

# What is the universe, and how do we make sense of it?

Use with textbook pages 292-299.

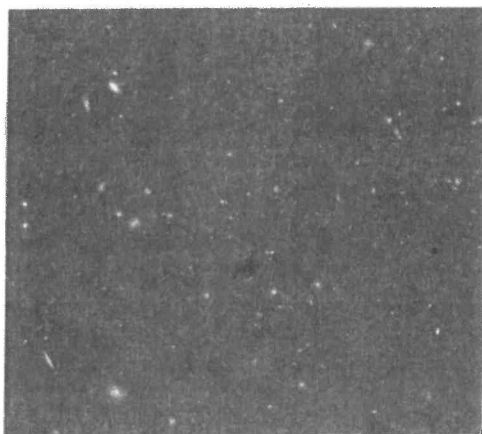
## The Meaning of “Universe”

The **universe** is all that exists everywhere—all matter, energy, planets, stars, and galaxies, as well as the space everything occupies. However, our perception of “all that exists” depends on many factors. Currently we know that billions of galaxies exist in the universe, and each is made up of billions of stars. But our understanding of the universe has changed incredibly, even within the past century. Almost 100 years ago scientists knew of only one galaxy: our own Milky Way. At that time, we thought it was our entire universe. Our ideas about the universe and our place within it have changed countless times. People in many different locations and in many different time periods have had many different views of the universe. These views were based on their own knowledge, experiences, cultures, and ways of knowing. The concept of “universe” is an evolving idea that tries to make sense of the vast realm beyond and including our own home planet, Earth.

## The Age of the Universe

The universe began about 13.8 billion years ago. This huge number is hard to comprehend using everyday examples. Here is an example that might help. At the time that this workbook was written, there were about 4.7 million people in BC. If each person represents one year in the age of the universe, it would take almost 3000 times this number of people to equal the age of the universe.

When we look into space, the light we see is travelling to our eyes at the highest speed we know. This speed is the speed of light, which is about 300 000 km/s. Since it takes time for light to travel to our eyes from so very far away, looking into space is like looking back in time. We are seeing stars and galaxies as they were long ago, when their light first began a journey to our eyes. For some stars, this journey has taken millions of year. For others, it has taken billions of years. Going back that far in time also leads to many questions about the universe, its beginnings, and how and why it has changed.



## **The Universe Before and After Edwin Hubble**

*Use with textbook pages 294-296.*

*Use the following reading passage to answer questions 1 to 3.*

In the early 1900s, scientists thought they knew a great deal about space and astronomy. For example, vast numbers of stars had been observed and studied. Scientists estimated that there were millions—or perhaps billions—of stars in total. Earth and our closest star, the Sun, as well as all other stars were thought to be members of the Milky Way galaxy. And this galaxy was thought to be the whole known universe. Edwin Hubble's discoveries changed all of this.

Hubble was an astronomer at the Mount Wilson Observatory in California. There, he was using a telescope that was the world's largest telescope at the time. He was interested in a blurry smudge that was thought to be a huge cloud of gas and space dust (called a nebula) in our galaxy. He realized that this smudge was really another galaxy. This galaxy, called Andromeda, is our Milky Way's nearest neighbour, but it is far beyond it. Hubble found many, many other distant galaxies, and he discovered something else. They were all in motion and moving away from each other! He developed a system to classify galaxy shapes, and ways to find their distance from us in space. As a result of Hubble's evidence and discoveries, our ideas about the universe changed dramatically. We now knew that stars were in motion, there were many galaxies in the universe, and that the universe itself was expanding as galaxies moved away from each other. Later in this unit, you will learn more about these and other discoveries and how they helped transform our understanding of the universe.

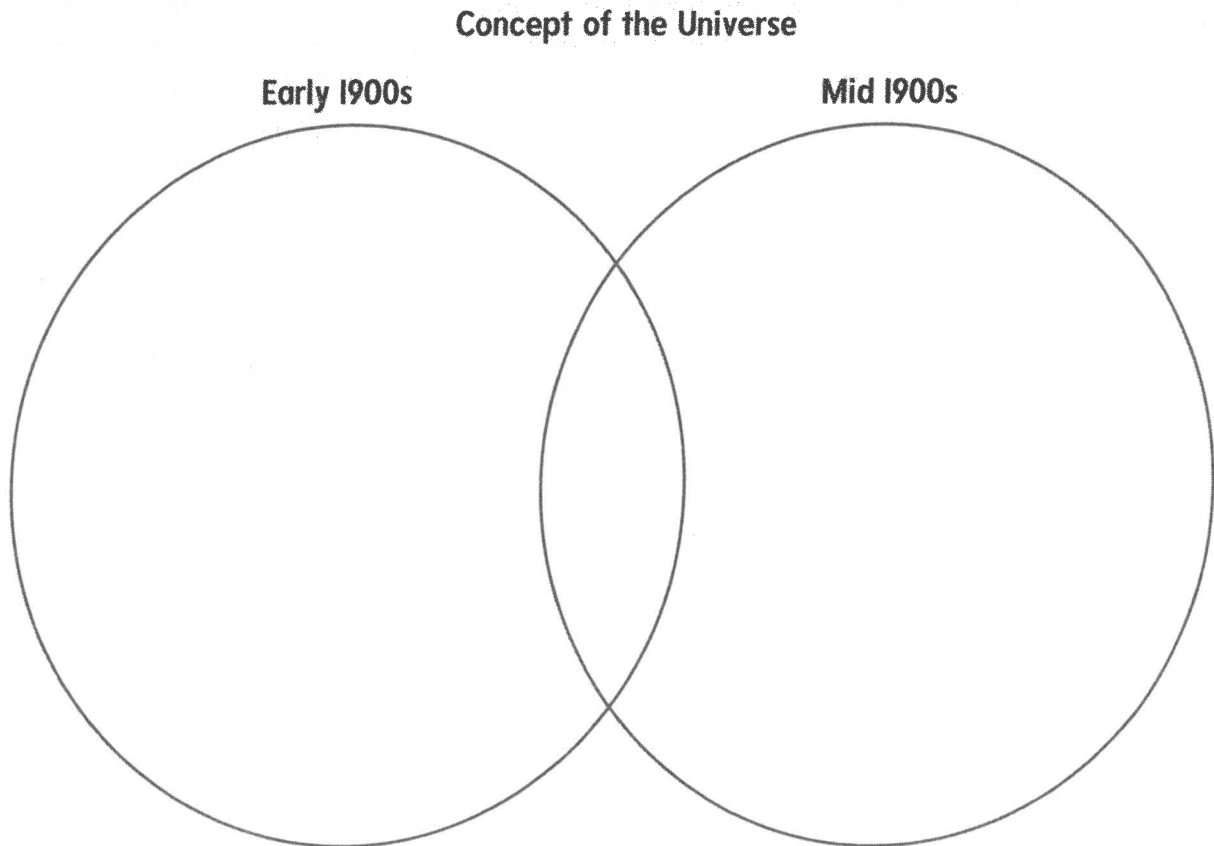
### **1. Asking Questions**

As you read the two paragraphs above, stop to ask yourself *who*, *what*, *when*, *where*, *why*, and *how* questions. Write these six questions down. See if your questions are answered in the text. If not, reread the paragraphs to see if you might have missed something.

- a) Who \_\_\_\_\_
- b) What \_\_\_\_\_
- c) When \_\_\_\_\_
- d) Where \_\_\_\_\_
- e) Why \_\_\_\_\_
- f) How \_\_\_\_\_

**2. Comparing and Contrasting—Using Graphic Organizers**

Comparing and contrasting helps you think about how two concepts are similar and different. Complete a Venn diagram to visually show the similarities and differences between the concept of the universe in the early 1900s and after Hubble's discoveries.



- 3. Research the life of Edwin Hubble. What can you find out about his areas of post-secondary study, his careers other than astronomy, and his challenges in presenting new evidence that conflicted with accepted ideas in science?**

## Components of the Universe

Use with textbook pages 294-296.

The **universe** is all that exists everywhere—all matter, energy, planets, stars, and galaxies, as well as the space everything occupies.

Use the graphic organizer below to access your prior knowledge of terms that are part of the definition of “universe.” For each term, include the following:

- What does the term mean to you? (For example, think about a definition or description you know or something you remember from a previous science course.)
- What examples can you think of that help describe or clarify the term’s meaning?
- How does this term apply to your overall understanding of the universe?

	Meaning	Examples	Application to the “Universe” Concept
matter			
energy			
planet			
star			
galaxy			
space			

**4.1 Assessment**

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

Term	Descriptor
1. ____ billions	A. approximate age of the universe in years
2. ____ relative	B. galaxy in which we live
3. ____ 13.8 billion	C. included in definition of the universe
4. ____ culture shock	D. collection of stars
5. ____ one	E. "all that exists"
6. ____ Milky Way	F. number of galaxies in the universe we know today
7. ____ matter and energy	G. not absolute or constant; depends on something else
8. ____ galaxy	H. sense of anxiety and disorientation in drastically new situations
9. ____ universe	I. number of galaxies in known universe 100 years ago

Circle the letter of the best answer for questions 10 to 19.

10. Which of the following describe galaxies?

I	look very different from Earth
II	changing, or having various stages
III	trillions of years old

A. I and II only

C. II and III only

B. I and III only

D. I, II, and III

11. If "all that exists" in the universe is *relative*, it depends on

A. who you are.

C. the time you live in.

B. where you live.

D. all of the above.

12. Place the terms in the correct order, from largest to smallest.

A. universe, planets, stars, galaxies

B. universe, galaxies, stars, planets

C. planets, stars, galaxies, universe

D. galaxies, universe, stars, planets

**13. Our concept of “universe”**

- A. has never varied over time.                      C. includes matter but not energy.  
B. includes stars only.                                  D. depends on many factors.

**14. How was the size of the universe thought of 100 years ago in comparison to what it is known to be today?**

- A. It was thought to be larger.  
B. It was thought to be the same size.  
C. It was thought to be smaller.  
D. No one knows the size of the universe today.

**15. Local knowledge about the universe has helped different groups of people**

- A. plan times of year to gather food.                      C. prepare for changes in seasons.  
B. navigate across waterways.                              D. all of the above

**16. Our current knowledge of the universe**

I	is complete and will not change in the future.
II	is constantly being revised with new information.
III	may change drastically during your lifetime.

- A. I and II only    C. II and III only  
B. I and III only    D. I, II, and III

**17. If you compare the number of years since the birth of the universe to the number of people on Earth, the ratio is approximately**

- A. 2:1.    C. 2000:1.  
B. 1:2.    D. 20:1.

**18. Matter is different from energy, since energy does not have**

- A. colour.  
B. mass or volume.  
C. ability to do work.  
D. heat.

19. The universe includes
- A. matter and energy only.
  - B. matter, energy, and stars only.
  - C. matter, energy, stars, and galaxies only.
  - D. matter, energy, stars, galaxies, and the space in which it all exists.
20. Consider the five related foundation themes or ideas in First Peoples science, namely interconnectedness, reciprocity, transformation, renewal, and connection with place. Design a spider map and suggest ways that these themes all connect with the concept of “universe.”