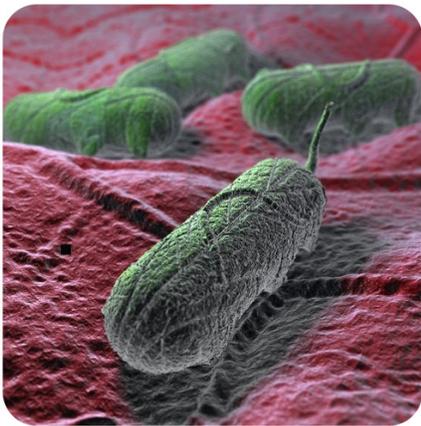


# Chapter 13

## Microorganisms: Prokaryotes and Viruses Worksheets



- Lesson 13.1: Prokaryotes
- Lesson 13.2: Viruses

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# 13.1 Prokaryotes

## Lesson 13.1: True or False

Name \_\_\_\_\_ Class \_\_\_\_\_ Date \_\_\_\_\_

*Write true if the statement is true or false if the statement is false.*

- \_\_\_\_\_ 1. Prokaryotes are single-celled organisms that lack a nucleus.
- \_\_\_\_\_ 2. Since prokaryotes do not have organelles, they do not have ribosomes.
- \_\_\_\_\_ 3. Cyanobacteria were probably the first organisms to photosynthesize.
- \_\_\_\_\_ 4. Cyanobacteria contain the organelle chlorophyll.
- \_\_\_\_\_ 5. The first Archaea discovered were the extremophiles.
- \_\_\_\_\_ 6. The most common prokaryotic shapes are helices, polygons, spheres, and rods.
- \_\_\_\_\_ 7. Prokaryotic DNA is usually one or two circular chromosomes.
- \_\_\_\_\_ 8. Both Bacteria and Archaea have plasma membranes and cell walls.
- \_\_\_\_\_ 9. Flagella help bacteria move.
- \_\_\_\_\_ 10. Because they are simple single cells, prokaryotes do not need energy.
- \_\_\_\_\_ 11. There are billions of bacteria inside the human intestines that help digest food.
- \_\_\_\_\_ 12. Insects are common vectors for spreading bacterial diseases between humans.
- \_\_\_\_\_ 13. Aerobic prokaryotes need oxygen, which they use for cellular respiration.
- \_\_\_\_\_ 14. Bacteria provide vital ecosystem services - they are important producers and are needed for the carbon and nitrogen cycles.
- \_\_\_\_\_ 15. Bacteria in food or water usually cannot be killed.

# Lesson 13.1: Critical Reading

Name \_\_\_\_\_ Class \_\_\_\_\_ Date \_\_\_\_\_

Read these passages from the text and answer the questions that follow.

## Evolution and Classification of Prokaryotes

Prokaryotes are currently placed in two domains. A domain is the highest taxon, just above the kingdom. The prokaryote domains are **Bacteria** and **Archaea**. The third domain is Eukarya. It includes all eukaryotes. Unlike prokaryotes, eukaryotes have a nucleus in their cells.

### Prokaryote Evolution

It's not clear how the three domains are related. Archaea were once thought to be offshoots of Bacteria that were adapted to extreme environments. For their part, Bacteria were considered to be ancestors of Eukarya. Scientists now know that Archaea share several traits with Eukarya that Bacteria do not share (see **Table 13.1**). In what ways are Archaea and Bacteria different? In what ways are Archaea and Eukarya alike? How can this be explained? One hypothesis is that Eukarya arose when an Archaeal cell fused with a Bacterial cell. The two cells became the nucleus and cytoplasm of a new Eukaryan cell. How well does this hypothesis fit the evidence in **Table 13.1**?

Table 13.1: **Comparison of Bacteria, Archaea, and Eukarya**

Characteristic	Bacteria	Archaea	Eukarya
Flagella	Unique to Bacteria	Unique to Archaea	Unique to Eukarya
Cell Membrane	Unique to Bacteria	Like Bacteria and Eukarya	Unique to Eukarya
Protein Synthesis	Unique to Bacteria	Like Eukarya	Like Archaea
Introns	Absent in most	Present	Present
Peptidoglycan (in cell wall)	Present	Absent in most	Absent

### Domain Bacteria

Bacteria are the most diverse and abundant group of organisms on Earth. They live in almost all environments. They are found in the ocean, the soil, and the intestines of animals. They are even found in rocks deep below Earth's surface. Any surface that has not been sterilized is likely to be covered with bacteria. The total number of bacteria in the world is amazing. It's estimated to be  $5 \times 10^{30}$ , or five million trillion trillion. You have more bacteria in and on your body than you have body cells!

Bacteria called **cyanobacteria** are very important. They are bluish green in color because they contain chlorophyll. They make food through photosynthesis and release oxygen into the air. These bacteria were probably responsible for adding oxygen to the air on early Earth. This changed the planet's atmosphere. It also changed the direction of evolution. Ancient cyanobacteria also may have evolved into the chloroplasts of plant cells.

### Domain Archaea

Archaea were first discovered in extreme environments. For example, some were found in hot springs. Others were found around deep sea vents. Such Archaea are called **extremophiles**, or "lovers of extremes." The places where some of them live are thought to be similar to the environment on ancient Earth. This suggests that they may have evolved very early in Earth's history.

*Questions*

1. What is a domain? What are the three domains of life?
2. List three main differences between Bacteria and Archaea.
3. Give three examples of places bacteria live.
4. What are cyanobacteria? What was their most significant contribution?
5. What is an extremophile?

## Lesson 13.1: Multiple Choice

Name \_\_\_\_\_ Class \_\_\_\_\_ Date \_\_\_\_\_

*Circle the letter of the correct choice.*

- The prokaryotic domains are
  - Bacteria and Eukarya.
  - Bacteria and Archaea.
  - Archaea and Eukarya.
  - Prokarya and Bacteria.
- One significant difference between Bacteria and Archaea is that
  - genes in Bacteria have introns.
  - peptidoglycan is found in the cell wall of most Archaea.
  - genes in Archaea have introns.
  - two of the above
- Cyanobacteria
  - contain chlorophyll.
  - make food through photosynthesis.
  - were probably responsible for adding oxygen to the air on early Earth.
  - all of the above
- Hyperthermophiles
  - live in very hot water.
  - live in very acidic environments.
  - live in very salty water.
  - are an early member of the domain Bacteria.
- The most common prokaryotic shapes include
  - rod, square, and helix.
  - helix, sphere, and rod.
  - sphere, rod, and double helix.
  - helical, icosahedral, and complex.
- Prokaryotic DNA
  - is usually circular and located in the cytoplasm.
  - is usually circular and located in the nucleus.
  - consists of numerous chromosomes and is located in the cytoplasm.
  - consists of numerous chromosomes and is located in the nucleus.
- Ways humans use bacteria include
  - killing plant pests.
  - transferring normal genes to human cells in gene therapy.
  - cleaning up oil spills and toxic wastes.
  - all of the above.
- Genetic transfer refers to
  - how Archaea dissolve in extreme environments and transfer their DNA to other prokaryotes.
  - how Bacteria evolve new genes through spontaneous mutations.
  - how prokaryotes increase genetic variation.
  - all of the above.

# Lesson 13.1: Vocabulary I

Name \_\_\_\_\_ Class \_\_\_\_\_ Date \_\_\_\_\_

*Match the vocabulary word with the proper definition.*

## Definitions

- \_\_\_\_\_ 1. bacteria that were responsible for adding oxygen to the air on early Earth
- \_\_\_\_\_ 2. prokaryotes that are specialized to live in extreme environments
- \_\_\_\_\_ 3. small, circular pieces of DNA
- \_\_\_\_\_ 4. used by prokaryotes to increase genetic variation
- \_\_\_\_\_ 5. first discovered in extreme environments
- \_\_\_\_\_ 6. the most diverse and abundant group of organisms on Earth
- \_\_\_\_\_ 7. results from misuse and over-use of the drugs
- \_\_\_\_\_ 8. a colony of prokaryotes that is stuck to a surface
- \_\_\_\_\_ 9. help prokaryotes move
- \_\_\_\_\_ 10. enclose the DNA and help it survive under conditions that may kill the cell
- \_\_\_\_\_ 11. bacteria with a thin cell wall
- \_\_\_\_\_ 12. bacteria with a thick cell wall

## Terms

- a. antibiotic resistance
- b. Archaea
- c. Bacteria
- d. biofilm
- e. cyanobacteria
- f. endospore
- g. extremophile
- h. flagella
- i. genetic transfer
- j. Gram-negative bacteria
- k. Gram-positive bacteria
- l. plasmid

## Lesson 13.1: Vocabulary II

Name \_\_\_\_\_ Class \_\_\_\_\_ Date \_\_\_\_\_

*Fill in the blank with the appropriate term.*

1. The prokaryote domains are \_\_\_\_\_ and \_\_\_\_\_.
2. The common prokaryotic shapes include helices, \_\_\_\_\_, and rods.
3. The DNA of a prokaryotic cell is in the cytoplasm because the cell lacks a \_\_\_\_\_.
4. Under ideal conditions, bacterial populations can double every \_\_\_\_\_ 20 minutes.
5. Bacteria called \_\_\_\_\_ make food through photosynthesis and release oxygen into the air.
6. Genetic \_\_\_\_\_ increases genetic variation in prokaryotes.
7. A \_\_\_\_\_ is a colony of prokaryotes that is stuck to a surface such as a host's tissues.
8. Bacterial infections in people can be treated with \_\_\_\_\_ drugs.
9. Prokaryotes reproduce through binary fission, a type of \_\_\_\_\_ reproduction.
10. A plasmid is an extra-chromosomal piece of \_\_\_\_\_.
11. Cellular respiration and photosynthesis take place in the \_\_\_\_\_ of prokaryotes.
12. Prokaryotes have a \_\_\_\_\_ outside their plasma membrane, usually to give strength and rigidity to the cell.
13. \_\_\_\_\_ live everywhere on Earth, including extreme environments such as deep sea vents.
14. There are \_\_\_\_\_ of bacteria inside the human intestines that help digest food.

## Lesson 13.1: Critical Writing

Name \_\_\_\_\_ Class \_\_\_\_\_ Date \_\_\_\_\_

*Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.*

What are cyanobacteria? Discuss the importance of this prokaryote.

# 13.2 Viruses

## Lesson 13.2: True or False

Name \_\_\_\_\_ Class \_\_\_\_\_ Date \_\_\_\_\_

*Write true if the statement is true or false if the statement is false.*

- \_\_\_\_\_ 1. An individual virus is a virion.
- \_\_\_\_\_ 2. Viruses lack cell membranes, cytoplasm, ribosomes, but they do have genetic material.
- \_\_\_\_\_ 3. Because they evolve, viruses are living organisms.
- \_\_\_\_\_ 4. A virus is essentially DNA or RNA and a protective protein coat.
- \_\_\_\_\_ 5. Populations of viruses still divide like cells even though they are not cells.
- \_\_\_\_\_ 6. Virus can remain latent in within the body for many years.
- \_\_\_\_\_ 7. Antibiotics only kill certain on viruses.
- \_\_\_\_\_ 8. Viruses can be used as vectors in gene therapy treatments.
- \_\_\_\_\_ 9. Viruses are small particles, smaller than eukaryotic cells but larger than prokaryotic cells.
- \_\_\_\_\_ 10. Scientists did not know about viruses until they were first seen with an electron microscope in the 1930s.
- \_\_\_\_\_ 11. A virus can only replicate inside a host cell.
- \_\_\_\_\_ 12. Some viruses can cause cancer.
- \_\_\_\_\_ 13. The protective protein coat around the virus is called a capsid.
- \_\_\_\_\_ 14. Viruses cause AIDS, the flu, chicken pox, the common cold, and food poisoning.

## Lesson 13.2: Critical Reading

Name \_\_\_\_\_ Class \_\_\_\_\_ Date \_\_\_\_\_

Read these passages from the text and answer the questions that follow.

### Characteristics of Viruses

An individual virus is called a **virion**. It is a tiny particle much smaller than a prokaryotic cell. Because viruses do not consist of cells, they also lack cell membranes, cytoplasm, ribosomes, and other cell organelles. Without these structures, they are unable to make proteins or even reproduce on their own. Instead, they must depend on a host cell to synthesize their proteins and to make copies of themselves. Viruses infect and live inside the cells of living organisms. When viruses infect the cells of their host, they may cause disease. For example, viruses cause AIDS, influenza (flu), chicken pox, and the common cold.

Although viruses are not classified as living things, they share two important traits with living things. They have genetic material, and they can evolve. This is why the classification of viruses has been controversial. It calls into question just what it means to be alive. What do you think? How would you classify viruses?

### Structure and Classification of Viruses

Viruses vary in their structure. The structure of a virus determines how it is classified.

#### Structure of Viruses

A virus particle consists of DNA or RNA within a protective protein coat called a **capsid**. The shape of the capsid may vary from one type of virus to another.

Some viruses have an envelope of phospholipids and proteins. The envelope is made from portions of the host's cell membrane. It surrounds the capsid and helps protect the virus from the host's immune system. The envelope may also have receptor molecules that can bind with host cells. They make it easier for the virus to infect the cells.

#### Classification of Viruses

Viruses are classified on the basis of several traits. For example, they may be classified by capsid shape, presence or absence of an envelope, and type of nucleic acid. **Table 13.2** gives examples of virus families and their traits. Most systems of classifying viruses identify at least 20 virus families, but only 4 are shown in the table. Have any of these viruses made you sick?

Table 13.2: **Virus Classification: Four Examples**

Virus Family	Capsid Shape	Envelope Present?	Type of Nucleic Acid	Disease Caused by a Virus in this Family
Adenovirus	icosahedral	no	DNA	acute respiratory disease
Herpesviruses	icosahedral	yes	DNA	chicken pox
Orthomyxoviruses	helical	yes	RNA	influenza
Coronaviruses	complex	yes	RNA	common cold

#### Questions

1. Describe a virion.



## Lesson 13.2: Multiple Choice

Name \_\_\_\_\_ Class \_\_\_\_\_ Date \_\_-

*Circle the letter of the correct choice.*

- Viruses are in which domain of life?
  - Archaea
  - Bacteria
  - Eukarya
  - none of the above
- Which of the following structures do viruses lack? (1) genetic material, (2) cell membrane, (3) cytoplasm, (4) ribosomes.
  - 1 only
  - 1, 2, and 3
  - 2, 3, and 4
  - 1, 2, 3, and 4
- Which statement best describes a capsid?
  - A capsid defines the shape of the virus.
  - A capsid is the outside coat of the virus.
  - A capsid is a protein coat that protects the genetic material of the virus.
  - A capsid is either helical, icosahedral, or complex.
- Which traits describe the virus that causes the common cold?
  - It is an RNA virus with a complex capsid surrounded by an envelope.
  - It is a DNA virus with a complex capsid surrounded by an envelope.
  - It is an RNA virus with a helical capsid surrounded by an envelope.
  - It is a DNA virus with an icosahedral capsid surrounded by an envelope.
- To replicate, a virus must
  - infect a host cell and use the cell's ribosomes, enzymes, DNA, and other components.
  - infect a host cell and use the cell's ribosomes, enzymes, ATP, and other components.
  - infect a host cell and use the viral enzymes, ATP, and other components.
  - infect a host cell and use the viral DNA and ribosomes, but the cell's enzymes, ATP and other components.
- Latency refers to
  - the process of viral disease formation inside a host.
  - the process of making a viral envelope from portions of the host's cell membrane.
  - a dormant state of the virus inside a host's body.
  - the process of viral replication inside a host.
- A vaccine
  - can be harmful because it contains pathogens such as viruses.
  - contains a changed pathogen, so the pathogen is no longer harmful.
  - provokes a response from the viral immune system.
  - all of the above
- Which of the following statements is true? (1) HPV causes cancer of the cervix in females. (2) Hepatitis B virus causes cancer of the liver. (3) Many viral diseases can be prevented with proper vaccination. (4) Antibiotics have no effect on viruses.

- (a) 1 and 2
- (b) 3 and 4
- (c) 1, 2, and 3
- (d) 1, 2, 3, and 4

## Lesson 13.2: Vocabulary I

Name \_\_\_\_\_ Class \_\_\_\_\_ Date \_\_\_\_\_

*Match the vocabulary word with the proper definition.*

### Definitions

- \_\_\_\_\_ 1. surrounds the capsid and helps protect the virus
- \_\_\_\_\_ 2. the ability to resist a pathogen
- \_\_\_\_\_ 3. a dormant state inside the body
- \_\_\_\_\_ 4. a protective protein coat
- \_\_\_\_\_ 5. usually considered to be nonliving
- \_\_\_\_\_ 6. a substance that contains harmless pathogens
- \_\_\_\_\_ 7. 20-sided
- \_\_\_\_\_ 8. spiral
- \_\_\_\_\_ 9. an individual virus

### Terms

- a. capsid
- b. envelope
- c. helical
- d. icosahedral
- e. immunity
- f. latency
- g. vaccine
- h. virion
- i. virus

## Lesson 13.2: Vocabulary II

Name \_\_\_\_\_ Class \_\_\_\_\_ Date \_\_\_\_\_

*Fill in the blank with the appropriate term.*

1. Many viral diseases can be prevented by giving people \_\_\_\_\_.
2. Viruses do not meet most of the criteria of \_\_\_\_\_.
3. The three shapes of viral capsids are helical, icosahedral, and \_\_\_\_\_.
4. Viruses are so small that they can be seen only with an \_\_\_\_\_ microscope.
5. Viruses must use the cell's \_\_\_\_\_, enzymes, ATP, and other components to replicate.
6. A virus particle consists of DNA or RNA within a \_\_\_\_\_ coat.
7. Viruses may cause illness by disrupting \_\_\_\_\_ in host cells.
8. Viruses are used as vectors in gene \_\_\_\_\_.
9. The virus that causes chicken pox may remain \_\_\_\_\_ within the body for decades.
10. Though some antiviral drugs are available, the more common \_\_\_\_\_ have no effect on viruses.
11. One way viruses cause \_\_\_\_\_ is by causing host cells to burst open and die.
12. Viruses cause diseases such as \_\_\_\_\_, influenza, chicken pox, and the common cold.

## Lesson 13.2: Critical Writing

Name \_\_\_\_\_ Class \_\_\_\_\_ Date \_\_\_\_\_

*Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.*

Are viruses living organisms? Discuss why or why not.