as a nitrogen base in nucleotides |
| _____ 6. nitrogen base | f. one of two purines used as a nitrogen base in nucleotides |
| _____ 7. adenine | g. abbreviation for deoxyribonucleic acid |
| _____ 8. cytosine | h. two strands of nucleotides twisted around each other |

In the space provided, explain how the terms in each pair are related to each other.

9. base-pairing rules, complementary

10. adenine, thymine

11. cytosine, guanine

Directed Reading

Section: The Replication of DNA

In the space provided, write the letter of the description that best matches the term or phrase.

_____ 1. DNA replication

_____ 2. DNA helicases

_____ 3. replication forks

_____ 4. DNA polymerases

_____ 5. synthesis

a. add nucleotides to the exposed nitrogen bases according to the base-pairing rules

b. process of making a copy of DNA

c. the two areas that result when the double helix separates during DNA replication

d. open up the double helix by breaking the hydrogen bonds between nitrogen bases

e. phase during the life cycle of a cell during which DNA replication occurs

Read each question, and write your answer in the space provided.

6. How did the complementary relationship between the sequences of nucleotides lead to the discovery of DNA replication?

7. What prevents the separated DNA strands from reattaching to one another during DNA replication?

8. What prevents the wrong nucleotide from being added to the new strand during DNA replication?

Complete each statement by writing the correct term or phrase in the space provided.

9. Prokaryotic DNA is reproduced with _____ replication forks.

Active Reading

Section: The Structure of DNA

Read the passage below. Then answer the questions that follow.

Watson and Crick determined that DNA is a molecule that is a **double helix**—two strands twisted around each other, like a winding staircase. Each strand is made of linked nucleotides. **Nucleotides** are the subunits that make up DNA. Each nucleotide is made of three parts: a phosphate group, a five-carbon sugar molecule, and a nitrogen base. The five-carbon sugar in DNA nucleotides is called **deoxyribose**, from which DNA gets its full name, deoxyribonucleic acid.

SKILL: READING EFFECTIVELY

Read each question, and write your answer in the space provided.

1. What does the key term *double helix* mean?

2. What is the purpose of the phrase “like a winding staircase” in the first sentence?

3. Name another object that provides a visual model of a double helix.

4. In many words, the prefix *sub-* means “forming part of a whole.” For example, a subset is part of a set. Why then, are nucleotides called subunits of DNA?

5. What are the three subunits that make up a nucleotide?

Active Reading

Section: The Replication of DNA

Read the passage below. Then answer the questions that follow.

The process of making a copy of DNA is called **DNA replication**. It occurs during the synthesis (S) phase of the cell cycle, before a cell divides. The process can be broken down into three steps.

Step 1: Before replication can begin, the double helix must unwind. This is accomplished by enzymes called **DNA helicases**, which open up the double helix by breaking the hydrogen bonds that link the complimentary nitrogen bases. Once the two strands of DNA are separated, additional enzymes and other proteins attach to each strand, holding them apart and preventing them from twisting back into their double-helical shape. The two areas on either end of the DNA where the double helix separates are called **replication forks** because of their Y shape.

Step 2: At the replication fork, enzymes known as **DNA polymerases** move along each of the DNA strands, adding nucleotides to the exposed nitrogen bases according to the base-pairing rules. As the DNA polymerases move along, two new double helixes are formed.

Step 3: Once a DNA polymerase has begun adding nucleotides to a growing double helix, the enzyme remains attached until all of the DNA has been copied and it is signaled to detach. This process produces two DNA molecules, each composed of a new and an original strand. The nucleotide sequences in both of these DNA molecules are identical to each other and to the original DNA molecule.

SKILL: READING EFFECTIVELY

Read each question, and write your answer in the space provided.

1. What is replication?

2. When does replication occur?

Active Reading

Section: The Replication of DNA

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SKILL: READING EFFECTIVELY

Read each question, and write your answer in the space provided.

1. What is replication?

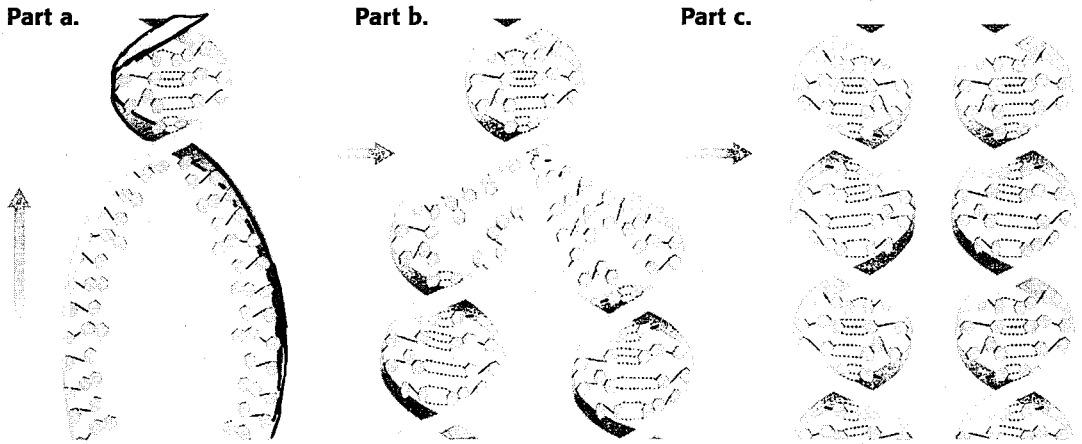
2. When does replication occur?

Active Reading *continued*

3. What must occur before replication can begin?

SKILL: INTERPRETING GRAPHICS

4. The figure below shows DNA replicating. In the space provided, describe what is occurring at each lettered section of the figure. *Use the previous passage as a guide*



Part a. _____

Part b. _____

Part c. _____

In the space provided, write the letter of the term or phrase that best completes the statement.

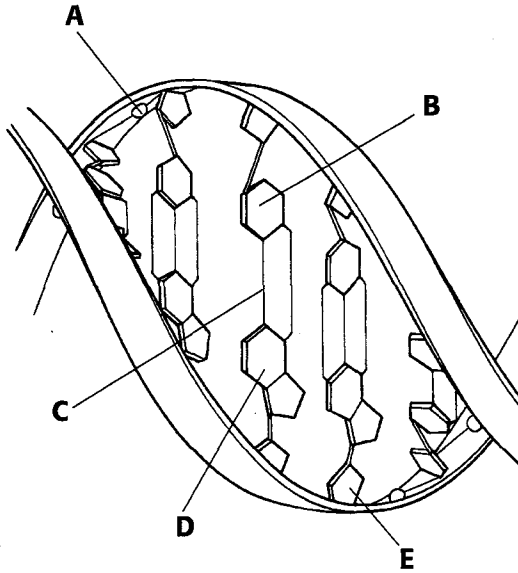
- _____ 5. DNA helicases and DNA polymerases are alike in that both are types of
- a. nucleotides.
 - b. nitrogen bases.
 - c. enzymes.
 - d. Both (a) and (b)

Skills Worksheet

Science Skills

Interpreting Diagrams

Use the figure below to answer questions 1–3.



Read each question, and write your answer in the space provided.

1. In the space provided, identify the structures labeled A–E.

- A. _____
- B. _____
- C. _____
- D. _____
- E. _____

2. What do the lines connecting the two strands represent? Why are there three lines connecting the strands in some instances and only two lines in others?

3. Suppose that a strand of DNA has the base sequence ATT-CCG. What is the base sequence of the complementary strand?

Skills Worksheet

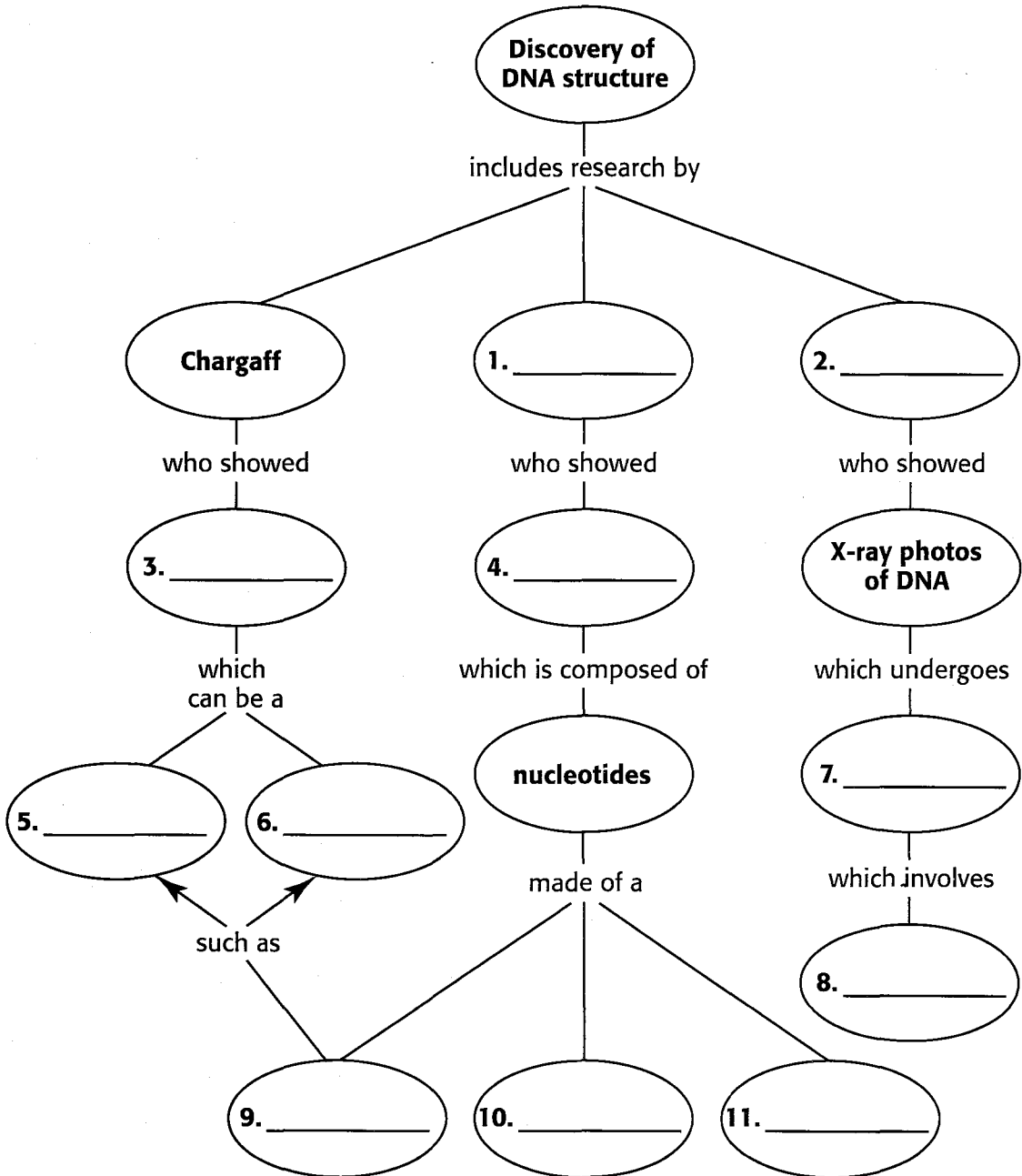
Concept Mapping

Using the terms and phrases provided below, complete the concept map showing the discovery of DNA structure.

amount of base pairs
DNA polymerases
double helix
five-carbon sugar

Franklin and Wilkins
nitrogen base
phosphate group
purine

pyrimidine
replication
Watson and Crick



Skills Worksheet

Vocabulary Review

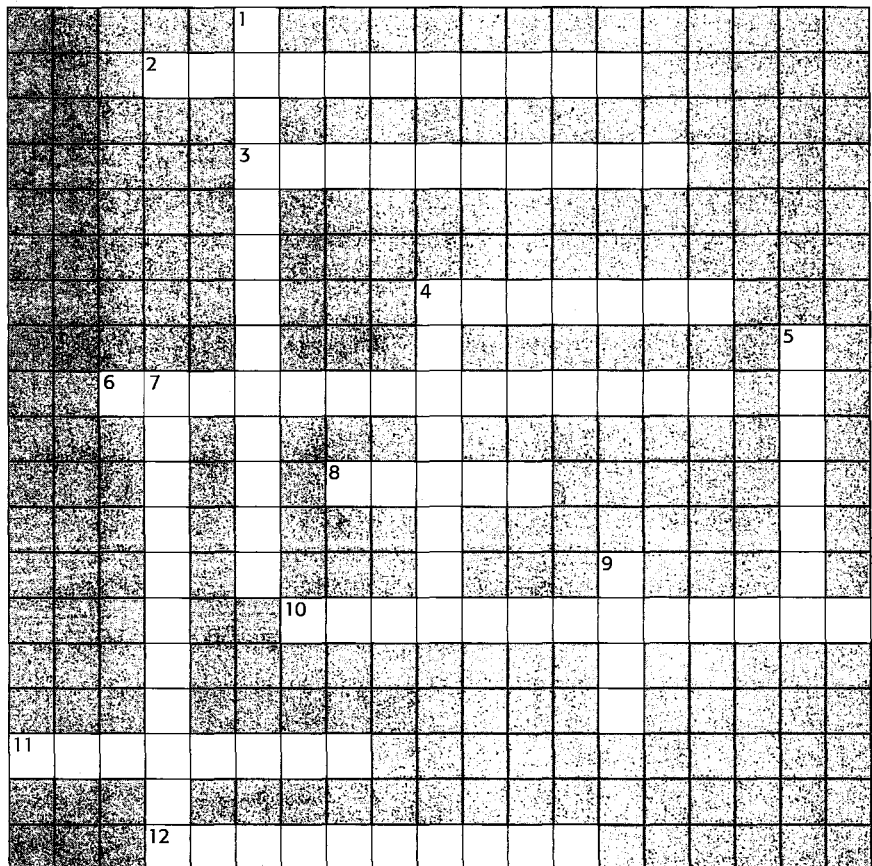
Complete the crossword puzzle using the clues provided.

ACROSS

- 2. five-carbon sugar found in DNA nucleotides
- 3. enzyme that adds nucleotides to exposed nitrogen bases
- 4. substance prepared from killed or weakened microorganisms
- 6. change in phenotype of bacteria caused by the presence of foreign genetic material
- 8. The term *double* _____ is used to describe the shape of DNA.
- 10. a virus that infects bacteria
- 11. enzyme that separates DNA by breaking the hydrogen bonds that link the nitrogen bases
- 12. name for DNA subunit

DOWN

- 1. relationship of two DNA strands to each other
- 4. disease-causing
- 5. Base-_____ rules describe the arrangement of the nitrogen bases between two DNA strands.
- 7. the process by which DNA is copied
- 9. A replication _____ is the area that results after the double helix separates during replication.



Skills Worksheet

Test Prep Pretest

Complete each statement by writing the correct term or phrase in the space provided.

1. In 1928, Frederick Griffith found that the capsule that enclosed one strain of *Streptococcus pneumoniae* caused the microorganism's _____ .
2. Avery's experiments demonstrated that DNA is the _____ material.
3. After infecting *Escherichia coli* bacteria with ^{32}P -labeled phages, Hershey and Chase traced the ^{32}P . The scientists found most of the radioactive substance in the _____ .
4. Watson and Crick used the X-ray _____ photographs of Wilkins and Franklin to build their model of DNA.
5. The process of making new DNA is called _____ .
6. The point at which the double helix separates during replication is called the _____ .
7. DNA replication occurs during the _____ phase of the cell cycle.
8. Eukaryotic DNA contains many replication forks working in concert, whereas prokaryotic DNA contains only _____ replication forks during replication.

Test Prep Pretest *continued*

In the space provided, write the letter of the description that best matches the term or phrase.

- | | |
|--------------------------------|---|
| _____ 9. transformation | a. discovered the three-dimensional structure of DNA with the help of other scientists |
| _____ 10. replication | b. proofreads DNA during replication |
| _____ 11. DNA helicase | c. developed high quality X-ray diffraction photographs of DNA |
| _____ 12. Wilkins and Franklin | d. results in two DNA molecules that are identical to the original DNA molecule |
| _____ 13. Watson and Crick | e. results in a change in a cell's genotype |
| _____ 14. DNA polymerase | f. demonstrated that DNA is the material responsible for transformation |
| _____ 15. Avery | g. discovered transformation in bacterial cells |
| _____ 16. Griffith | h. unwinds the two DNA strands during replication |

Read each question, and write your answer in the space provided.

17. Relate the role of base-pairing rules to the structure of DNA.

18. Describe the components of a nucleotide.

19. What happened when Griffith mixed harmless living *R* bacteria with harmless heat-killed *S* bacteria and then injected mice with this mixture?

Test Prep Pretest *continued*

20. How did Avery's experiment identify the material responsible for transformation?

21. Why did Hershey and Chase use radioactive elements in their experiments?

22. Explain how DNA polymerase "proofreads" a new DNA strand.

23. Describe the role of DNA helicases during replication.
