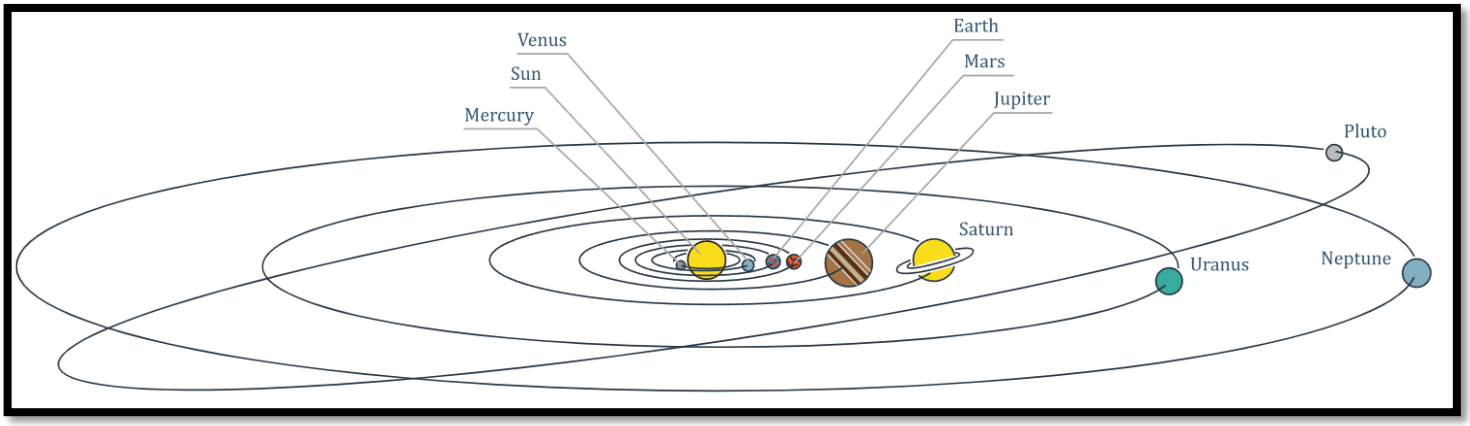
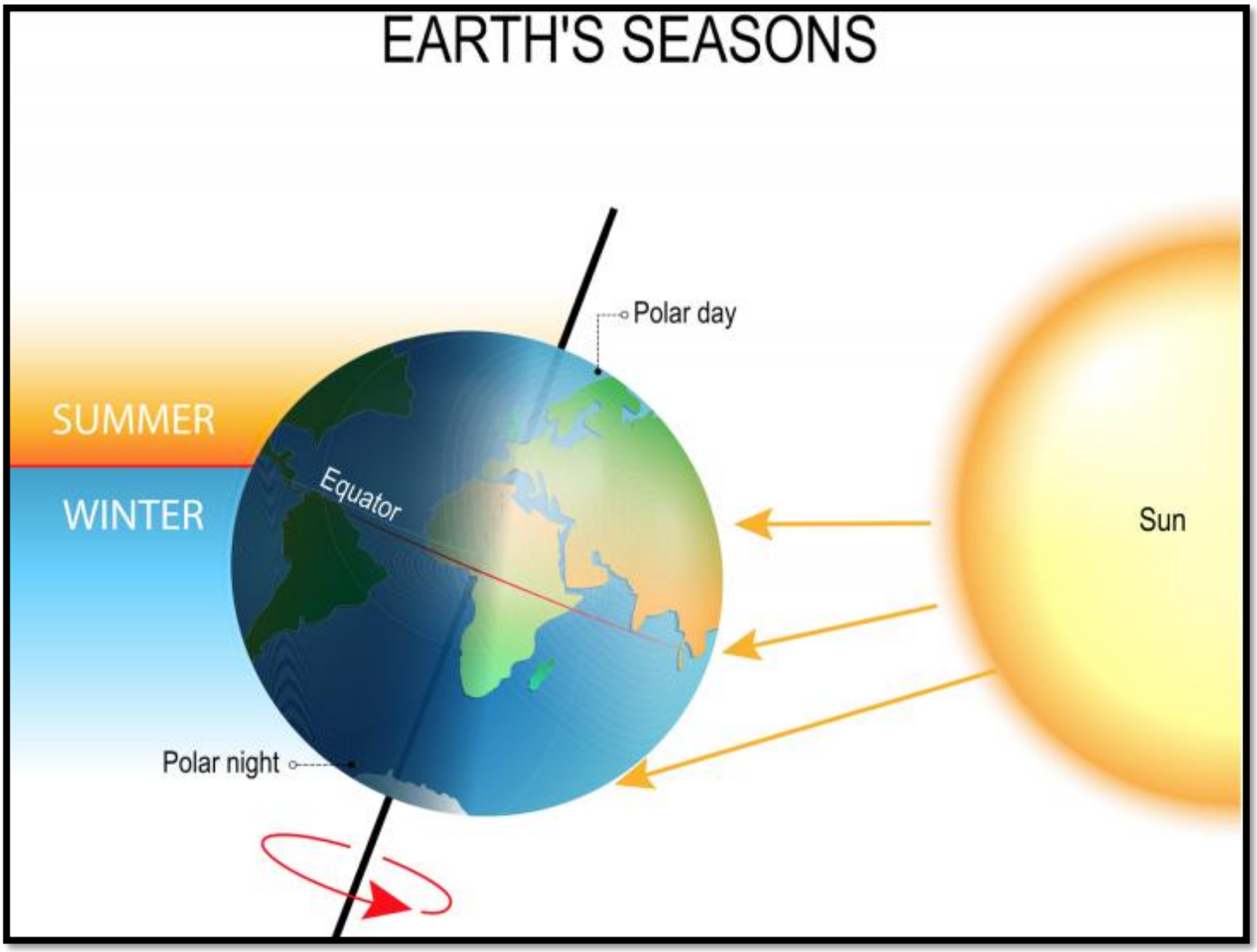
Science: Solar System - Motion of the Solar System





Name: _____

Science: Solar System – Motion of the Solar System

Big Idea (6): The solar system is part of the Milky Way, which is one of billions of galaxies.
Content (6): The overall scale, structure, and age of the universe
Content (6): The position, motion, and components of our solar system in our galaxy
Curricular Competency (6): Questioning and Predicting: Make predictions about the findings of their inquiry
Curricular Competency (6): Questioning and Predicting: Make observations in familiar or unfamiliar contexts
Curricular Competency (6): Planning and Conducting: Observe, measure, and record data, using appropriate tools, including digital technologies
Curricular Competency (6): Planning and Conducting: Use equipment and materials safely, identifying potential risks
Curricular Competency (6): Processing and Analyzing Data and Information: Compare data with predictions and develop explanations for results
Curricular Competency (5): Evaluating: Identify possible sources of error
Curricular Competency (5): Evaluating: Suggest improvements to their investigation methods
Curricular Competency (5): Applying and Innovating: Generate and introduce new or refined ideas when problem solving
Curricular Competency (5): Communicating: Communicate ideas, explanations, and processes in a variety of ways
First Peoples Principles of Learning: Learning is experiential

Background Information

1. Planets Orbit the Sun

- All planets travel around the Sun in a path called an **orbit**.
- Orbits are mostly **elliptical** (slightly stretched circles).
- The Sun's **gravity** pulls the planets toward it, keeping them from flying off into space.
- Planets move at different speeds: **closer planets orbit faster**, farther planets orbit slower.
    - Example: Mercury takes 88 days to orbit the Sun, while Neptune takes 165 years!

2. Rotation (Spinning) of Planets

- Planets also **spin on their axes**, which causes **day and night**.
- Some planets spin faster than others:
    - Jupiter spins fastest – one day is about 10 hours.
    - Venus spins very slowly – one day is longer than a year!

3. Moons Orbit Planets

- Moons are smaller objects that **orbit planets**.
- Like planets, moons stay in orbit because of **gravity** and their forward motion.
- Moons can orbit close or far, fast or slow, depending on their size and distance from the planet.

4. Asteroids, Comets, and Meteoroids

- **Asteroids** mostly orbit the Sun in the **asteroid belt**.
- **Comets** travel in long, elliptical orbits, sometimes coming close to the Sun and developing tails.
- **Meteoroids** move through space, and if they enter Earth's atmosphere, they become **meteors** (shooting stars).

5. Why Motion Happens

- Motion in the solar system is caused by a balance of:
    1. **Gravity** – pulls objects toward a larger body.
    2. **Inertia / forward motion** – objects keep moving in a straight line unless acted on by gravity.
- This balance keeps planets, moons, and other objects moving in **stable orbits**.

Fun Facts

- Earth's orbit is almost circular, but some planets have more stretched orbits (eccentric).
- Jupiter's gravity is so strong that it helps protect Earth by attracting or deflecting comets.
- Some moons rotate and orbit in unusual ways – like Neptune's moon Triton, which moves **backwards** around the planet!

Goal

To better understand why we have day/night, years, and seasons.

Materials

- Scrap paper
- Lamp / flashlight

Curricular Competency (6): Planning and Conducting: Use equipment and materials safely, identifying potential risks owing information

How will you ensure safety during this lab? Read through the rest of this lab, and discuss all of the ways that you can keep yourself safe, others safe, and the learning environment safe:

_____

_____

_____

_____

_____

_____

_____

Curricular Competency: Questioning and Predicting: Make **predictions** about the findings of their inquiry

SEASONS

You will be scrunching up paper into balls, to make a "planet". You will then tilt the planet on an angle, and have it face the light. What are your predictions?

As you tilt the ball towards the light, will you see shadows on the other side of the ball?_____

_____

_____

Will the top of the ball always be in light, even if it's tilted?_____

_____

_____

DAY AND NIGHT

You will asked to spin a paper ball slowly, in the direction of a light source. You are asked to make some predictions. Write down your thoughts:

Will the ball ever be totally in shade? Totally in light? Why? _____

_____

_____

YEARS

You will be asked to run around a pylon, to simulate a "year". You are asked to make some predictions. Write down your thoughts: Will the people closer to the cone do a lap faster than the people further away?

_____

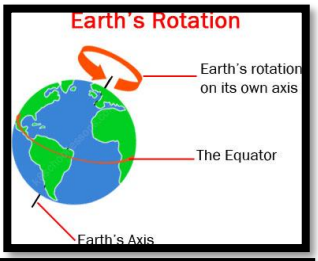
Why is that? _____

_____

_____

SEASONS

Background information: Earth's **tilt** and **orbit around the Sun** make the Sun hit different parts of Earth at different angles. This causes the **warm and cold seasons** we feel each year.

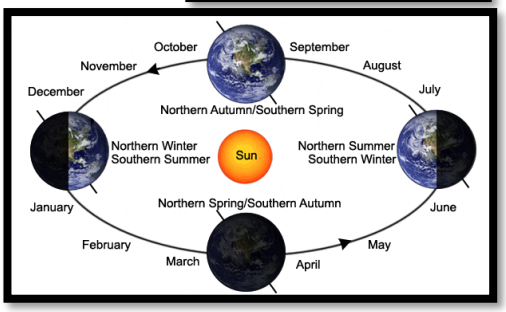


1. Earth is Tilted

- Earth's axis is tilted **about 23.5°** from vertical.
- This tilt means different parts of Earth get **different amounts of sunlight** as Earth moves around the Sun.

2. Earth Orbits the Sun

- Earth travels around the Sun in **one year** (~365 days).
- As it orbits, the tilt causes sunlight to hit the **Northern and Southern Hemispheres** differently.



3. How the Tilt Affects Seasons

- **Summer:** Hemisphere tilted **toward the Sun** → sunlight is stronger, days are longer, warmer temperatures.
- **Winter:** Hemisphere tilted **away from the Sun** → sunlight is weaker, days are shorter, colder temperatures.
- **Spring & Autumn (Fall):** Sunlight hits the hemisphere **evenly** → mild temperatures, day and night are about the same length.

4. Northern vs. Southern Hemisphere

- When it's **summer in the Northern Hemisphere**, it's **winter in the Southern Hemisphere**. Seasons are **opposite** on each side of the equator.

Common Misconception. Seasons are **not caused by Earth being closer or farther from the Sun** – it's mostly due to the **tilt of Earth's axis**.

Curricular Competency: Planning and Conducting: Observe, measure, and record data, using appropriate tools, including digital technologies

Steps.

1. Scrunch up a piece of paper into a ball. **Mark the North Pole.** Use a marker to indicate the **North Pole** on the paper ball.
2. **Set Up the Sun.** Place a flashlight on the table / use a lamp, to represent the **Sun**.
3. **Tilt the Earth.** Hold the paper ball so the North Pole is **tilted slightly toward you**. Keep this tilt **pointed in the same direction** as you move the ball.
4. **Simulate the Orbit.** Slowly move the paper ball **in a circle around the flashlight**. Notice where the "North Pole" is tilted toward or away from the light.
5. **Observe the Sunlight.** When the North Pole is tilted **toward the Sun**, that hemisphere is having **summer**. When the North Pole is tilted **away from the Sun**, that hemisphere has **winter**. The hemisphere perpendicular to the Sun experiences **spring or fall**.

Observations:

Sketch the ball in **four positions** around the Sun (summer, autumn, winter, spring). Shade the area that gets the least amount of light. Label which hemisphere is experiencing which season. In the space below, draw a diagram of what you did. Make sure to label everything. Then, write down your observations:

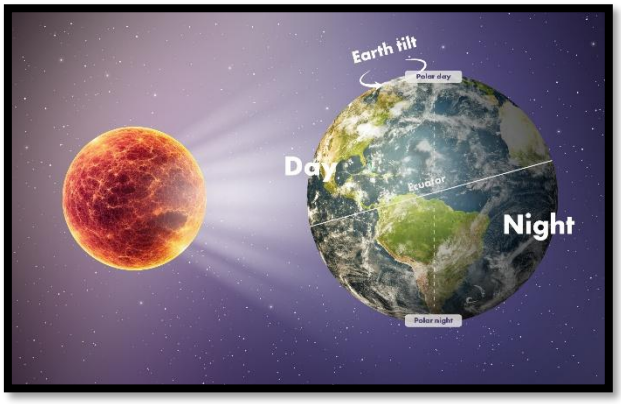
Diagram	Observations
	_____ _____ _____ _____ _____ _____ _____ _____ _____ _____

DAY AND NIGHT

Background information:

1. Earth Spins on Its Axis

- Earth is always **rotating (spinning)** around an imaginary line called its **axis**.
- One full spin takes about **24 hours**.
- This spinning is what causes **day and night**.



2. Sunlight Hits Only One Side at a Time

- The side of Earth **facing the Sun** gets sunlight — that's **daytime**.
- The side **facing away from the Sun** is in shadow — that's **nighttime**.

3. Earth's Rotation is Constant

- Earth spins in the same direction all the time (west to east).
- This is why the Sun seems to **rise in the east and set in the west**.

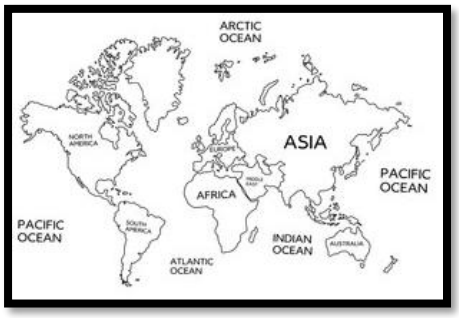
4. Earth Rotates, Not the Sun

- People sometimes think the Sun moves around Earth, but really **Earth is spinning**.
- The Sun only appears to move across the sky because of Earth's rotation.

Curricular Competency: Planning and Conducting: Observe, measure, and record data, using appropriate tools, including digital technologies

Steps.

1. **Mark a Spot on Earth.** Use a marker to label an approximate location for: NORTH AMERICA, AFRICA, ASIA, and PACIFIC OCEAN.
2. **Set Up the Sun.** Place the flashlight / lamp on a table to represent the **Sun**.
3. **Simulate Rotation.** Hold the paper ball and slowly **spin it once** while keeping the flashlight pointed at it. Watch how the marked spot moves into and out of the light.
4. **Observe Day and Night.** When the marked spot **faces the flashlight**, it is **daytime**. When it **faces away**, it is **nighttime**.



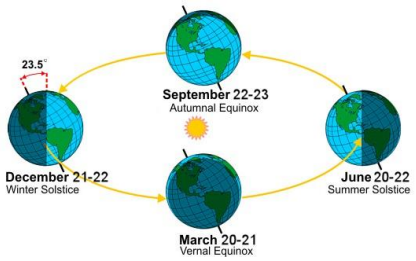
In the space below, draw a diagram of what you did. Make sure to label everything. Then, write down your observations:

Diagram	Observations
	_____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____

YEARS

Background information:

The Sun stays where it is in the universe. The Earth orbits/rotates around the Sun. It takes one whole year (365 days) for the sun to go around the sun once. The path that it takes to go around the sun isn't a perfect circle – it's more of an oval. Earth moves around the Sun in an **oval-shaped orbit (ellipse)** because of the Sun's gravity and the pull of other planets. It's not a perfect circle, but it's close enough that the difference is small.



Because the other planets are at a different distance from the Sun (than Earth), their "year" is a different length than here on Earth.

Length of a Year on the Planets

Planet	Length of a Year (Earth Days)	Kid-Friendly Comparison
Mercury	88 days	Less than 3 months — super fast!
Venus	225 days	About 7.5 months — almost a full Earth year
Earth	365 days	1 year — what we know!
Mars	687 days	Almost 2 Earth years
Jupiter	4,333 days	About 12 Earth years — very long!
Saturn	10,759 days	About 29 Earth years — a Saturnian year is huge!
Uranus	30,688 days	About 84 Earth years
Neptune	60,182 days	About 165 Earth years — very slow orbit!

Curricular Competency: Planning and Conducting: Observe, measure, and record data, using appropriate tools, including digital technologies

Planets closer to the Sun orbit faster, and planets farther away orbit slower. We are going to do an active running lab to show how the closer the "planet" (person) is to the "sun" (cone / object), the less time it takes to do a full lap around.

Steps:

1. **Set Up the Sun and Orbits.**
   - Place a cone or chair in the center to represent the **Sun**.
   - Use cones or tape to mark **circular paths** around the Sun for different planets.
   - The paths can be **small circles for inner planets** and **large circles for outer planets**.
2. **Assign Planets to Students**
   - For each student in your group, assign them a different planet
   - They will run around the Sun along their planet's orbit.
3. **Model Planet Speeds**
   - Inner planets (closer to the Sun) take **fewer steps per lap** or **run faster**.
   - Outer planets take **more steps per lap** or **run slower**.
   - Use a timer to measure **how long it takes each "planet" to complete one orbit**.
4. **Observe and Record**
   - Record each planet's "year length" in **seconds**.
   - Compare relative lengths – Mercury's orbit is shortest, Neptune's is longest.

In the space below, draw a diagram of what you did. Make sure to label everything. Then, write down your observations:

Diagram	Observations

Curricular Competency: Processing and Analyzing Data and Information: Compare data with predictions and develop explanations for results

How did your predictions compare with your findings?

Curricular Competency (5): Applying and Innovating: Generate and introduce new or refined ideas when problem solving

Now that you have learned more about our movement in the universe, how could someone use this knowledge to come up with a new idea, or to solve a problem?

Curricular Competency (5): Evaluating: Identify possible sources of error

Every lab has potential flaws in it. What are some of the ways that the lab itself (not you), could lead people to different results?

Curricular Competency (5): Evaluating: Suggest improvements to their investigation methods

How could you have improved your investigation methods?

Emerging	Developing	Proficient	Extending
Some sections are completed. Decipherable answers show initial understanding of the concepts, and sometimes incorporate specific vocabulary terms and reasoning.	All sections are completed. Answers show a growing understanding of the concepts, with some correct use of vocabulary and reasoning. Students are beginning to make connections and explain ideas with increasing clarity.	All sections are completed. Answers are reasonable, show clear understanding of the concepts, and include appropriate vocabulary and logical reasoning.	All sections are completed thoroughly. Answers are reasonable, insightful, and demonstrate clear connections to bigger ideas, with precise vocabulary, effective reasoning, and reflect awareness of multiple perspectives or broader implications of the concept.