

**Name:**

**Class:**

**Date:**

## As Time Goes By

*Spring passes and one remembers one's innocence.  
Summer passes and one remembers one's excitement.  
Autumn passes and one remembers one's respect.  
Winter passes and one remembers one's determination.*

-Author Unknown

1. As time goes by, winter turns to spring, spring turns to summer, summer turns to autumn, autumn turns to winter, and eventually winter turns to spring again. The years roll by, and the Earth keeps spinning around the Sun, which gives us the seasons to enjoy. But how? To find out the secret of how this happens, try this investigation.

### Materials Needed:

- A round piece of fruit (An apple, orange, or lemon will work well.)
- A wooden skewer
- A large spacious darkened room
- A lamp in the middle of the room



2. These items will help you *simulate* the Earth's rotation around the Sun. Your piece of fruit represents the Earth, while the lamp is the Sun. Stick the skewer through the top of the fruit and out the bottom. The skewer, stem, or core of the fruit represents the Earth's core, creating its axis. The top of the fruit is the North Pole, and the bottom is the South Pole.

### Experiment One: Creating Night and Day

3. Holding the Earth level with the Sun, notice how the side nearest the Sun is brightly lit, while the side further away is in darkness. Try spinning the Earth around its axis. Marking a specific point on the Earth allows you to track your hometown through night and day.

### Experiment Two: Earth with No Tilt

4. Holding the Earth upright with the axis on the top, spin the Earth again. Observe that the side of the Earth facing the Sun has sunlight from the North to the South Poles. Notice that your hometown always receives light at some time during the rotation.

### Experiment Three: Earth with Tilt

5. Repeat the experiment again, but tilt the axis about 45° towards or away from the Sun. Watch as the area around one of the poles has constant sunlight, while the other pole stays in the dark. When the North Pole is pointing away from the Sun, all areas inside the *Arctic Circle* stay in unending darkness. The *Antarctic Circle* is the area around the South Pole that the Sun never reaches during certain times of the year. Remember that the North Pole always points in the same direction.

**Experiment Four: Creating the Seasons**

6. Keeping the Earth tilted at the same angle and in the same direction, move to the opposite side of the Sun. Spin it again and watch as the pole that was in darkness is now in the sunlight all the time. Walk around the Sun and notice the changes that occur. This causes the Sun to move Shigher or lower in the sky.
7. March, June, September, and December are important months in the year related to the seasons you just created.
8. March 21<sup>st</sup> is called the *Vernal Equinox* and represents the beginning of spring in the Northern Hemisphere. (*Vernal* means spring.) It is the point at which the Sun crosses the Equator (an imaginary line that runs around the center of the Earth splitting it equally north and south) and rises exactly east and sets exactly due west. At this time, the hours of daylight and darkness are equal, creating *equinox*, meaning "equal night."
9. June 21<sup>st</sup> is the *Summer Solstice*, or Midsummer's Day, in the Northern Hemisphere. This is when the Sun has reached the farthest point north of the Equator. Before June 21<sup>st</sup>, more sunlight reaches the Northern Hemisphere, and the days are longer than the nights. After June 21<sup>st</sup>, the Sun begins to travel south and causes the days to become shorter.
10. September 21<sup>st</sup> is the *Autumnal Equinox*, which is when the Sun crosses the Equator heading south.
11. December 21<sup>st</sup> is the *Winter Solstice* and the shortest day in the Northern Hemisphere. It is the middle of the summer in the Southern Hemisphere. The Sun has reached its farthest point traveling south. The seasons are reversed in the Southern Hemisphere, and autumn is in March, winter is in June, spring is in September, and summer is in December.
12. In the experiment, you kept the Earth's axis pointing in the same direction. However, the axis wobbles slightly, but it takes 25,765 years for the Earth's axis to make a full circle. This is known as the *Precession of the Equinox*. It has no major effects on the seasons.
13. Now you know the reasons for the seasons! As the Earth tilts and revolves, keeping the North Pole always pointing in the same direction, you get to enjoy what each season offers.

**Question #1****What is the author's *main* reason for writing this selection?**

- A to describe that as the Earth's tilt changes, sunlight decreases
- B to illustrate that a simple model can show the Earth's orbit
- C to demonstrate that as the seasons change, so does the equinox
- D to explain how the Earth's movement and tilt cause seasons

**Question #2****With which statement would the author *most likely* agree?**

- A Scientific investigations are more fun and educational when performed at home.
- B Common items can be used to help students understand scientific concepts.
- C Observing the reasons for seasons is best done at the Equator instead of at the South Pole.
- D It is challenging to observe seasonal changes in the Southern Hemisphere.

**Question #3****What can a reader tell about the author from this selection?**

- A The author is probably a science teacher.
- B The author believes that the reason for seasonal changes is an interesting topic.
- C The author did not spend enough time researching what causes the seasons to change.
- D The author writes lots of articles about science.

## **“Important Inventions”**

- 1. In the early 1800s, most people lived in cities on the East Coast. Only adventurers moved west, and life outside the cities of the East Coast was hard. New inventions were needed to make people’s lives better. Some people studied science to get new ideas, and others worked on experiments. Experiments were done to try to improve life, and many times the experiments led to inventions.**
- 2. The United States Congress wanted to help. They knew that good inventions would help America to grow and would help people to have better lives. Congress funded scientists and inventors who used the money to develop good ideas. New technologies were created, and some very important inventions came from this time period. Among the most significant were the steam engine, the telegraph, and the telephone.**
- 3. In the early days, moving goods from place to place required boats. Cities like St. Louis, Missouri built up near the rivers. Farmers grew many crops in the rich soil, and when they harvested them, they were then loaded on boats. Merchants, or people who sell products, shipped the goods on the boats from St. Louis to other parts of the country. The goods were sold directly from the boats. However, there was one big issue. The larger rivers only ran north and south, so merchants used wagons for east and west travel to move goods, making it difficult to sell products quickly.**
- 4. Inventors worked hard to make travel and commerce better. Soon, the steam engine was invented, and a man named James Watt improved it to make it more useful for transportation.**
- 5. The steam engine was used in locomotives. The trains could go east and west and could go much faster than a wagon. They could also hold many more people and goods. Since goods moved faster on trains, and could travel in more directions, business owners made money more quickly. The locomotive was probably the most important invention for economic and population growth in the West.**
- 6. People also wanted to *communicate* more quickly. Family members and friends who lived far away from each other missed talking to each other. Business owners also needed to talk to their partners, suppliers, and consumers. Communicating with others across the country took a very long time.**

7. **The telegraph was invented to speed up communication. A man named Samuel Morse studied electricity and sound and learned how to send sound over an electric wire. Not voice sounds, but beeps and tapping sounds were sent. The Morse code was created to understand the patterns. People were trained to learn the code and sat in offices writing down the messages that the telegraph tapped out. People in town went to the telegraph office to check for messages. The telegraph made sending messages easier, but it only worked where there were wires. The first telegraph wires were erected in 1846, and they ran from Washington, D.C. to New York City.**
8. **Alexander Graham Bell knew that he could improve the telegraph. He saw an opportunity to make it even more useful by finding a way to make the wires carry voices as well as other sounds, so the telephone was invented! The telephone made it easier for people to speak to their loved ones and businesses to communicate faster across long distances.**
9. **Inventions sped up the economic growth of America. Businesses grew because of new ideas. They could do everything faster and better. They transported goods faster. They communicated across greater distances. These inventions created jobs like engineers and telegraph and telephone operators. People moved to new cities, and more jobs were created. Businesses and railroads were built and expanded across the country. America was on the road to success!**

#### Question #4

What is the purpose of the selection?

- A to argue that older inventions are better than newer inventions
- B to compare the inventions in the East and the West
- C to try to convince the reader to become an inventor
- D to inform readers about several significant inventions

**Question #5****What did the author *most likely* want a reader to learn in this selection?**

- A The inventions of the 1800s made people's lives better.
- B The city of St. Louis was built near a river.
- C The wagon was the fastest mode of transportation in the 1800s.
- D Trains transported both passengers and goods.