

## THE REASON FOR SEASONS

### Overview:

In this activity, students learn how Earth's tilt and its relation to the sun affect the seasons.

### Objectives:

The student will:

- relate Earth's motion around the sun to changes in seasons and day and night cycle;
- examine changes that take place in each season; and
- list traditional activities that take place in the various seasons.

### Targeted Alaska Grade Level Expectations:

#### Science

[5-8] SA1.1 The student demonstrates an understanding of the processes of science by asking questions, predicting, observing, describing, measuring, classifying, making generalizations, inferring, and communicating.

[8] SD3.1 The student demonstrates an understanding of cycles of influence by energy from the sun and by Earth's position and motion in our solar system by recognizing the relationship between the seasons and Earth's tilt relative to the sun and describing the day/night cycle as caused by the rotation of Earth every 24 hours.

### Vocabulary:

**axis** – an imaginary line around which an object rotates; in a rotating sphere, such as Earth and other planets, the two ends of the axis are called poles

**Earth** – the third planet from the sun and the fifth largest; the only planet known to support life; the only planet on which water in liquid form exists, covering more than 70 percent of its surface

**equator** – the imaginary line forming a great circle around Earth's surface halfway between the North and South poles; divides Earth into the Northern Hemisphere and the Southern Hemisphere

**hemisphere** – one half of a sphere, formed by a plane that passes through the center of the sphere; either the northern or southern half of Earth as divided by the equator, or the eastern or western half as divided by a meridian

**latitude** – distance north or south on Earth's surface, measured in degrees from the equator, which has a latitude of 0°; used to identify any point on the surface of Earth

**North Pole** – the northern end of Earth's axis of rotation, a point in the Arctic Ocean

**orbit** – the path of a celestial body or an artificial satellite as it revolves around another body; one complete revolution of such a body

**revolve / revolution** – the motion of an object around a point, especially around another object or a center of mass; a single complete cycle of such motion

**rotate / rotation** – the motion of an object around its own axis; a single complete cycle of such motion

**seasons** – one of four natural divisions of the year—spring, summer, autumn, and winter—in the North or South Temperate Zones; each season begins as the sun passes through a solstice or an equinox

**South Pole** – the southern end of Earth's axis of rotation, a point in Antarctica

**sun** – the star that is orbited by all the planets and other bodies of our solar system and that supplies the heat and light that sustain life on Earth; it has a diameter of about 864,000 miles (1,390,000 kilometers) and an average distance from Earth of about 93 million miles

**tilt** – to cause to have an inclination

### Whole Picture:

The observation of seasons by Alaska Native people is crucial for subsistence hunting, food gathering, celebrations, and other activities important to life in the Arctic. Awareness of seasonal migration patterns and animal behavior, such as mating and birthing, ensures successful fishing and hunting. For example, some animals, such as bears and beavers, hibernate and cannot easily be found throughout the winter season. Salmon return to the rivers from the ocean to spawn at certain times each summer. Integrating Native Knowledge with the science behind the seasons brings increased relevance.

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Earth's four seasons (the amount of daylight and the temperature) are caused by its orientation to the sun. The orientation is related to its orbit around the sun, its rotation on its axis, and the degree its axis is tilted.

Earth rotates counterclockwise on its axis once every 24 hours, creating day and night. Earth orbits the sun in a 365-day cycle. Earth's axis is tilted at an angle of approximately 23.5°. This angle remains constant throughout its rotation and orbit. Milankovitch Cycles: changes to axis tilt.

The distance between Earth and the sun varies slightly during its orbit, however this distance has little impact on seasons. Instead it is the tilt of Earth on its axis and the orientation of the axis to the sun that creates variations in daylight and temperature, creating seasonal variations.

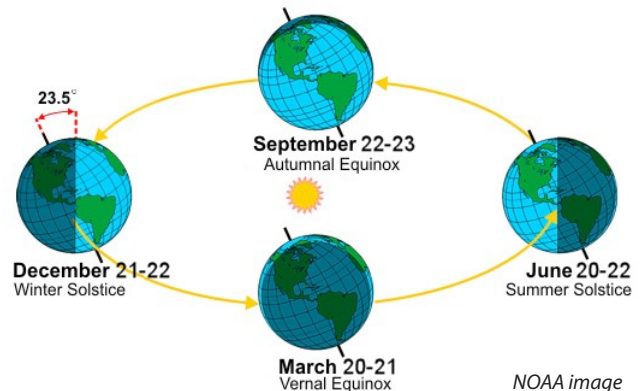
In summer, when the northern hemisphere is tilted toward the sun, it receives a greater amount of solar energy, and therefore experiences warmer temperatures and increased daylight. In winter, when the region is tilted away from the sun, a reduction in solar energy leads to cooler temperatures and reduced daylight.

About June 21st, the northern hemisphere is tipped directly toward the sun. Known as summer solstice, this date marks summer's beginning. For most of the hemisphere it is the day of the year with the longest period of daylight.

About September 22nd, Earth has moved around the sun so the poles neither point towards nor away from the sun. This is known as the autumnal equinox, when the entire planet experiences 12 hours of daylight and 12 hours of darkness. This marks the beginning of fall, or autumn.

The winter solstice occurs about December 21st when Earth is oriented so the North Pole is facing away from the sun and the South Pole into the sun. Northern regions experience the shortest period of daylight on this "first day of winter."

About March 20th, begins the spring equinox. Earth is similarly positioned to that which occurs in September, only on the other side of the sun. Again, the orientation produces 12 hours of daylight and 12 hours of darkness, and signals the beginning of spring, or the vernal equinox.



### Materials:

#### For demonstration:

- Globe
- Flashlight
- Circle stickers (two)
- Masking tape
- Sticky notes
- Refreshments for Elder
- TEACHER INFORMATION SHEET: "Word Table"

#### For student activity:

- Four-inch Styrofoam balls (one per group)
- Pencils (one per group)
- Rubber bands (must fit snugly over Styrofoam ball; one per group)
- Stickers (two per group)
- TEACHER INFORMATION SHEET: "Word Table"
- STUDENT WORKSHEET: "The Four Seasons"
- STUDENT WORKSHEET: "Season Vocabulary: Find Someone Who"
- VISUAL AID: Seasonal Equinox"

### Activity Preparation:

1. In advance: Invite an Elder or culture bearer to discuss seasons and seasonal changes with your class. Prepare students ahead of time to have appropriate and respectful behavior when an Elder is present. When the Elder or culture bearer arrives, have students greet the guest and escort them to the classroom. Offer

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- refreshments and invite the person to a comfortable spot until they are introduced, but do not keep them waiting long. As Chief Robert Charlie says, "Would you keep the governor waiting?"
2. Prepare a piece of chart paper or an area of the board for a class vote. Title the chart, "The Reason for Seasons." Divide the area into four sections. Label the sections: "How close Earth is to the sun," "The moon's influence on tide," "Earth's tilt as it orbits the sun," and "The sun moves East to West." Cover the chart with a blank piece of chart paper until later.
  3. With masking tape, tape off a large circle representing Earth's orbit on the classroom floor.
  4. Prepare Styrofoam balls and Globe:
    - a. Take each ball and insert a pencil through keeping as close to the center as possible. The pencil represents the North and South Poles. Put a rubber band around the middle to represent the equator.
    - b. On the globe, place one circle sticker on your state and one on the equator.
  5. Using the Teacher Information Sheet: "Word Table", write the appropriate native language words for the community, along with the English equivalent, on the board for reference. If your community's language is not represented in the table, consider asking your invited guest Elder to teach the words to the class.

### Activity Procedure:

1. Pass out Student Worksheet, "The Four Seasons," then review the kind of information students will be listening for as they hear from the invited guest. Tell them not to write while they are listening, just to listen for information. Introduce Elder or culture bearer and ask them to share a story or an impression about seasons, seasonal changes, what signals a new season, why such knowledge is important, etc. Give students an opportunity to ask questions. Invite the Elder to stay for the remaining class time, if they wish, or leave when they are done sharing. Ask students to complete page one of the STUDENT WORKSHEET: "The Four Seasons."
2. Give each student a sticky note; ask them to write their initials. Uncover the chart on the board, "The Reason for Seasons" and tell students to think about what causes seasons. Read all the choices but emphasize that only one answer is correct. Ask students to quickly place their yellow sticky note in the section they believe is correct. (Don't talk about which one is correct until later in the activity.)
3. Point out the Native language words for Earth and sun written on the board. If possible, practice saying the words. Ask for two student volunteers to help with a demonstration: One to hold the globe (Earth) and one to hold the flashlight, representing the sun. You may consider using both the English and Native language words as you proceed with the activity. Tell the sun to point the light directly at the globe and remain fixed on it even when the globe moves. Introduce the concept that Earth is tilted on its axis at an angle of approximately 23°. Ask Earth to begin rotating on its axis. Ask all students to observe the colored stickers in relation to the sun. Point out the Northern Hemisphere, the Southern Hemisphere and the equator that marks the division. Ask questions as Earth rotates:
  - a. When is the sun more directly on our state? The equator?
  - b. When is it daytime in our state? Nighttime?
  - c. Is this the only motion of Earth? (No, it also orbits the sun.)
4. Show VISUAL AID: "Seasonal Equinox" and discuss. Explain that Earth, like all planets in our solar system, orbits the sun (the sun is in one spot, Earth moves around it). As it moves around the sun, it remains tilted on its axis and it continues to rotate. Ask for two different volunteers to help demonstrate this concept. One will represent Earth, the other the Sun. Ask Earth to walk around the Sun, following the taped orbital path. The sun is to remain fixed on the globe. Have Earth periodically stop, observe the tilt, and ask such questions as:
  - a. When is it winter in the Northern Hemisphere? Southern Hemisphere? How about summer?
  - b. What makes it winter? What makes it summer?
  - c. When is it fall or spring?
  - d. What is happening at the equator? Further north? South? How does this contribute to changes in season at those locations?

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5. Divide students into groups and hand out one Styrofoam ball and one flashlight to each group. Remind them that the tilt of Earth is a constant, and the sun is always pointed at Earth (because it remains stationary while Earth moves around it). Ask students to simulate:
  - a. The tilt of Earth on its axis
  - b. Earth rotating on its axis
  - c. Earth in orbit around the sun
  - d. Day and night
  - e. Summer in the Northern Hemisphere and Southern Hemispheres
  - f. Winter in the Northern Hemisphere and Southern Hemispheres
6. Ask students to complete the second page of The Four Seasons worksheet. Allow them to use the Styrofoam models as they consider questions seven and eight.
7. Refer to the sticky notes on the board and ask if anyone would like to change their answer. Discuss the correct answer based on the activity.
8. Hand out the vocabulary activity, Student Worksheet: Find Someone Who, and ask students to complete it according to the directions. Allow five to 10 minutes for students to complete the activity, then regroup to discuss. Go over each question to be sure correct information was discussed among students. For subjective questions, such as “someone who has experienced winter in another state,” ask for raised hands. (Students can share if there is time.) For objective questions, refer to the Answers section for correct answers.

### Answers:

#### STUDENT WORKSHEET: The Four Seasons

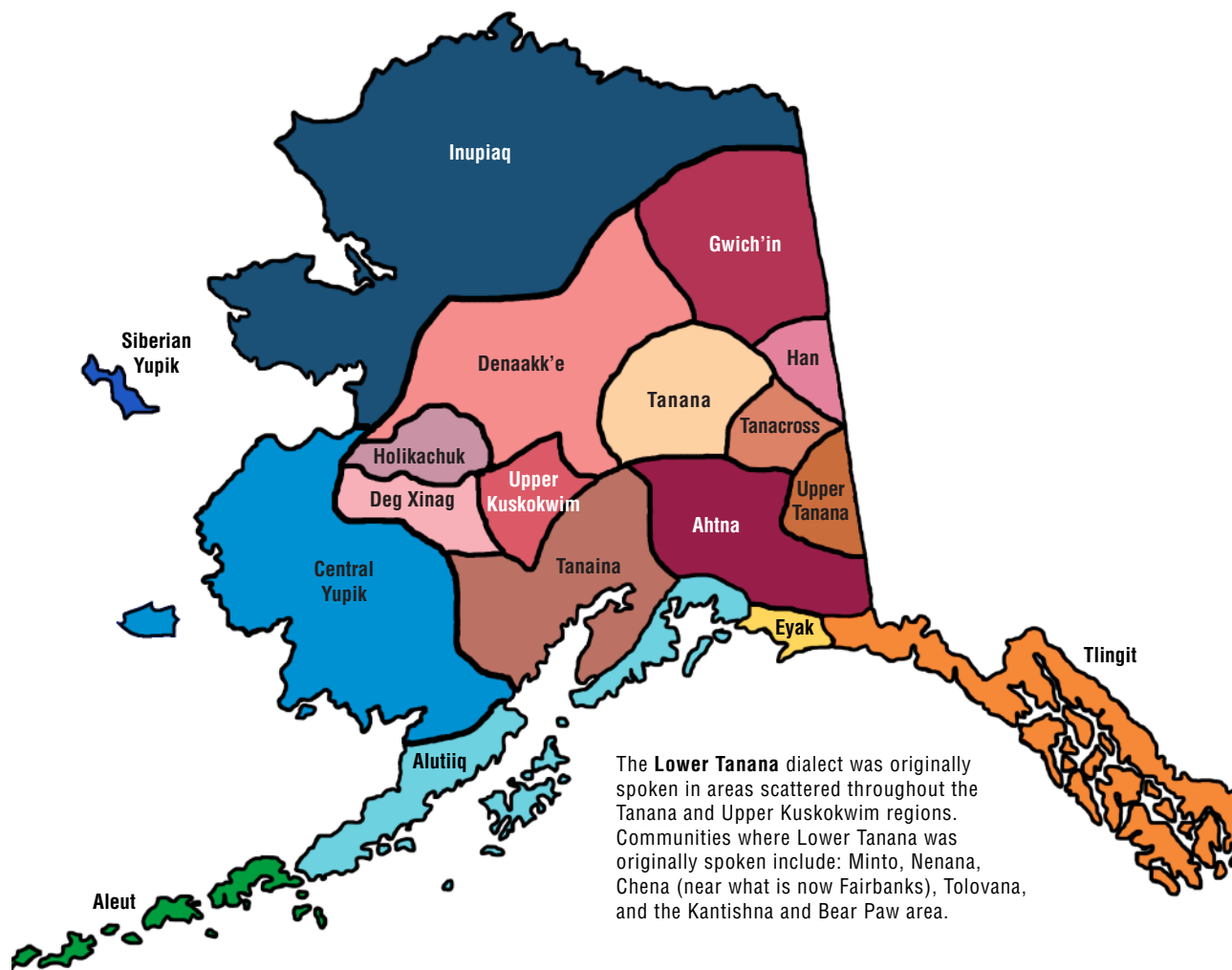
1. Answers related to activities will vary. Native language words will vary according to region. See chart included in lesson.
2. Answers will vary.
3. A. Northern Hemisphere
4. B. Winter
5. False
6. A. summer, b. night, c. winter, d. axis, e. day, f. orbital path
7. Answers will vary, but should indicate that there would be no seasonal changes – climate would remain constant.
8. Answers will vary, but should indicate that there would not be day and night as we know it. There would, instead, be a 365-day period in the cycle of day and night, instead of 24 hours.

#### STUDENT WORKSHEET: Seasons Vocabulary: Find Someone Who

1. Earth’s tilt is approximately 23°.
2. It takes 24 hours for Earth to rotate one time.
3. The tilt of Earth means less direct solar energy, so temperatures drop in the fall and winter.
4. The latitude of the equator is 0°.
5. The sun
6. Summer
7. axis
8. Earth
9. 365 days

## WORD TABLE

English	Gwich'in	Denaakk'e	Lower Tanana	Deg Xinag	Your Language
Earth	Nan	Nenkkokk'e	Ngan'	Nen'koget	
Sun	Drin oozhrii	So	No'oy	Sro	
Spring	Shreenyaa	Early: sonot Late: h̄lookk'ət	Xulegg ding'	Sronot	
Summer	Shin	Saanh	Sanh	Sanh	
Fall / Autumn	Khaiints'a	H̄yts'en'	Xiyts' in'	Xwyhts'en	
Winter	khaii	h̄yh	Xiyh	xwyh	



## OUR SEASONS

The activities of the Athabascan people have always followed the seasons—a never-ending cycle. “Such were the old ways and such are the new,” reads the Tanana Chiefs Conference website. “From season to season, from camp to camp, life is a never-ending cycle. The integrity of life is in this understanding.”

Late fall and early winter meant hunting. Especially the migrating caribou, which provided vital food as well as hide for clothing and shelter. Athabascan Chief Robert Charlie says, though modern materials are now used for clothes and homes, hunting is still an important subsistence food-gathering activity. “In the fall it is time for moose, bear and caribou hunting,” Charlie explains.



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During the old days, the cold and dark of winter forced people to stay sheltered. During those times oral history, through stories and legends, were passed from generation to generation. Charlie remembers that it was also a time for trapping many fur-bearing animals.

“The men would go out and trap—marten, lynx, minks, wolves, foxes and wolverines.” Trapping is still an important winter activity for many people.



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By early spring food was running out and the Athabascan people journeyed to spring camps to hunt. Even today subsistence food gathering can start as early as March with the trapping of beaver, Charlie explains. “In April there is the trapping of muskrats,” he says, “then in May more muskrats and the taking of waterfowl and freshwater fish.”

Summers were spent along the rivers which were the lifeblood of the Athabascans, providing food and transportation. “The third week of June is

the time to start building a fish wheel for harvesting salmon, which goes to the end of August,” Charlie explains. “This season requires the most activities. Work goes on 12 hours a day – even more if there is a good run of salmon.”

As fall approached, the activities shifted away from fish and to the migrating waterfowl and ripening berries. “There was berry picking,” Charlie says, “blueberries, cranberries, high-bush cranberries, dry berries, and rose berries.” Those activities continue to be an important part of fall.

As it was from the beginning, the cycle starts again. To quote the Tanana Chiefs Conference site, “To an Athabascan, the only things that change are the ways of survival.”



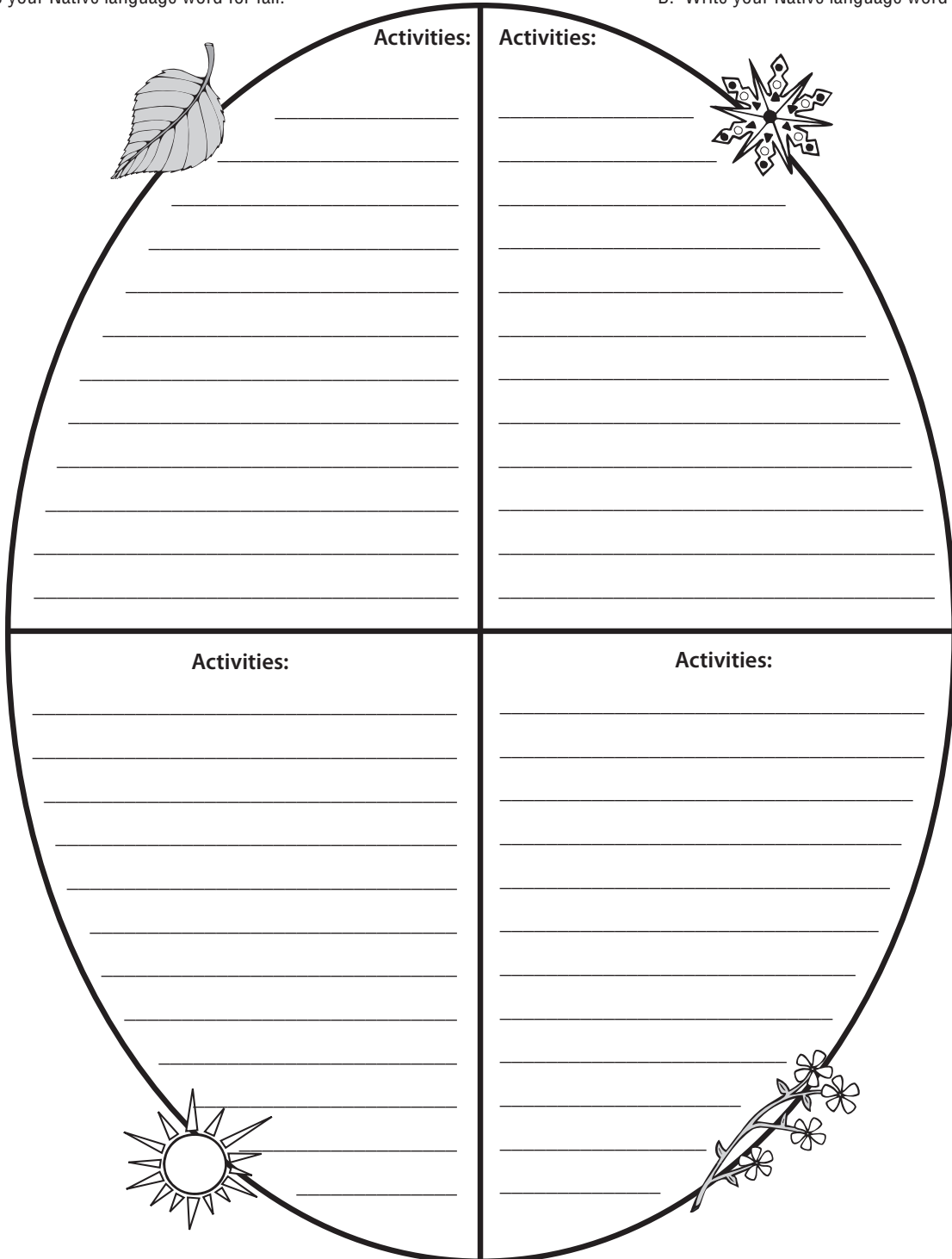
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NAME: \_\_\_\_\_  
**THE FOUR SEASONS**

1. Write your Native language word for each season on the correct line. In the oval below, list traditional activities that take place during the various seasons.

A. Write your Native language word for fall.

B. Write your Native language word for winter.



**Activities:**

**Activities:**

**Activities:**

**Activities:**

C. Write your Native language word for summer.

D. Write your Native language word for spring.

NAME: \_\_\_\_\_  
**THE FOUR SEASONS**

2. What things signal the coming of spring?

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3. What hemisphere is north of the equator?

- A. Northern Hemisphere
- B. Southern Hemisphere
- C. Eastern Hemisphere
- D. Western Hemisphere

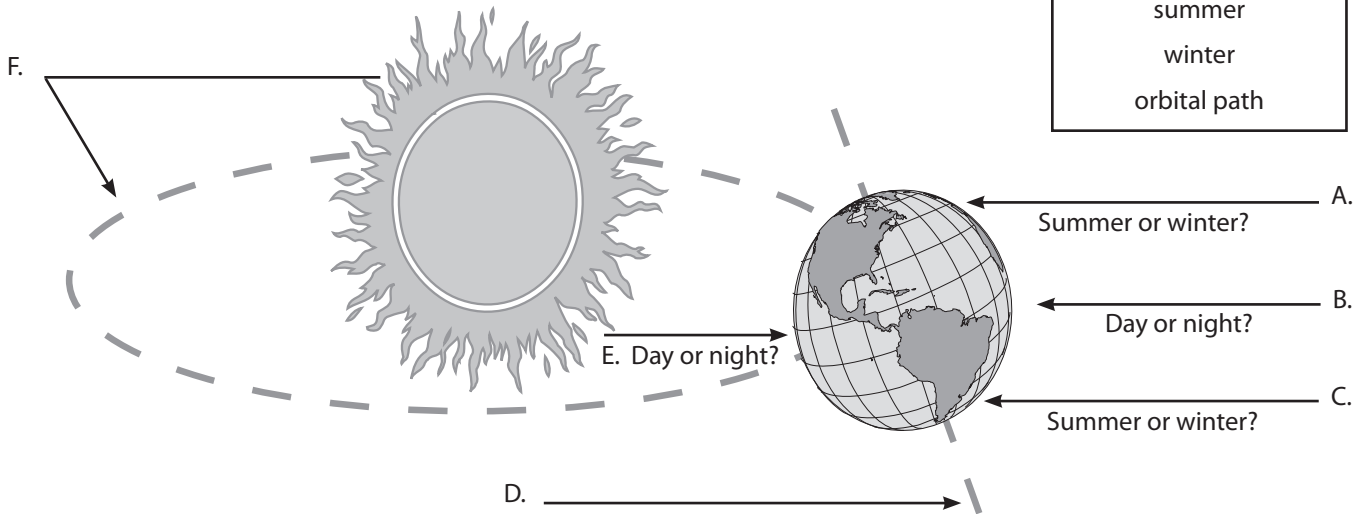
4. When it is summer in the southern hemisphere, what season is it in the northern hemisphere?

- A. fall
- B. winter
- C. spring
- D. summer

5. True or False: Earth's tilt changes as it rotates around the sun. \_\_\_\_\_

**Word Bank**

day  
night  
axis  
summer  
winter  
orbital path



6. Label the diagram above with words from the word bank.

7. What would it be like if Earth's axis did not tilt?

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8. What would it be like if Earth did not rotate?

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NAME: \_\_\_\_\_  
SEASONS VOCABULARY

**Directions:** Find someone who can complete each statement below. Have him/her do what it says and put his/her initials by the corresponding sentence. Continue until your sheet is complete. Each person may only sign your sheet once.

Find someone who...

1. \_\_\_\_\_ can demonstrate what it means to tilt and tell the angle of Earth's tilt.
2. \_\_\_\_\_ is willing to rotate for 20 seconds and tell you how long it takes for Earth to rotate one time.
3. \_\_\_\_\_ has experienced winter in another state.
4. \_\_\_\_\_ can explain why temperatures drop in the fall and winter.
5. \_\_\_\_\_ can point to the equator on the globe and tell its latitude.
6. \_\_\_\_\_ can name a holiday in all four seasons.
7. \_\_\_\_\_ can name the star that is orbited by all of the planets and provides life-giving energy to Earth.
8. \_\_\_\_\_ can name the season that occurs in a hemisphere that is tilted toward the sun during orbit.
9. \_\_\_\_\_ can pick a spot in the room and make one orbit around it.
10. \_\_\_\_\_ can name the imaginary line around which Earth rotates.
11. \_\_\_\_\_ can name the third planet from the sun.
12. \_\_\_\_\_ tell you how long it takes for Earth to orbit the sun one time.

# SEASONAL EQUINOX

