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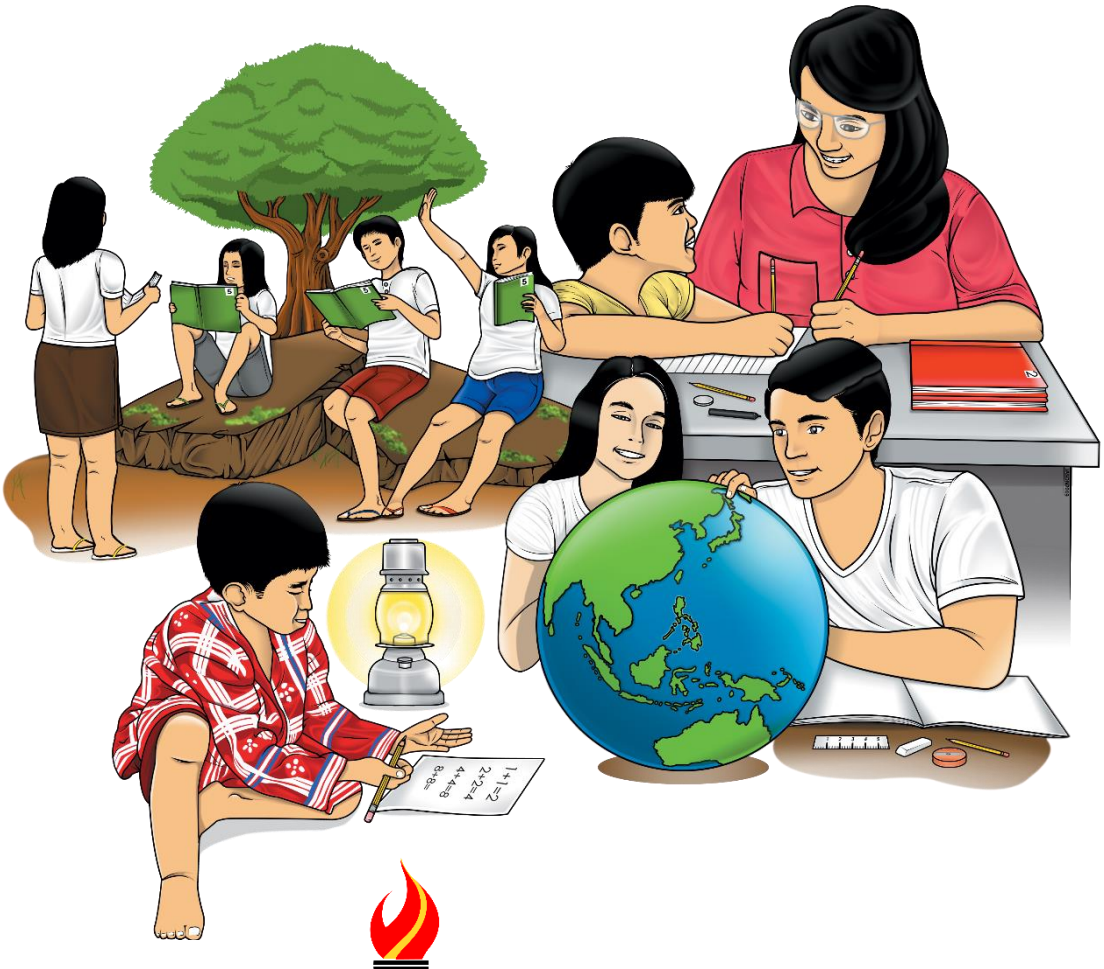
Science

Quarter 4 – Module 7:
Earth around the Sun



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Science

Quarter 4 – Module 7:
Earth around the Sun

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Introductory Message

This Self-Learning Module (SLM) is prepared so that you, our dear learners, can continue your studies and learn while at home. Activities, questions, directions, exercises, and discussions are carefully stated for you to understand each lesson.

Each SLM is composed of different parts. Each part shall guide you step-by-step as you discover and understand the lesson prepared for you.

Pre-tests are provided to measure your prior knowledge on lessons in each SLM. This will tell you if you need to proceed on completing this module or if you need to ask your facilitator or your teacher's assistance for better understanding of the lesson. At the end of each module, you need to answer the post-test to self-check your learning. Answer keys are provided for each activity and test. We trust that you will be honest in using these.

In addition to the material in the main text, Notes to the Teacher are also provided to our facilitators and parents for strategies and reminders on how they can best help you on your home-based learning.

Please use this module with care. Do not put unnecessary marks on any part of this SLM. Use a separate sheet of paper in answering the exercises and tests. And read the instructions carefully before performing each task.

If you have any questions in using this SLM or any difficulty in answering the tasks in this module, do not hesitate to consult your teacher or facilitator.

Thank you.

What I Need to Know

Hello kids! How are you doing today? You've probably noticed longer nights than daytime in December or longer daylight than nights in the summer. While the occurrence of the day and nights is due to the earth's rotation around its axis, what do you think causes this variation in day and night on earth?

In your previous grade, you tracked the weather for the whole school year. You found out that there are two seasons in the Philippines: rainy and dry. You might have noticed too that there are months of the year when it is cold and months when it is hot. The seasons follow each other regularly and you can tell in advance when it is going to be warm or cold and when it is going to be rainy or not.

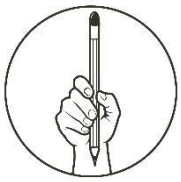
But can you explain why there are seasons at all? Do you know why the seasons change? In this module you will learn the position of the earth in its orbit, and its characteristics around the sun.

Most Essential Learning Competency:

Using Models, relate the position of the Earth in its orbit to the height of the sun in the sky. **(S7ES-IVh-9)**

After going through this module, you are expected to:

- Determine the characteristics of the Earth's orbit from the sun.
- Illustrate the Earth and its orbit at different times of the year.
- Explain the relationship of the height of the sun in the sky to the seasons



What I Know

Directions: Read and understand each item carefully. Write your answers on a separate sheet.

1. What is the speed of the Earth's orbit around the sun?

   A. 108, 000 km/h

   B. 109, 000 km/h

   C. 110, 000 km/h

   D. 111, 000 km/h

2. How many solar days the Earth completes one orbit?

   A. 364.542199 solar days
   B. 365.242199 solar days
   C. 365.542199 solar days
   D. 366 solar days

3. What do you call the point on Earth's orbit when the Earth is closest to the sun?

   A. Aphelion

   B. Astronomical

   C. Orbital

   D. Perihelion

4. What do you call the point on Earth's orbit when the Earth is at its farthest distance from the sun?

   A. Aphelion

   B. Astronomical

   C. Orbital

   D. Perihelion

5. What is the average distance of the Earth from the sun?

   A. 145.5 million km

   B. 147.6 million km

   C. 148.7 million km

   D. 149.6 million km

6. Rather than being a perfect circle, the Earth moves around the Sun in an extended circular or oval pattern. This is known as?

   A. Astronomical orbit

   B. Elliptical orbit

   C. Spherical orbit

   D. Circular orbit

7. What is the point in the orbit of maximum axial tilt toward or away from the sun?

   A. Aphelion

   B. Equinoxes

   C. Perihelion

   D. Solstices

8. When the direction of the tilt and the direction to the Sun are perpendicular. What do you call this phenomenon?

   A. Vertical

   B. Solstices

   C. Axial tilt

   D. Equinoxes

9. When the Northern Hemisphere is tilted away from the Sun, it experiences what season?

   A. fall

   B. spring

   C. summer

   D. winter

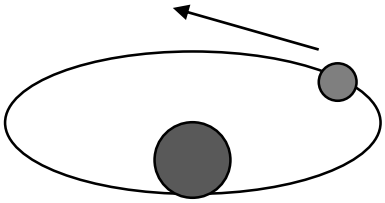
10. Consider the picture below. How would you describe the position of the earth in its orbit around the sun?

A. The earth rotates on its own axis.

B. The earth orbits the sun in an elliptical manner.

C. The earth spins in a counter clockwise direction.

D. The earth's axis is tilted with respect to the plane of the orbit.



11. Which of the following is TRUE about the characteristics of Earth's orbit around the Sun?

I. The planet travels 940 million km during a single orbit.
II. The Earth's orbit around the Sun is 108, 000 km/h.
III. The earth completes 365.242199.

A. I, II, III only
B. II, III, IV only
C. III, IV only
D. I, II, III, IV

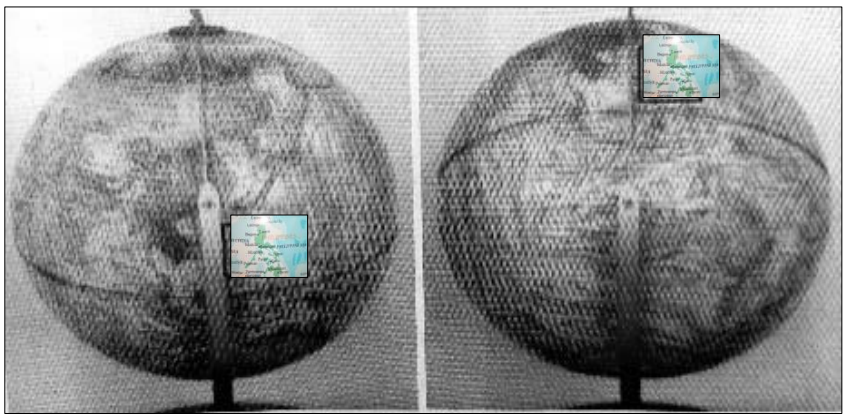
12. The planet's distance from the Sun also varies as it orbits. Which of the following statement is **TRUE?**

I. The Earth is never the same distance from the Sun from day to day.
II. When the Earth is closest to the Sun, it is said to be at perihelion.
III. When the Earth is at its farthest distance it is at aphelion.

A. I, II, III only
B. I, III, IV only
C. II, III, IV only
D. I, II, III, IV

13. Study the globes below. The globes represent the Earth facing from the direction of the Sun. In the photo A, the Northern Hemisphere is tilted toward the Sun. In photo B, the Northern Hemisphere is tilted away from the Sun.

The Philippines is inside the black square. Which photo shows the Philippines during summer?



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A **B**

A. photo A

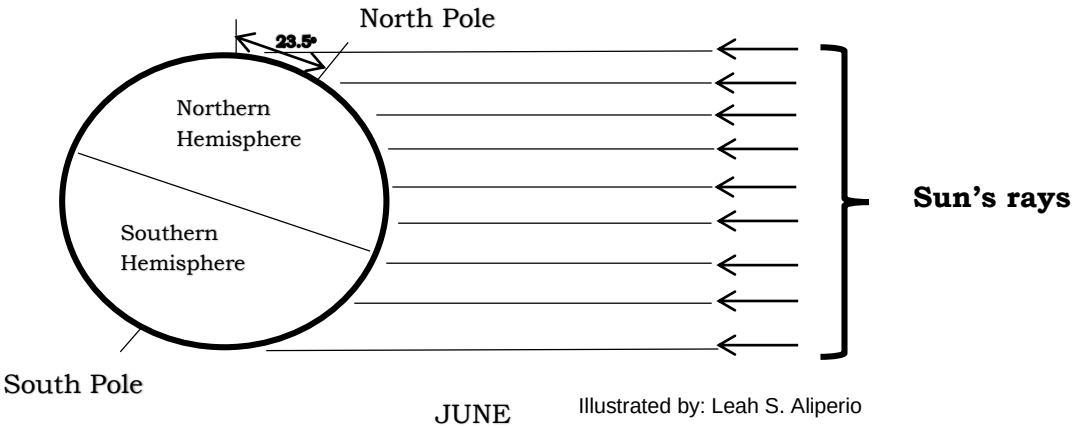
B. photo B

C. photo A & B

D. Neither A nor B

14. Study the figure below, the drawing shows how the Earth is oriented with respect to the Sun during the month of June.

Which hemisphere receives direct rays from the Sun in June?



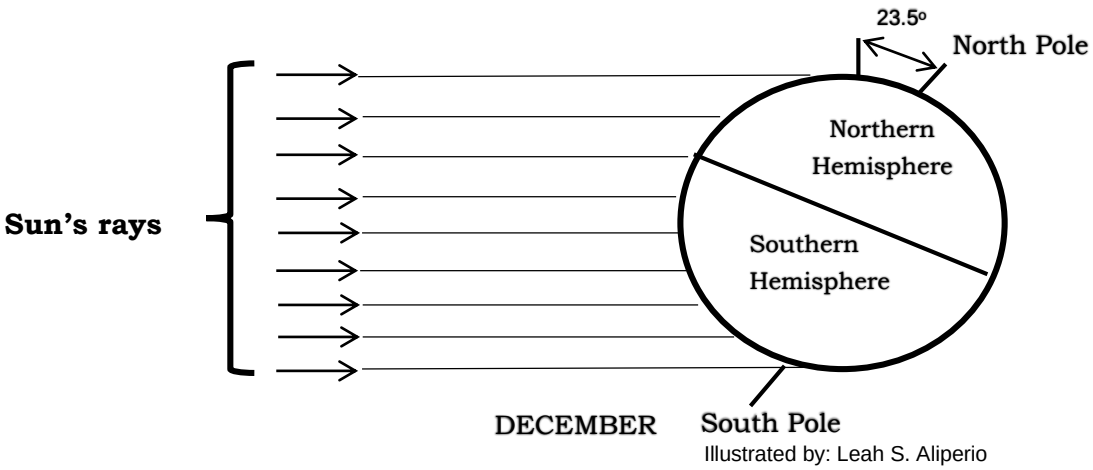
Illustrated by: Leah S. Aliperio

I. Northern Hemisphere II. Southern Hemisphere

A. I only
B. II only
C. I and II
D. neither I nor II

15. Study the figure below, the drawing shows how the Earth is oriented with respect to the Sun during the month of December.

Which hemisphere receives direct rays from the Sun in December?



Illustrated by: Leah S. Aliperio

I. Northern Hemisphere II. Southern Hemisphere

A. I only
B. II only
C. I and II
D. neither I nor II

Lesson 1

How far is the Sun in the Sky?

What's In

Hello, learners! In the previous module, you learned that the day and night are due to the Earth's rotation on its own axis. In other parts of the earth, there are months when day time is longer than night time while there are also months when night time becomes longer than day time. Amazingly, there are certain periods of the year when the length of daytime and nighttime is roughly the same!

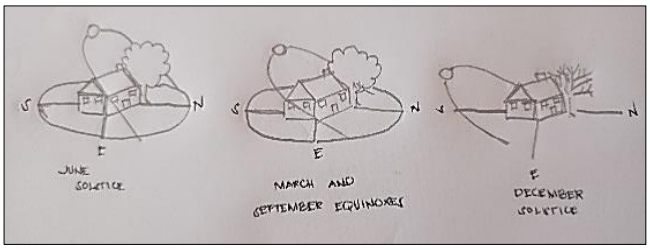
You probably already knew that the earth also moves around the sun as it moves about its own axis. What do you think is the result of this earth's motion around the sun? What causes the variations of the length of day time and night time around the year round in some parts of the earth? Let's try to find out in this module.

WHAT TO DO:

Directions: Look at the pictures in column A, match it with the seasons in column B. Write your answer in a separate sheet.

Seasons on Earth

A **B**



Illustrated by: Leah S. Aliperio

a. Summer
b. Winter
c. Fall
d. Spring

What's New

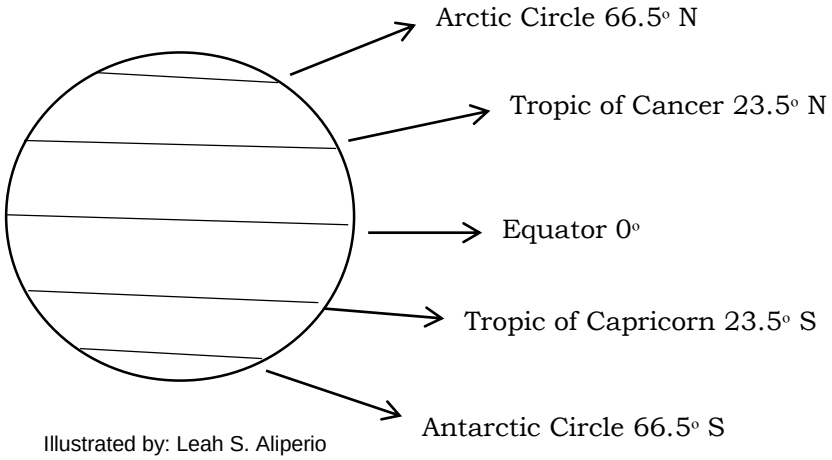
Ever since the 16th century when Nicolaus Copernicus demonstrated that the Earth revolved around the Sun, scientists have worked tirelessly to understand the relationship in mathematical terms. If this bright celestial body – upon which depends the seasons, the diurnal cycle, and all life on Earth – does not revolve around us, then what exactly is the nature of-the earth's orbit around it?

Have you ever seen a top spinning around and round? The earth spins around in much the same way as a top does. The earth spins around an imaginary line that runs through its center. This line is called the **axis**. Every twenty - four hours, the earth makes one complete spin, or a **rotation.** The rotation of the earth causes day and night.

It is also important to remember that there is another imaginary line that divides the earth around the middle into two halves- the Northern hemisphere and the Southern hemisphere. This line is called the **equator.** The earth's axis and the equator play a huge role in understanding about the seasons of the planet.

Are you now interested in our lesson? I hope that you can apply your analytical skills in the activities that we will discuss in this module. Let us start!

Activity 1. The Earth and its Latitude



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Questions:

1. How do the sun's rays hit the Tropic of Cancer when the Earth is tilted toward the sun?

2. Will the sun rise and set in the Arctic Circle when the northern hemisphere is facing away from the sun? Why or why not?

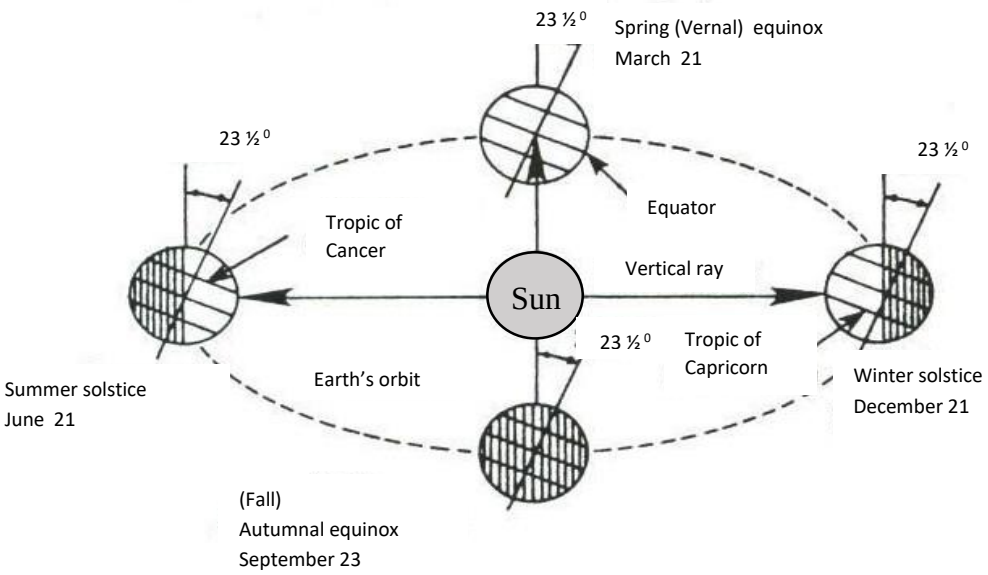
See rubrics at the end of the module for you to be guided in answering the activity.

What is It

The earth moves around the sun in a path called an **orbit**. The movement of the earth around the sun is called **revolution.** The Earth revolves around the sun at a speed of 108, 000 kilometers per hour. This means that the planet travels 940 million kilometers during a single orbit. The earth completes one orbit every 365 days, 6 hours and 8 minutes (approximately 365 1/4) days or one year. The remaining one-fourth day is added to the calendar after every four years. The year with 366 days is called a **leap year.**

The Earth's Axis

The Earth's axis is tilted at 23.5^0 from the vertical. As viewed above the North Pole, the Earth rotates counterclockwise which explains why the Sun appears to rise in the East and set in the West.

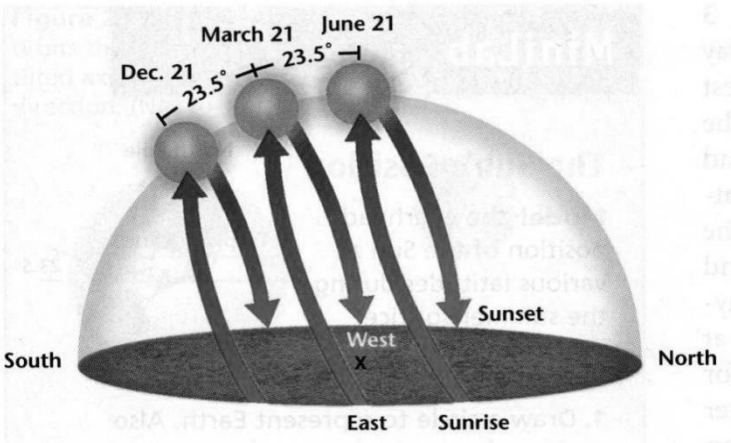


Illustrated by: Leah S. Aliperio

Figure 3. Earth and its Orbit at different times of the year

("The shaded parts show the non-illuminated sides of the Earth during specific seasons.")

The orientation of the Earth's axis remains fixed throughout the seasons. It points directly toward Polaris, the North Star. As a result of this fixed tilt, the Northern Hemisphere is tilted away from the Sun in December and towards the Sun in June. Meanwhile, the tilt of the Earth is neither towards nor away from the Sun during March and September.



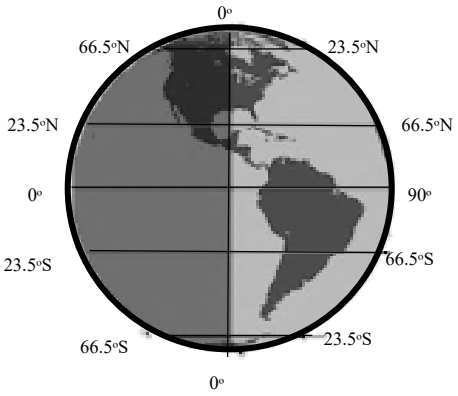
Source: I, SEDIP. 2004. *Integrated Science.* Caloocan City: GRAND C GRAPHICS, INC.

Figure 4: The Axis Tilt and the Sun's Height in the Sky

The fixed tilt of the Earth as it orbits the Sun results in a change in the observed height of the Sun above the horizon. The Sun appears to cross a higher path above the horizon in the summer and a lower path in the winter. This means that the Sun takes longer to cross the sky in the summer and a shorter amount of time in the winter. During spring and fall, it traces an intermediate path.

The Sun's height is at the maximum when it is directly overhead at solar noon. The location on Earth where this occurs is called the **subsolar point**. The **subsolar point** occurs on the equator during the spring and fall equinoxes. On these periods, the subsolar point is over the equator with a sun angle of 90 degrees at solar noon. All the latitudes (except the extreme poles) in the Northern and Southern Hemispheres are illuminated and receive roughly the same length of daylight and darkness. At each of these two equinoxes, the Sun rises due east and sets due west.

In Figure 5, the maximum Sun's altitude declines with latitude as one travels away from the Equator. For each degree of latitude traveled, the maximum Sun's altitude decreases by the same amount. The noon Sun angle can be measured by subtracting the location's latitude from 90 degrees.

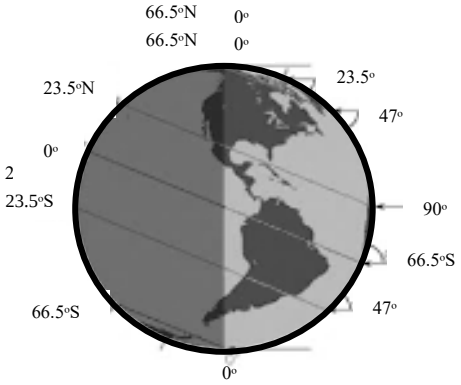


illustrated by: Leah S. Aliperio

Figure 5: At equinox, the Sun is overhead at 90 degrees on the equator at solar noon

During the summer solstice, the subsolar point moves to the Tropic of Cancer (23.5° N) as the Northern half of the Earth is angled towards the Sun. On this day, the position of the Sun in the sky at noon is at its highest altitude, and the position

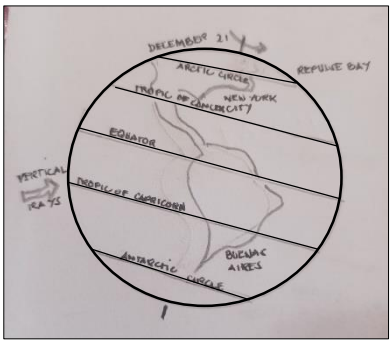
of the Sun at sunrise and sunset is farthest north. All places above this latitude have maximum Sun altitudes that are 23.5 degrees higher from the equinox positions. Places above the Arctic Circle (extreme North pole) are in 24 hours of daylight. Below the Tropic of Cancer, the noon angle of the Sun decreases a degree in height for each degree of latitude. At the Antarctic Circle, the maximum Sun's altitude becomes zero degree and locations lower than this point are in 24 hours of darkness.



Illustrated by: Leah S. Aliperio

Figure 6: During the summer solstice, the subsolar point is at 23.5 degrees North of the equator (Tropic of Cancer).

During the winter solstice, the subsolar point is located at the Tropic of Capricorn (23.5° S) when the South Pole is tilted 23.5° towards the Sun. The Sun rises and sets farthest south. No light reaches above the Arctic circle (66.5 degrees N) and all locations below the Antarctic Circle (66.5 degrees south latitude) experience 24 hours of sunlight.



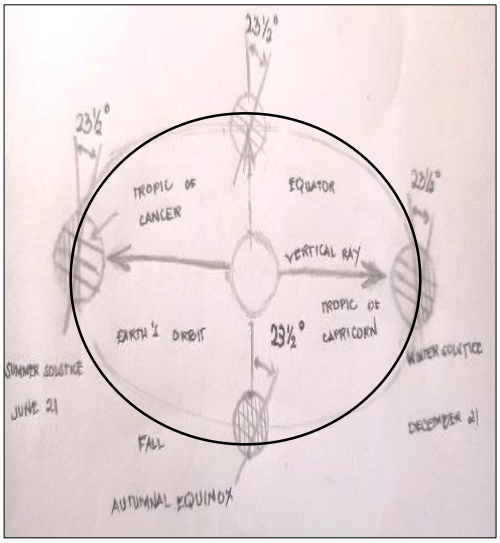
Illustrated by: Leah S. Aliperio

Figure 7: At winter solstice, the subsolar point is located at the Tropic of Capricorn (23.5° S) when the South Pole is angled 23.5° toward the Sun.

The Earth's Orbit

The shape of the Earth's orbit also adds to the amazing characteristics of the planet. Rather than being a perfect circle, the Earth moves around the Sun in an extended circular or oval pattern. This is what is known as an "elliptical" orbit. This orbital pattern was first described by Johannes Kepler, a German mathematician and astronomer. This shape of the earth's orbit explains why there are periods of the year when the earth is closest to and farthest from the sun. In fact, the Earth is never the same distance from the Sun from day to day.

When the Earth is closest to the Sun, it is said to be at **perihelion.** This occurs around January 3rd each year, when the Earth is at a distance of about 147,098, 074 km. When it is at its farthest distance from the Sun, the Earth is said to be at **aphelion** – which happens around July 4th where the Earth reaches a distance of about 152,097,701 km. The average distance of the Earth from the Sun is about **149.6 million km**, which is also referred to as one astronomical unit (AU). Although it varies, there is a little difference between the perihelion and aphelion so the Earth's distances between the two points differ at less than 5 million kilometers. This small difference between the aphelion and perihelion is not enough to affect the seasons on Earth.

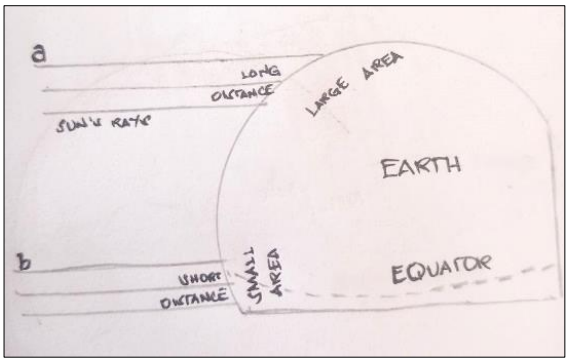


Illustrated by: Leah S. Aliperio

Figure 8: Aphelion and Perihelion

What's More

Are you getting familiar with the characteristics of the Earth's orbit around the sun? Let us have more practice exercises. I prepared this activity for you so I hope you will like it. Let's start!



Illustrated by: Leah S. Aliperio

Figure 9: Angle of inclination of the sun's rays in equatorial and polar areas.

Study the picture above and answer the following questions on a separate sheet.

Assuming that the Earth intercepts the same amount of energy from both Rays A and B,

1. Which area would receive more energy per unit area?

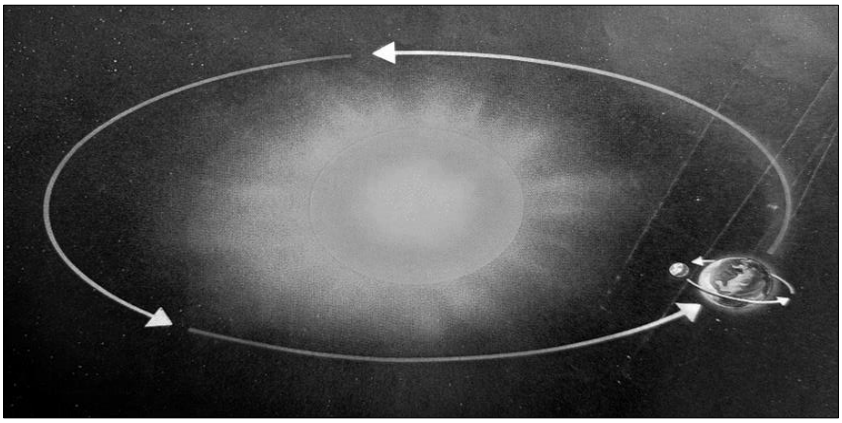
2. Which would you expect to be warmer?

Activity 2. How the Earth Moves Around the Sun

What to Do:

1. Look at the figure below, describe the characteristics of the Earth's motion around the sun.

2. Write your answers on a separate sheet.



Source: I, SEDIP. 2004. *Integrated Science.* Caloocan City: GRAND C GRAPHICS, INC

Figure 2. The Earth's Orbit around the Sun

Question #1: Is the distance of the earth around the sun the same as it orbits?

Question #2: What do you call the point when the earth is close to the sun?

Question #3: What do you call the point when the earth is far from the sun?

Question #4: What causes the earth to revolve around the sun?

See rubrics at the end of the module for you to be guided in answering the activity.

What I Have Learned

Now that you have learned a lot from our module, let us test your familiarity with our lesson by simply answering our activity below. Are you ready? Let us start.

Directions: Read the following questions carefully. Answer it on a separate sheet.

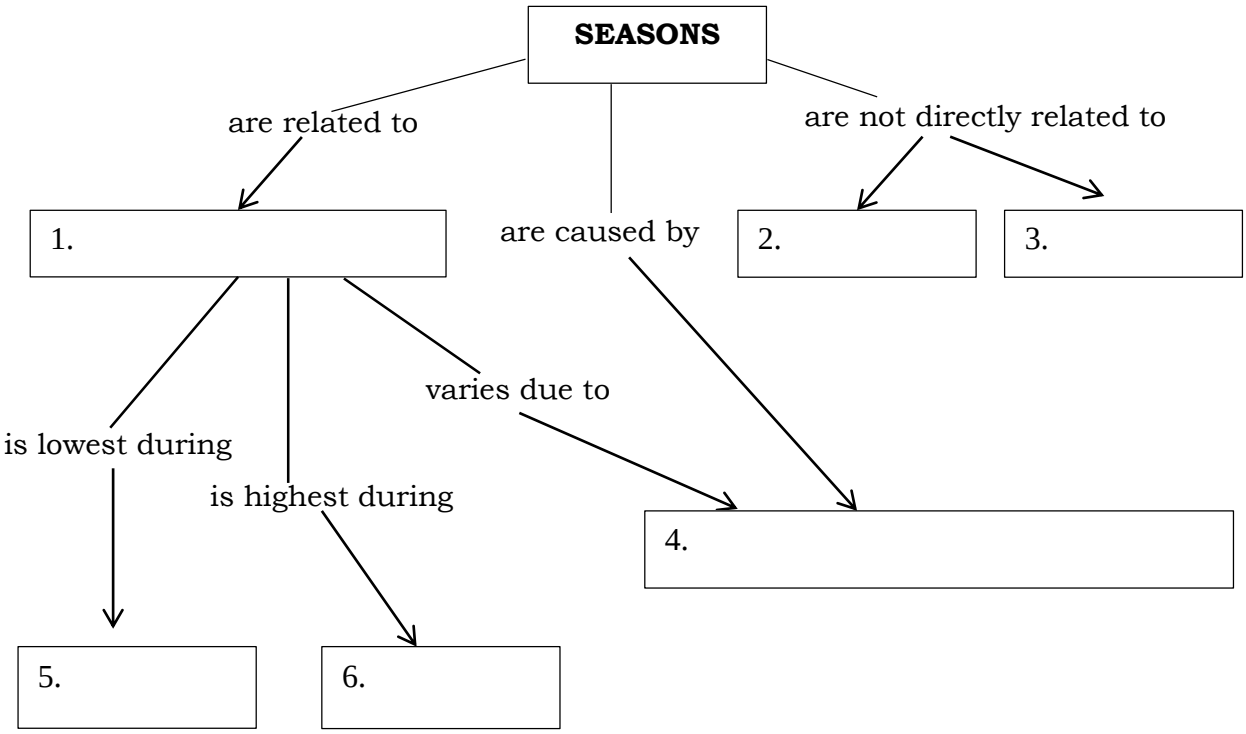
1. Summarize the characteristics of the earth and its motion around the sun in a table like the one below. The first characteristic is given as your guide.

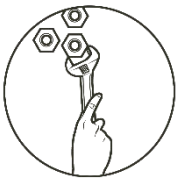
Characteristics	**Facts**
Speed	**108,000 km/h**

Concept Map

Complete the concept map below. Use the words/phrases inside the box as your choices. Answer it on a separate sheet.

aphelion	**the height of the noon sun in the sky**	**perihelion**
summer	**the tilt of the earth**	**winter**





What I Can Do

Congratulations! You are fantastic in doing the activities. Here is your final challenge to prove what you got.

Challenge!

1. How are the people's way of living influenced by the seasonal changes of the earth?

2. How do you feel living in a place or country that does not get to experience the true seasons?

3. What do you think are the advantages and disadvantages of living near the equator?

Please see the rubrics at the end of this module for you to be guided in answering the activity.

See rubrics at the end of the module for you to be guided in answering the activity.

Assessment

Directions: Read each item carefully. Choose the letter of the correct answer from the given choices. Write your answers on a separate sheet.

1. What is the force that keeps the earth from moving straight into space?

   A. axis
   B. gravity
   C. orbit
   D. speed

2. The earth makes one _____ every twenty – four hours.

   A. orbit
   B. revolution
   C. rotation
   D. tilt

3. The Earth makes one revolution around the sun in about how many days?

   A. 1 day
   B. 24 days
   C. 365 days
   D. 635 days

4. The earth takes one _____ to move around the sun.

   A. day
   B. minute
   C. month
   D. year

5. What is an imaginary line through the center of the earth around which the earth rotates?

   A. axis
   B. gravity
   C. orbit
   D. speed

6. What do you call the point on Earth's orbit when the Earth is closest to the sun?

   A. Aphelion
   B. Astronomical
   C. Orbital
   D. Perihelion

7. What effect does the tilting of the earth cause?

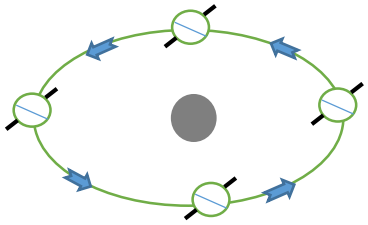
   A. When the earth is tilted away from the sun we have day.
   B. When the earth is tilted away from the sun we have night.
   C. It changes the angle than the sun strikes the earth in different land areas.
   D. It causes the earth to be farther away from the sun at different times of the year.

8. When it is summer in southern hemisphere, which of the following best describes the tilting of the Earth in the northern hemisphere?

   A. towards the sun
   B. away from the sun
   C. towards or away from the sun
   D. neither toward or away from the sun

9. Which motion do the arrows in the diagram represent?

   A. Sun's rotation
   B. Earth's rotation
   C. Sun's revolution
   D. Earth's revolution



Illustrated by: Leah S. Aliperio

10. The sun's height is at the maximum when it is directly overhead at solar noon. What do you call the location on Earth where this occurs?

    A. Aphelion
    B. Equinox
    C. Perihelion
    D. Sub solar point

11. Which of the following best describe solstices?

    A. The earth is closest to the sun.
    B. The Northern Hemisphere is tilted away from the sun.
    C. The direction of the tilt and the direction of the sun are perpendicular.
    D. The point in the orbit of maximum axial tilt toward or away from the sun.

12. Where would direct rays from the sun hit in June?

A. At the North and South poles
B. Mostly in the Northern Hemisphere
C. Mostly in the Southern Hemisphere
D. Both Northern and Southern hemispheres

13. Where would direct rays from the sun hit in December?

A. At the North and South poles
B. Mostly in the Northern Hemisphere
C. Mostly in the Southern Hemisphere
D. Both Northern and Southern hemispheres

14. How long does it take the Earth to complete one revolution around the sun?

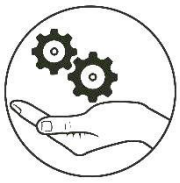
I. 1 month II. 30 days III. 365 days IV. 1 Year

A. I and II
B. III only
C. III and IV
D. IV only

15. What is the Earth's orbit?

I. The path of an Earth around the Sun. II. One full spin of an Earth around its axis III. The movement of an Earth around the Sun.

A. I only
B. II only
C. III only
D. Neither I, II, III



Additional Activities

Good job! You have come this far. I know that you are knowledgeable enough with our lesson. For your additional learning, try to answer this one:

1. **Write a poem or a story about the Sun's observed height and its effects on the length of daylight and amount of solar energy on Earth.**

Rubrics

Features	4	3	2	1
Ideas	Demonstrate in depth understanding of the topic. It uses scientific reasoning to address ideas.	Demonstrates understanding of the topic. Somewhat uses scientific reasoning to address ideas.	Demonstrates little understanding of the topic. Gives some new information but poorly organized	Lacks understanding of the topic. Gives no new information and poorly organized.
Grammar, Usage & Mechanics	No incorrect spelling, punctuation or grammatical errors.	Few spelling and punctuations, errors, minor grammatical errors.	A number of spelling, punctuation or grammatical errors.	So many spelling, punctuation and grammatical errors that it interferes with the meaning.
Effort	Took so much of time and worked hard on the activity	Slightly worked hard for the activity	Put a small effort into the activity	It was done in a rushed and did not work hard

Answer Keys

Assessment

1. B
2. B
3. C
4. D
5. A
6. D
7. C
8. B
9. D
10. D
11. D
12. B
13. C
14. C
15. A

What I Know

1. A
2. B
3. D
4. A
5. D
6. C
7. D
8. B
9. D
10. C
11. B
12. D
13. A
14. A
15. B

What's In

1. A
2. C & D
3. B

What I Have Learned

1. The height of the noon sun in the sky
2. aphelion
3. perihelion
4. the tilt of the Earth
5. winter
6. summer

What's More

1. B
2. B

References

Books

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