

Science 9: Unit 1

# Exploring Our Universe

Name: \_\_\_\_\_

Period: \_\_\_\_\_ Room: \_\_\_\_\_

Ms. Hayduk

# Table of Contents

The Scientific Method .....	4
The Scientific Method .....	4
The Purpose.....	4
The Hypothesis.....	4
Fair Tests.....	5
Variables.....	5
Variables Example.....	5
Results.....	6
Conclusion .....	6
Activity: The Scientific Method .....	7
Historical Perspectives on the Universe .....	9
The Origin of the Universe.....	9
Astronomy.....	9
Creation Stories.....	9
Activity: Creation Stories.....	10
Theories in Science .....	13
Scientific Understanding .....	13
Fact .....	13
Hypothesis.....	13
Theory.....	13
Law .....	13
Activity: Developing a Theory... Murder! .....	14
Evolution of Astronomical Knowledge.....	16
Humans and Space.....	16
Big Questions.....	16
More Big Questions.....	17
Distances in Astronomy.....	17
Scientific Notation .....	17
Converting to Scientific Notation.....	17
Converting to Standard Form.....	18
Comparing Values .....	18
Scientific Notation Practice .....	18
Activity: Solar System Data .....	19

Characteristics of Astronomical Bodies .....	20
Rotation of the Earth.....	20
The Seasons .....	20
Solstices.....	20
Equinoxes .....	21
The Moon.....	21
Project: Canadian Space Technology.....	22
Activity: Benefits and Costs of Space Exploration.....	23

# The Scientific Method

## The Scientific Method

The scientific method is a process of doing experiments. It tells the scientist the steps they need to take. In general, the order is:

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_
4. \_\_\_\_\_
5. \_\_\_\_\_

## The Purpose

The purpose is the \_\_\_\_\_, or the question you want to answer.

It can be given as a statement:

\_\_\_\_\_

Or as a question:

\_\_\_\_\_

The purpose:

1. Tells others why the experiment was conducted
2. Keeps the experiment focused on what you are trying to find out
3. Gives a starting point for doing research and planning the experiment

It should describe what you want to know and why you are doing the experiment. It should be \_\_\_\_\_ (something you can make an experiment around). Generally it is not a yes-or-no question, but it can be. It should also include the variables being investigated.

## The Hypothesis

A hypothesis is an \_\_\_\_\_. It is a prediction of what the results of an experiment will be.

The hypothesis is based on previous knowledge and usually some research or new learning.

A hypothesis should have a \_\_\_\_\_ and a \_\_\_\_\_:

\_\_\_\_\_

\_\_\_\_\_

## Fair Tests

For an experiment to give good results, it needs to be a fair test. This means that the data collected needs to be based on

\_\_\_\_\_

\_\_\_\_\_.

If too many things are changed all at once, it is impossible to tell why the results are different.

## Variables

Variables are factors in an experiment that can be \_\_\_\_\_ to get results.

The \_\_\_\_\_ variable is the variable the experimenter is changing (on purpose).

The \_\_\_\_\_ variable is the variable that is being measured or observed (changing as a result of the other variable).

\_\_\_\_\_ variables are variables that should not change, and are being kept the same on purpose.

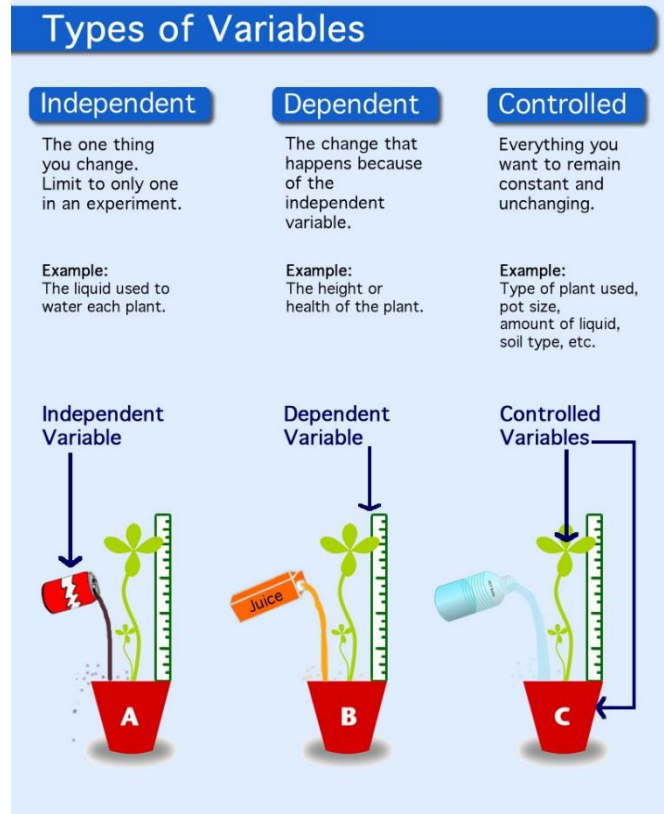
## Variables Example

You want to know if adding different amounts of salt to water makes it boil faster.

1. What should your control set up be?

2. What variable are you changing?

3. What variables need to be the same in every trial?



that

## Results

Results of experiments should be given in graphs, tables or charts, whenever possible. For any measurements, be sure to include \_\_\_\_\_ (like cm or L). Show any calculations you did.

After collecting observations and data during an experiment, you need to analyze your results while considering the purpose of your experiment.

Basically:

---

---

---

## Conclusion

A conclusion should be two to three sentences that:

---

---

Nothing said in the conclusion should be something new – it should be a summary of the things you have already said.

Name: \_\_\_\_\_

Date: \_\_\_\_\_

Period: \_\_\_\_\_

Due Date: \_\_\_\_\_

### Activity: The Scientific Method

#### Purpose

To become familiar with the scientific method, including stating a hypothesis, defining variables and collecting and analyzing data.

#### Materials

- Roto-copters sheet
- Paper clip
- Scissors
- Stopwatch

#### Procedure

1. Cut out and fold the roto-copters according to the instructions on the sheet.
2. Drop one roto-copter at a time while standing on a lab table. Time how long it takes for the roto-copter to fall.
3. Repeat three times with each roto-copter.

---

#### Question

#### Hypothesis

#### Variables

Independent Variable	Dependent Variable	Controlled Variables

**Data**

Roto-Copter	Length of Wings (cm)	Trial 1 Time (s)	Trial 2 Time (s)	Trial 3 Time (s)	Average Time (s)
A					
B					
C					
D					

**Discussion**

1. What did you find out? (1 sentence)

2. Why do you think this happened? (2 sentences)

3. Explain something that could have affected the accuracy of your results. (3 sentences)

**Conclusion**



# Historical Perspectives on the Universe

## The Origin of the Universe

All human cultures use observations and understandings to explain the world around them. Since ancient times, cultures and religions have come up with how the universe was created. In all of these stories, there are similarities.

## Astronomy

Astronomy is a branch of science that involves the study of objects and phenomena in space. Over time, astronomy has become more sophisticated, using new technologies and more advanced scientific understanding.

However, the main goal has remained the same: to learn more about our place in the universe and where we came from.

## Creation Stories

- Gaia (Greek)
- Genesis (Christianity)
- The Raven (Inuit)
- Cherokee creation story (Cherokee)
- Dine Bahame' (Navajo)
- Four Worlds (Hopi)
- Atum (Egyptian)
- Popil Vuh (Mayan)
- Pan Gu (Chinese)
- Khepri (Egyptian)
- Muslim creation story (Islam)
- Rangi and Papa (Maori)
- Bakuba creation story (Kuba, Central African)
- Aztec creation story (Aztec)
- Kumulipo (Hawaiian)
- Norse creation story (Norse)

Name: \_\_\_\_\_

Date: \_\_\_\_\_

Period: \_\_\_\_\_

Due Date: \_\_\_\_\_

## Activity: Creation Stories

### Purpose

1. To describe cultural perspectives on the origin of the universe.
2. To identify common characteristics of creation stories

### Task

#### Story-Telling

With a partner, find a good version of one of the creation stories listed in your notes. The story should be readable in less than five minutes. Print it out, then practice reading it together so you can tell it to the class in an engaging way. When you read it, the rest of the class will take notes.

You also need the following information:

- Area of the world the culture/religion is found
- Approximate time the story was first told

#### Analysis

With a group of 3-4 students, use the information you collected about each story to come up with a list of common themes and ideas in the stories. Each similarity doesn't need to be in every story – but make a note of how common each idea is.

### Assignment

Read Chapter 11.1, pages 372-376, then write one page to answer the following three questions:

1. What are some similarities you identified in the creation stories you heard?
2. Why do you think that there are differences and similarities among the creation stories of different cultures?
3. Why do you think humans, regardless of culture, have attempted to explain the origin of the universe?

### Evaluation

Criteria	Great (5)	Good (4)	Average (3)	Poor (2)	Missing (0)
<b>Understanding and Analysis</b> Question 1 & 2	Thorough understanding of the topic; reasonable connections made with sufficient detail	Considerable understanding of the topic; reasonable connections made, could have more detail	Some understanding of the topic; some connections made by limited in detail or sophistication	Limited understanding of the topic; weak connections made	Incomplete or not submitted, or no understanding of the topic
<b>Application and Critical Thinking</b> Question 2 & 3	Well-explained, creative and thoughtful explanation; able to consider the questions from multiple perspectives	Well-explained explanation; considers at least two perspectives when answering the questions	Reasonable explanation, but limited in scope	Limited explanation that does not fully answer the questions	No critical thinking evident

**Information**

<b>Myth</b>	<b>Area of the World</b>	<b>Time of Origin</b>	<b>Notes</b>
Gaia			
Genesis			
Cherokee			
Dine Bahame'			
Four Worlds			
Atum			

Popil Vuh			
Pan Gu			
Muslim			
Rangi and Papa			
Bakuba			
Aztec			
Kumulipo			
Norse			

# Theories in Science

## Scientific Understanding

There are different levels of understanding when it comes to scientific knowledge. There are four different words that can be used to explain scientific understanding:

---

---

---

---

## Fact

A fact is an \_\_\_\_\_. In general, a fact is something that is accepted to be true and that other people would also be able to observe.

Example: \_\_\_\_\_

## Hypothesis

You should remember that a hypothesis is an \_\_\_\_\_. It is a proposed explanation for a set of observations. Hypotheses are usually based on some understanding, but usually need more information to confirm them.

Example: \_\_\_\_\_

## Theory

A theory is a \_\_\_\_\_. Theories are backed up by evidence, including facts, laws, inferences and tested hypotheses.

Example: \_\_\_\_\_

## Law

A law is a statement based on repeated experimental observations that describes a \_\_\_\_\_. Laws are proof that something happens and how it happens, but not why.

Example: \_\_\_\_\_

Name: \_\_\_\_\_

Date: \_\_\_\_\_

Period: \_\_\_\_\_

Due Date: \_\_\_\_\_

**Activity: Developing a Theory... Murder!**

**Purpose**

1. To understand the difference between a fact, a hypothesis and a theory
2. To develop a theory based on evidence

**Task**

Five guests were all invited to an exclusive party at Clue Mansion. However, during the long, dark night, the owner of the spectacular mansion, Mr. Deadbody, was found dead in his office. The trouble is, every member of the party went into his office, each at a different time, with a different weapon, motive and clue that incriminated them.

As the evidence is revealed, use the grid below to come up with a theory about who the murderer is, the murder weapon used and the motive of the killer.

	Poison	Dagger	Revolver	Lead Pole	Rope	Jealousy	Greed	Blackmail	Revenge	Rage	Fingerprint	Note	Blood	Footprint	Hair	9:05	10:30	10:45	11:25	11:55	
Mr. Rose																					
Ms. Tulip																					
Sir Daisy																					
Lord Pansy																					
Miss Lily																					
9:05																					
10:30																					
10:45																					
11:25																					
11:55																					
Fingerprint																					
Note																					
Blood																					
Footprint																					
Hair																					
Jealousy																					
Greed																					
Blackmail																					
Revenge																					
Rage																					

## Questions

Read Chapter 11.2, pages 378-386, then answer the following questions.

1. Explain how solving a murder is a lot like developing a scientific theory. (2 marks)

---

---

---

2. Why is it important to keep doing research and collecting evidence for scientific theories? (2 marks)

---

---

---

3. Explain the Big Bang Theory in your own words. (2 marks)

---

---

---

4. Explain one of the two pieces of evidence (red-shift of galaxies or cosmic background radiation) for the Big Bang Theory in your own words. (2 marks)

---

---

---

---

---

---

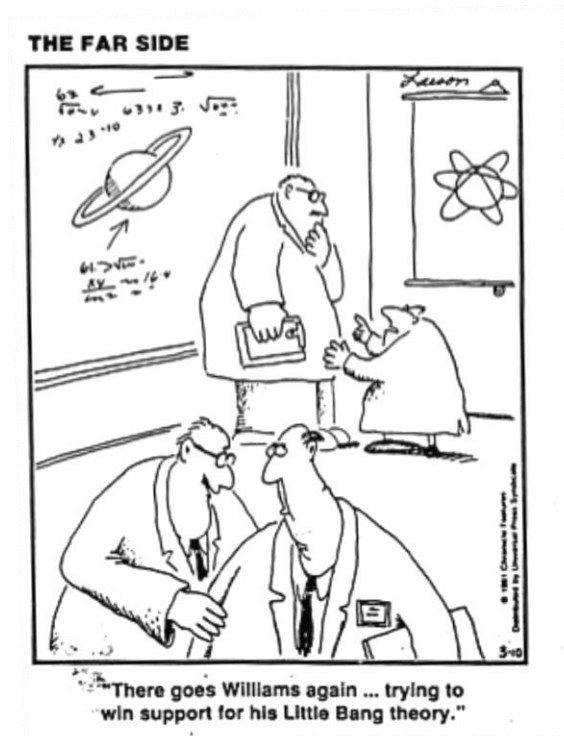
5. Will the Big Bang Theory ever become a law? Explain why or why not. (2 marks)

---

---

---

---



# Evolution of Astronomical Knowledge

## Humans and Space

We have already looked at different cultural explanations for the origin of the universe and Earth. This gives us evidence that humans have always been fascinated by space.

However, before the invention of the telescope, humans weren't able to explore space in the same way, so many questions were asked and left unanswered.

## Big Questions

After the invention of the telescope, there were many big questions that could be answered. Even though we have answered a lot of questions, with new knowledge, new questions will arise.

### Is Earth the centre of the universe?

Original models of the universe were \_\_\_\_\_, in which the Earth was stationary. Earth is the centre of the universe, and everything else rotates around it.

Eventually, astronomers began to collect evidence for a \_\_\_\_\_, which states that the Sun is the centre of the solar system and that the Earth and other planets rotate around it.

### How far away are stars?

A star is a \_\_\_\_\_ that has nuclear reactions taking place in its core.

Stars are all different distances away from Earth. The brightness, or \_\_\_\_\_, of a star tells astronomers how far away it is and where it is in its life cycle.

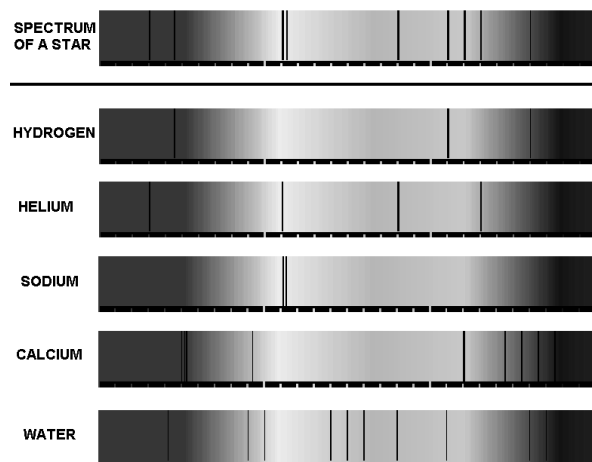
Other than the Sun, the nearest star to us is \_\_\_\_\_ away – so very, very far!

### What are stars made of?

The elements that make up a star can be identified technique called \_\_\_\_\_.

Spectroscopy breaks down the light coming from the specific patterns, which allow astronomers to get an what elements are present.

Most stars are made up of \_\_\_\_\_, have heavier elements in them too.





### Are we in the centre of the galaxy?

Our solar system is located in the \_\_\_\_\_ galaxy.

On clear nights, the rest of the galaxy is visible. stars lie along a \_\_\_\_\_, revolving around a centre.

We are towards the edge of the galaxy.



The

### More Big Questions...

As we have answered a lot of questions about the universe, more questions have arisen:

1. What is beyond Pluto in our solar system?
2. Is there life on other planets?
3. Why is space expanding? What is it expanding in to?
4. Are there other universes?

## Distances in Astronomy

### Scientific Notation

Distances in astronomy are \_\_\_\_\_. It can be difficult to work with numbers that are very big or small, so scientists have come up with a way to express those numbers.

Numbers written in scientific notation are done as a \_\_\_\_\_  
\_\_\_\_\_.

Examples:

A positive exponent is a big number:

A negative exponent is a small number:

### Converting to Scientific Notation

1. Place the decimal point so that there is \_\_\_\_\_  
\_\_\_\_\_. Get rid of any extra zeros.
2. Count the number of spaces the decimal moves to determine the exponent on the 10.
  - If the decimal moves \_\_\_\_\_, the exponent is \_\_\_\_\_. (big number)
  - If the decimal moves \_\_\_\_\_, the exponent is \_\_\_\_\_. (little number)

**Example 1:**

3 346 000 000

1. Write as a decimal with no extra zeros:
2. Find the exponent on the 10:
3. Write the number in scientific notation:

**Example 2:**

0.000 002 340

1. Write as a decimal with no extra zeros:
2. Find the exponent on the 10:
3. Write the number in scientific notation:

**Converting to Standard Form**

Multiply the two terms (the decimal between 1 and 10 and the power of 10) together. This can also be used to check the original conversion.

**Comparing Values**

Numbers with higher exponents on the 10 are greater:

$$10 \text{ ___ } 3 \qquad 4 \text{ ___ } -1 \qquad -2 \text{ ___ } -5$$

For numbers with the same exponent, numbers with a larger decimal value are greater:

$$6.43 \times 10^5 \text{ ___ } 2.17 \times 10^5 \qquad 3 \times 10^{-2} \text{ ___ } 1 \times 10^{-2}$$

**Scientific Notation Practice**

Express each of the following numbers using scientific notation:

- |                  |       |                     |       |
|------------------|-------|---------------------|-------|
| 1. 325           | _____ | 6. 0.361            | _____ |
| 2. 70            | _____ | 7. 0.042 8          | _____ |
| 3. 96 400        | _____ | 8. 0.005 73         | _____ |
| 4. 6 587 324 000 | _____ | 9. 0.000 05673      | _____ |
| 5. 3 621.471     | _____ | 10. 0.000 000 000 9 | _____ |

Write each of the following numbers as ordinary numbers:

- |                          |       |                            |       |
|--------------------------|-------|----------------------------|-------|
| 11. $3.64 \times 10^4$   | _____ | 16. $2.97 \times 10^{-4}$  | _____ |
| 12. $3.9734 \times 10^5$ | _____ | 17. $3.88 \times 10^{-2}$  | _____ |
| 13. $6.285 \times 10^3$  | _____ | 18. $5.65 \times 10^{-1}$  | _____ |
| 14. $5.8643 \times 10^2$ | _____ | 19. $4.763 \times 10^{-3}$ | _____ |
| 15. $3.487 \times 10^3$  | _____ | 20. $8.654 \times 10^{-2}$ | _____ |

Name: \_\_\_\_\_

Date: \_\_\_\_\_

Period: \_\_\_\_\_

Due Date: \_\_\_\_\_

## Activity: Solar System Data

### Purpose

1. To compare composition and physical characteristics of planets in the solar system
2. To organize data about planets and draw conclusions about the solar system

### Task

1. As a class, Ms. Hayduk will show you how to make a bar graph and a pie chart using MS Excel.
2. You and your partner will be assigned one set of data. You will be responsible for making and printing the graph for your data. Make sure your name is on the graph! (5 marks)
3. The graphs will be posted for you to use to answer the questions.



### Questions (20 marks)

1. Which planet is the biggest? Which is the smallest?
2. How do the sizes of the planets compare to their distances from the Sun, in general?
3. Which planets are the lightest? Which is the heaviest?
4. Which planet spins the slowest? Which spins the fastest?
5. Which planet is the hottest? Is this the one you would expect to be hottest? Why or why not?
6. Which planet is the coldest? Is this the one you would expect to be coldest? Why or why not?
7. Which planet has the most moons? How do the number of moons compare to the size of the planets, in general?
8. What planets have gravities stronger than Earth's?
9. How does the gravity of the planets compare to their masses, in general?
10. Which planets have atmospheres that are primarily hydrogen?
11. Which planets have atmospheres that are primarily nitrogen?
12. Which planets have atmospheres that are primarily carbon dioxide?

# Characteristics of Astronomical Bodies

## Rotation of the Earth

The Earth rotates on its \_\_\_\_\_, which is at an angle of \_\_\_\_\_ from upright.

This rotation is what causes \_\_\_\_\_. The side of the Earth that faces the Sun experiences \_\_\_\_\_.

It takes \_\_\_\_\_ for a full rotation. The Earth spins counter-clockwise, when seen from above, which means the Sun rises in the \_\_\_\_\_ and sets in the \_\_\_\_\_.



## The Seasons

Seasons are caused by the \_\_\_\_\_.

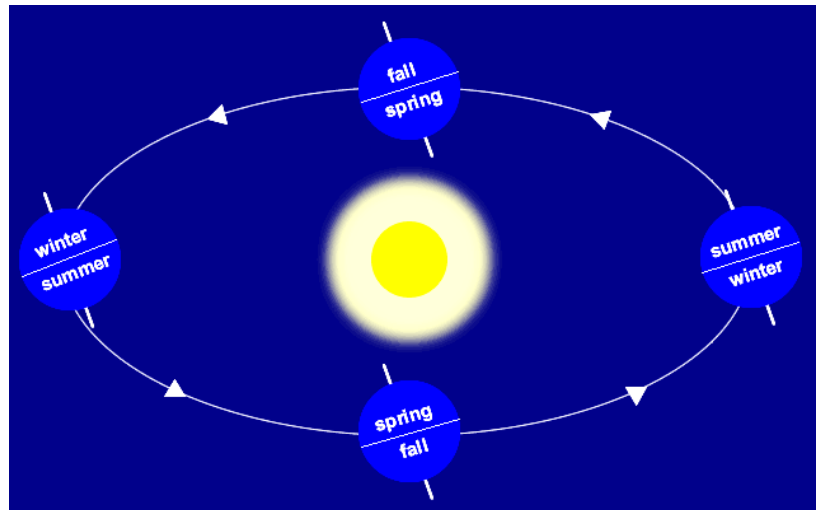
Because the Earth's axis is tilted, one half of the planet always leans closer to the Sun and gets more direct sunlight during the day.

A full orbit takes \_\_\_\_\_.

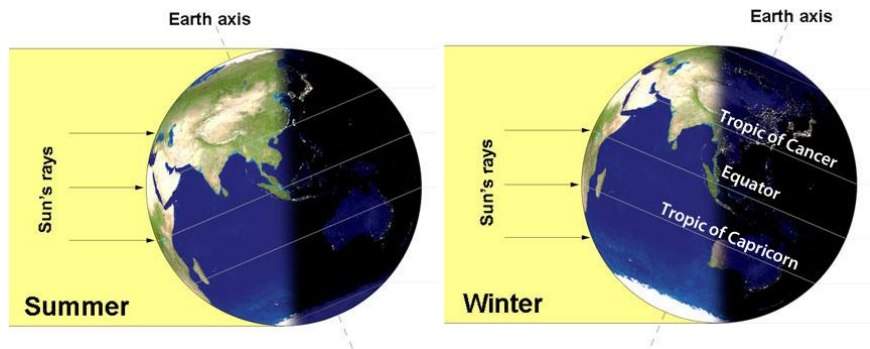
## Solstices

The Earth rotates on an \_\_\_\_\_ (oval-shaped) orbit. A solstice occurs when the Earth reaches either of the furthest points on its orbit.

These are the \_\_\_\_\_ days of the year.



In the Northern hemisphere, \_\_\_\_\_ is the summer solstice and \_\_\_\_\_ is the winter solstice. This is opposite for Southern hemisphere.



the

## Equinoxes

An equinox occurs when the Earth is at the closest point to the Sun in its orbit. During an equinox, everywhere on the Earth has \_\_\_\_\_.

The spring (\_\_\_\_\_) equinox occurs on \_\_\_\_\_, and the fall (\_\_\_\_\_) equinox occurs on \_\_\_\_\_.

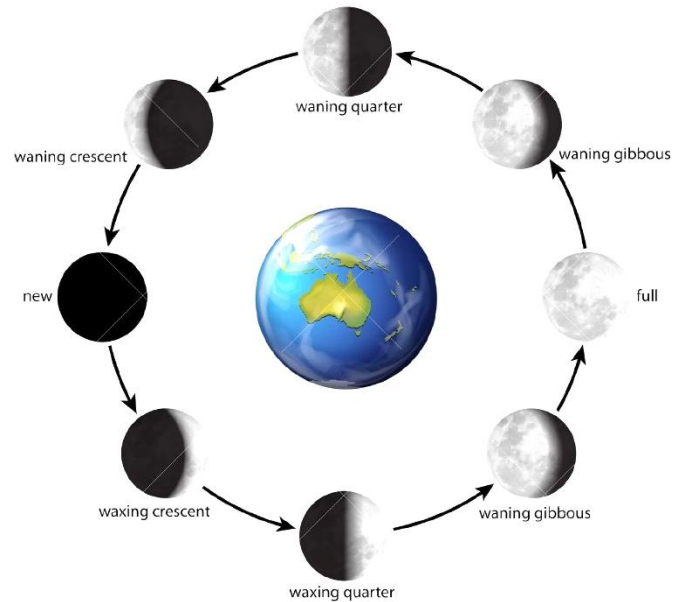
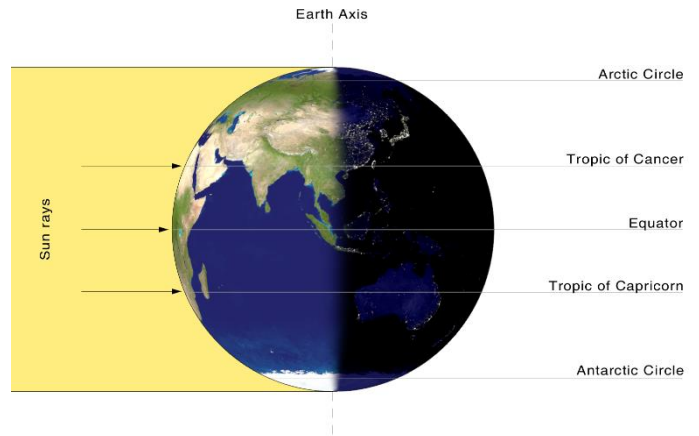
## The Moon

The Moon reflects the Sun's light, which is what allows us to see it in the sky.

It takes the Moon \_\_\_\_\_ to orbit around the Earth, and \_\_\_\_\_ to rotate on its axis. Because of this, we always see the same side of the moon. The opposite side is what is called the \_\_\_\_\_.

Depending on where the Moon is in its orbit, we see different amounts of the Moon.

This is called the phases of the Moon. A \_\_\_\_\_ occurs when the Moon is on the opposite side of the Earth from the Sun. A \_\_\_\_\_ is when it is on the same side of the Earth as the Sun.



Name: \_\_\_\_\_

Date: \_\_\_\_\_

Period: \_\_\_\_\_

Due Date: \_\_\_\_\_

## Project: Canadian Space Technology

(From Saskatchewan Science 9, pg. 412-413)

### Purpose

1. To examine Canadian contributions to space technology and space exploration
2. To formulate opinions on the nature of Canada's space program, including the benefits and drawbacks

### Task

1. In a group of 2-3 students, choose one of the following categories to research:
  - Satellite technology in Canada
  - Canada's work on the International Space Station
  - Canada's astronaut program
  - Current research in astronomy in Canada
  - The David Florida Laboratory
  - Canadian contributions to space technology
2. Do some preliminary research, then, as a group, come up with a question to answer about your topic.
3. Conduct research to answer your question. Include facts, timelines and images. Keep track of all of your sources for your works cited. You should address the following points:
  - What is your topic? What is some important background information that your audience needs to know?
  - What are the benefits and costs of your topic? Do you think the costs outweigh the benefits?
4. Assemble your information into a presentation that will be about five minutes long. When you present, each person needs to speak, and you should not be reading off the screen!

### Evaluation

Criteria	Great (5)	Good (4)	Average (3)	Poor (2)	Missing (0)
<b>Knowledge</b> Demonstrates an understanding of space and space technology		Student demonstrates considerable understanding of space and space technology.			
<b>Skills</b> Identifies a practical problem and develops possible solutions		Student identifies a practical problem, generates several solutions, selects a solution, and develops a simple procedure.			
<b>Communication</b> Uses appropriate vocabulary and communicates results clearly		Student's use of terms is accurate and appropriate and explanations are adequate.			
<b>STSE</b> Demonstrates an understanding of how space and space research affects society and the environment		Student is able to explain how the identified human connections influence space science.			
<b>Attitudes</b> Works within a team in a manner that promotes collaboration and appropriate scientific inquiry		Student interacts with the team well and presents in a professional and engaging way.			

Name: \_\_\_\_\_

Date: \_\_\_\_\_

Period: \_\_\_\_\_

Due Date: \_\_\_\_\_

### Activity: Benefits and Costs of Space Exploration

#### Purpose

To engage in critical thinking about space exploration

#### Task

Write a paragraph (5-8 sentences) to answer the question:

Should humans continue to explore space?

Be sure to back up your opinion with evidence. Use Chapter 12.2 in your textbook to get some points. You may choose to use the internet to do additional research, but remember that all writing needs to be in your own words.

#### Evaluation

Criteria	Great (5)	Good (4)	Average (3)	Poor (2)	Missing (0)
Knowledge		Student demonstrates considerable understanding of the benefits or costs of exploring space.			
Application		Opinion supported by accurate evidence and insights.			
Communication		Student's use of terms is accurate and appropriate and explanations are adequate.			
		Writing is clear, easy to read, logical and demonstrates a reasonable level of effort.			