Name Date

Topic 1.4 Summary

What interactions occur between humans and micro-organisms?

Micro-organisms

Micro-organisms, or microbes for short, are so small that a microscope is needed to see them. Bacteria are an example.

How Microbes Help Ecosystems

Some microbes are **producers**. They are the first links in the food chain for many kinds of living things. They also make oxygen.

Some microbes are **decomposers**. They return nutrients to the environment. Other living things use these nutrients for their life functions.

Some kinds of bacteria grow on the roots of plants such as peas and beans. These plants need nitrogen, and the microbes make it available to them in a form they can use.

Harmful and Helpful Interactions with Microbes

Some microbes hurt us (and other living things) by making us sick or causing illnesses that threaten life. Others help us by keeping us healthy or providing many of the products we eat or use each day.

Examples of Interactions with Microbes

Some Harmful Interactions	Some Helpful Interactions
• Pathogens are microbes that can make us sick. • Some microbes cause food to spoil. • Some microbes cause wood to rot.	• Some microbes help us digest food and prevent infection. • Microbes are used in food processing, drug, and agricultural industries. • Microbes are used in waste management.

Check for Understanding

As you read this section, highlight the main point of each paragraph. Use a different colour to highlight an example that helps explain the main point, or write your own.

Reading Check

1. What is a microbe?

2. Give an example of how microbes can be helpful and another example of how microbes can be harmful.

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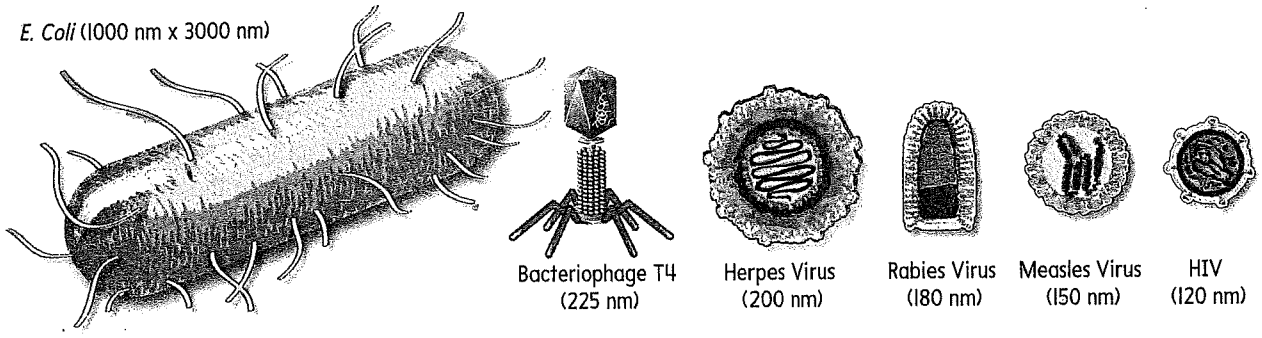
How Small Are Microbes?

The following diagram shows the relative sizes of various microbes. For each microbe, determine how many would fit end-to-end along a straight line that measures 1 m in length. A sample calculation has been provided to guide you.



Note: metre is a base unit

prefix "nano" means 1 billionth

$$1 \text{ nm} = \frac{1}{1\,000\,000\,000 \text{ m}}$$

$$= 0.000\,000\,001 \text{ m}$$

Sample Calculation:

How many *E. Coli*, with length of 3000 nm, would fit end-to-end on a straight line that measures 1 m in length?

Step 1: Convert nanometres to metres to calculate the actual length of the microbe in metres. Write the amount and unit given.

3000 nm

Step 2: Multiply by a fraction with the nanometre unit in the denominator and the metre unit in the numerator. There are 1 000 000 000 nm in 1 metre.

$$3000 \text{ nm} \times \frac{1 \text{ m}}{1\,000\,000\,000 \text{ nm}}$$

Step 3: Cancel the common units in the numerator and the denominator.

$$3000 \cancel{\text{nm}} \times \frac{1 \text{ m}}{1\,000\,000\,000 \cancel{\text{nm}}} = 0.000\,003 \text{ m}$$

So, 3000 nm = 0.000 003 m.

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Step 4: To determine how many microbes fit onto a 1 m line, divide 1 m by the actual length of the microbe in metres.

$$\frac{1\text{ m}}{0.000\,003\text{ m}} = 333\,333\ \textit{E. Coli}\text{ in }1\text{ m}$$

Microbe	Length in nanometres (nm)	Calculations	Length in metres (m)	Number of microbes that would fit on a 1 m line
Bacteriophage (virus that attacks bacteria)	225 nm			
Herpes Virus (virus that causes cold sores)	200 nm			
Rabies Virus (virus that causes inflammation of the brain)	180 nm			
Measles Virus (virus that causes measles)	150 nm			
HIV (virus that causes AIDS)	120 nm			

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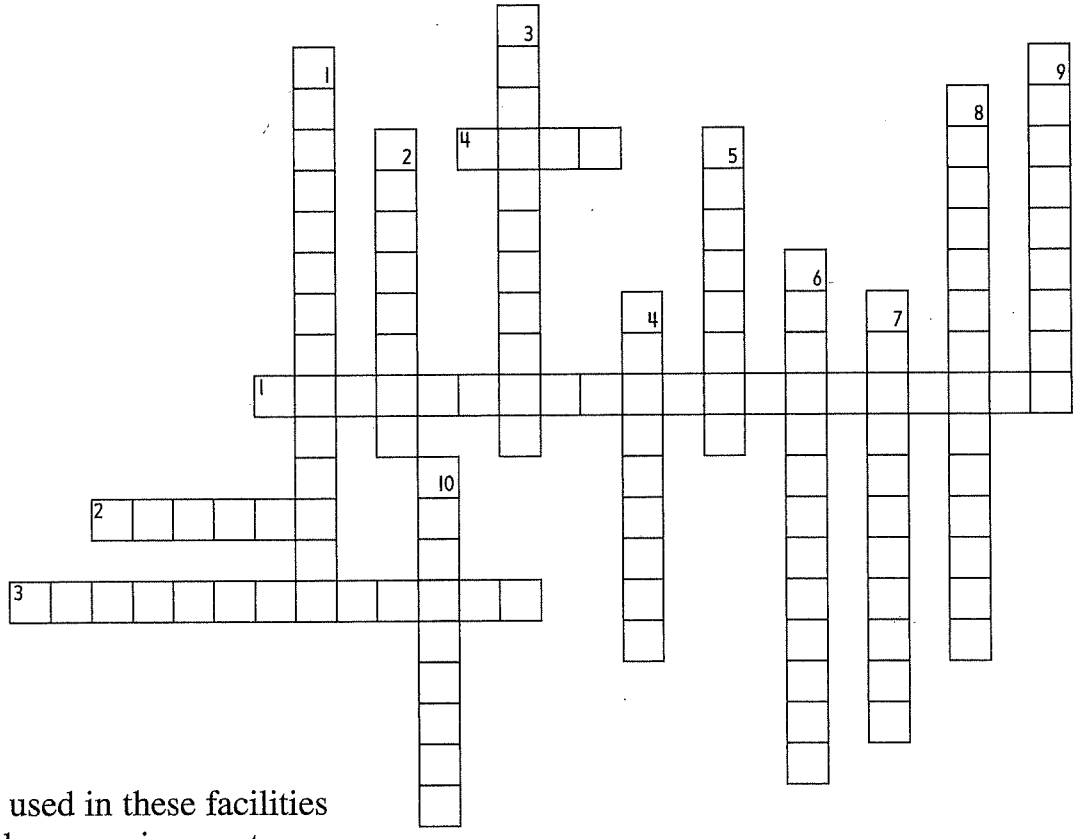
Roles of Microbes

Complete the following crossword puzzle by using the clues and vocabulary list provided.

Vocabulary

chloroplast
decomposers
food
food poisoning
medicines
microbes
micro-organisms
nitrogen
nutrients
pathogens
photosynthesis
phytoplankton
toxins
water treatment plants



Across

1. bacteria are used in these facilities to assist in decomposing wastes
2. poisons
3. condition caused by *E. Coli, Listeria,* and *Botulism*
4. bacteria that make things like cheese, chocolate, and yogurt

Down

1. organisms that need a microscope to be seen
2. short form for micro-organism
3. bacteria that break down dead organisms to return nutrients to the soil
4. substance made available due to bacteria decomposing waste materials
5. nutrient made available to plants by bacteria in root nodules of peas and beans
6. microbes that live in oceans and lakes that produce 50% of the oxygen in the atmosphere
7. organelle found in producers that carry out photosynthesis
8. cellular process carried out by producers to make oxygen
9. organisms that cause diseases
10. examples include antibiotics and insulin made by bacteria

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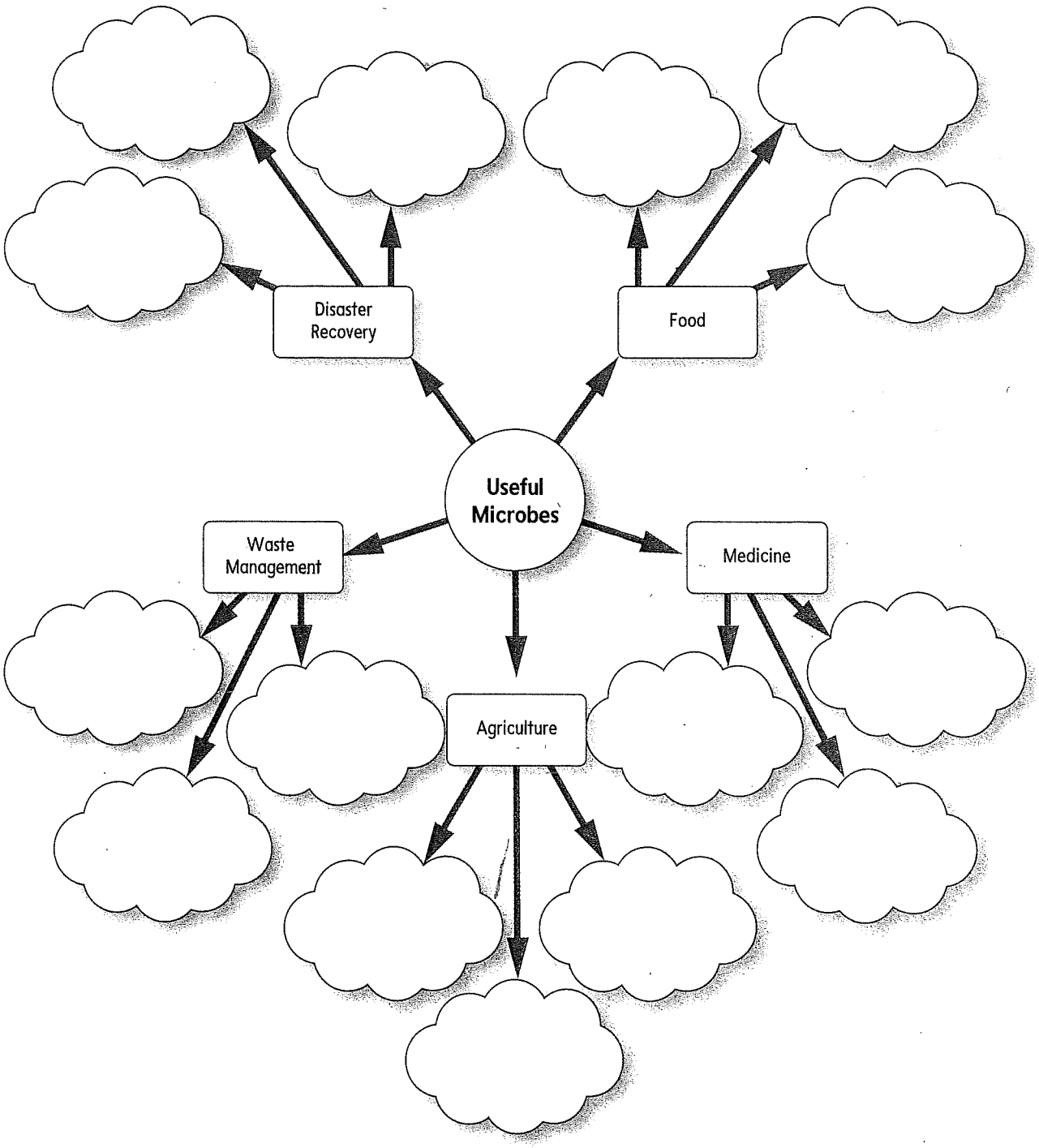
Useful Microbes

1. Complete the following concept map to illustrate the positive contributions that useful microbes make to the lives of humans.



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Pathogens That Cause Food Poisoning

Norovirus, Listeria, Salmonella, E. Coli, and *Campylobacter* are microbes responsible for causing food poisoning. In the last few decades, these microbes have been found in contaminated food. The average numbers of cases each year in Canada are shown in the following table.

Microbes	Food-borne Illnesses	Hospitalization
Norovirus	1 million	1 180
Listeria	178	150
Salmonella	88 000	925
E. Coli	12 800	245
Campylobacter	145 000	565
Total Cases	1 245 978	3 065

(Source: Government of Canada)

1. Create a pie chart from the hospitalization data given in the table. Show the data in the pie chart as percents.

2. Which microbe is the leading cause of food-borne illnesses and hospitalizations?

_____

3. Which two bacteria have caused the greatest number of cases of food-borne illness?

_____

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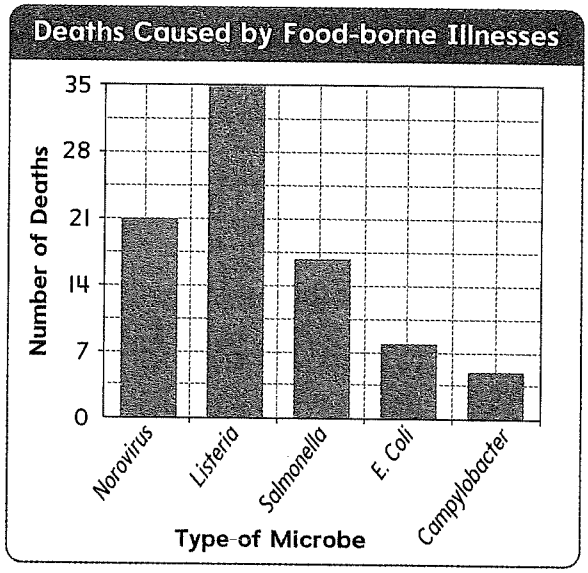
4. What percent of hospitalizations are due to *Campylobacter*?

5. Since *Salmonella, E. Coli, Listeria,* and *Campylobacter* have been linked to food poisoning, what are these four microbes also known as?

6. According to the data, which one microbe results in 30% of the hospitalizations for food-borne illnesses.

Use the following bar graph of Deaths Caused by Food-borne Illnesses to answer questions 7 to 9.



7. Which microbe is responsible for the greatest percent of deaths related to food-borne illnesses?

8. Which microbe contributes to about 10% of the deaths related to food-borne illnesses?

9. What percent of food-borne illness related deaths are caused by Salmonella?

10. What precautions can people can take to prevent food-borne illnesses?

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1.4 Assessment

Match each term on the left with the best description on the right. Each description may be used only once.

Term	Description
1. ____ microbe	A. short form for micro-organism
2. ____ producer	B. organism that can cause a disease
3. ____ pathogen	C. an organism that requires a microscope to be seen
4. ____ decomposer	D. organism that breaks down dead and waste materials
5. ____ micro-organism	E. organism that can produce its own food through photosynthesis

Circle the letter of the best answer for questions 6 to 15.

6. Which of the following is not referred to as a micro-organism?

A. ant on a log

B. phytoplankton in the ocean

C. yeast used to make beverages

D. influenza virus that causes the seasonal flu

7. Where can microbes be found on the human body?

I	on the skin
II	in the airway
III	in the urogenital tract

A. I and II only

B. I and III only

C. II and III only

D. I, II, and III

8. Which of the following correctly matches the microbe with a possible location where it could be found?

	Type of Microbe	Possible Location
A.	archaea	root nodules of clover
B.	producer	at the bottom of the ocean on the sea floor
C.	decomposer	on a fallen tree that has been struck by lightning
D.	nitrogen fixer	inside the intestine of a human

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9. Through genetic engineering, bacteria are used to do which of the following?

I	make drugs
II	attack and kill viruses
III	produce drought-resistant crops

A. I and II only

B. I and III only

C. II and III only

D. I, II, and III

10. Which of the following does not describe a pathogen?

A. It is usually harmless.

B. It can make people sick.

C. It is a disease-causing agent.

D. It can produce toxins or poisons.

11. Which of the following organisms are examples of pathogens?

A. Bacteria in the intestine help digest food.

B. Wood-decay fungus eats moist wood, which leads to the wood rotting.

C. Bacteria produce erythromycin, an antibiotic used to treat infections.

D. Bacteria in the mouth cause gum disease, resulting in inflammation of the gums.

12. Which of the following microbes are used to break down waste and pollutants in industrial sewage treatments?

A. producers

B. pathogens

C. decomposers

D. nitrogen fixers

13. Which of the following microbes could be called "extremists"?

A. archaea

B. bacteria

C. pathogens

D. decomposers

14. Which of the following are examples of the benefits of bacteria?

I	cause food to spoil
II	produce insulin for diabetic people
III	used to genetically modify tomatoes so they become frost tolerant

A. I and II only

B. I and III only

C. II and III only

D. I, II, and III

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15. Which of the following statements explains why farmers alternate between growing corn for one year and then legumes the next year?

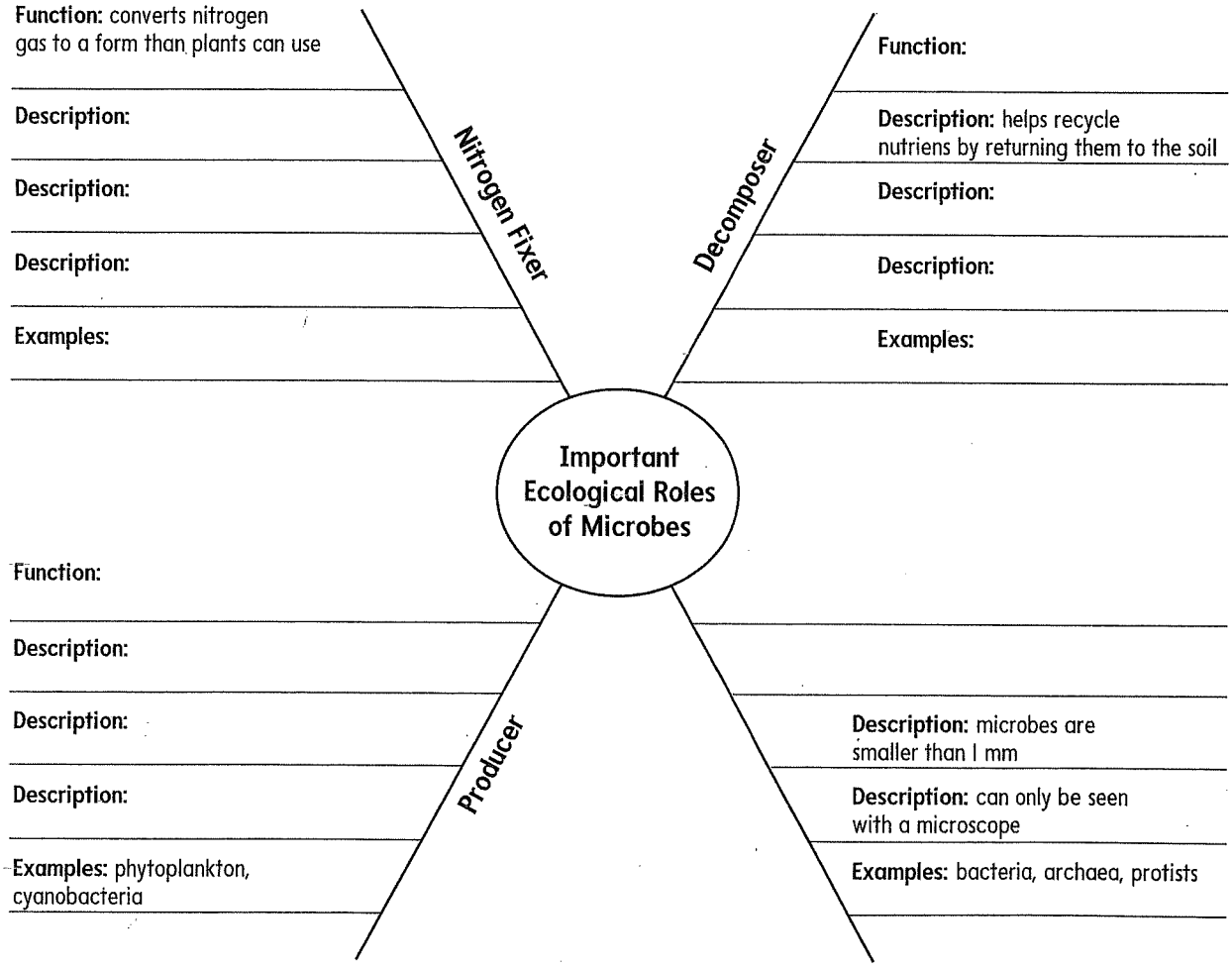
A. Legumes help replenish the supply of usable nitrogen in the soil.

B. Legumes can recycle nutrients, while corn cannot recycle nutrients.

C. Legumes will help decompose the nutrients left behind by the corn for plants to use.

D. Legumes balance things out by absorbing less oxygen, while the corn absorbs more oxygen from the atmosphere.

16. Micro-organisms play three important roles in the ecosystem: decomposers, nitrogen fixers and producers. Complete the following spider map/chart by providing a function, descriptions, and some examples of these different ecological roles. The chart has been partially completed to help guide you.



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