Grade 5 Space

Cosmic Coders: Bringing Space to Life with Scratch

Driving Question: In what ways can design be used to achieve desired purposes when observing and interpreting astronomical phenomena?

Project Overview: Students take on the role of young astronomers working for a space agency tasked with investigating cosmic events. They will then use SCRATCH to design interactive simulations, animations, or games that model astronomical phenomena. They will investigate real space events and translate their learning into engaging, coded projects to help others understand the wonders of space.

1. Exploring Astronomical Phenomena

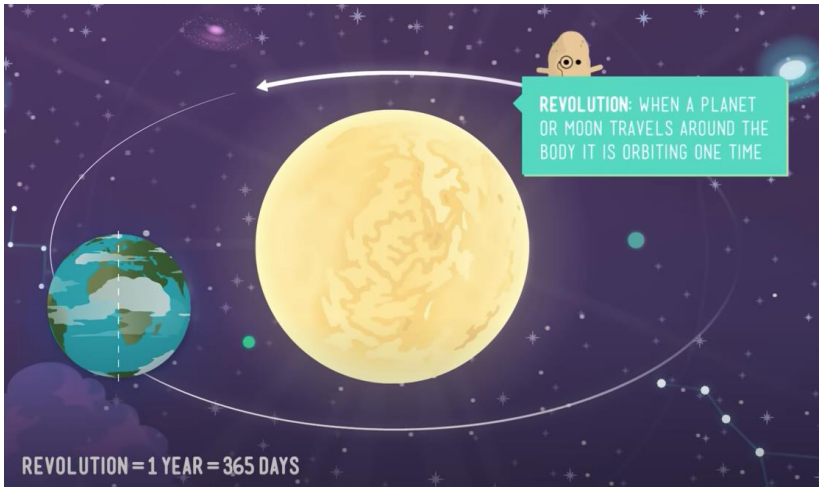
A phenomenon is a _____

- Phenomenon is ONE
- Phenomena is MORE THAN ONE

1		9	
2		10	
3		11	
4		12	
5		13	
6		14	
7		15	
8			

Earth's Movements: Rotation and Revolution

Video Link



Introduction

- The Sun appears to rise and set, but it's actually the Earth that _____.
- Our planet is always _____ on its axis.

Earth's Axis

- An imaginary line passing through the center of Earth from the North Pole to the South Pole is called the _____.
- Earth spins around this axis like a _____.

Earth's Rotation

- The spinning movement of Earth is called _____.
- Earth's rotation gives us _____ and _____.
- One full rotation takes _____ hours.

Day and Night

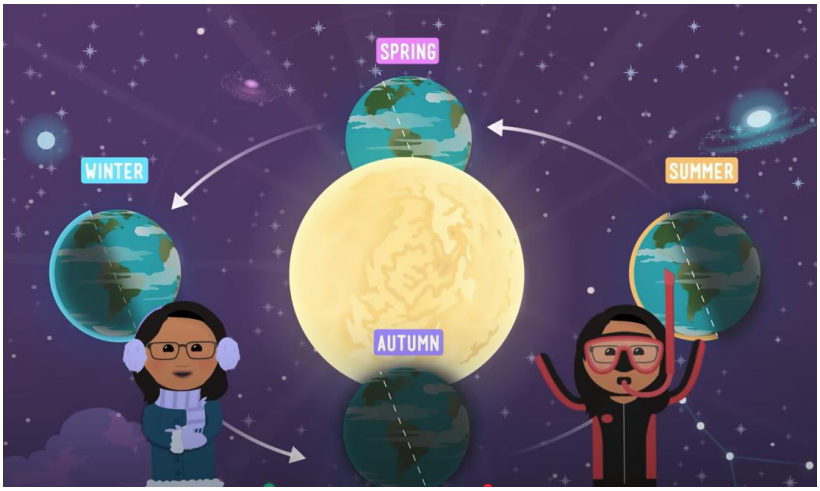
- When you're on the side of Earth facing away from the Sun, it's _____.
- When you're on the side facing the Sun, it's _____.

Earth's Revolution

- At the same time Earth spins, it also _____ around the Sun.
- This movement is called Earth's _____.
- One full orbit around the Sun takes _____ days or _____ year.

Earth's Tilt

- Earth's axis is tilted by _____ degrees.
- This tilt causes different parts of Earth to get _____ amounts of sunlight and heat.



Seasons

- Earth's tilt and revolution create _____.
- When your part of Earth leans towards the Sun, it's _____.
- When your part leans away from the Sun, it's _____.
- In between, it's _____ or _____.

Demonstration

- You need a _____, a table _____ without a shade, and a _____.
- The lamp represents the _____.
- The globe represents the _____.
- Spinning the globe shows Earth's _____.
- Moving the globe around the lamp shows Earth's _____.

Conclusion

- The Sun doesn't move around us; we move around the _____.
- There are _____ planets in our solar system that orbit the Sun.

Student Exploration: Summer and Winter

Directions: Follow the instructions to go through the simulation. Respond to the questions and prompts in the orange boxes.

Vocabulary: axis, equator, hemisphere, latitude, season, summer solstice, winter solstice

Prior Knowledge Questions (Do these BEFORE using the Gizmo.)

1. When during the year is the Sun highest in the sky? Lowest?

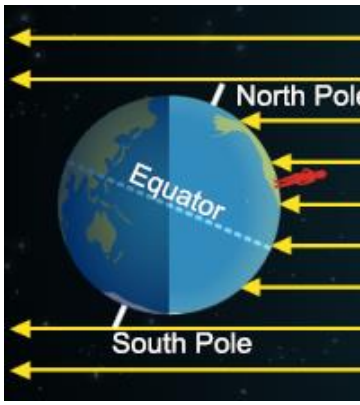
2. When during the year is daylight longest? Shortest?

3. Why do you think it is colder during the winter than the summer?

Gizmo Warm-up

The SPACE tab of the *Summer and Winter* Gizmo shows two different "snapshots" of Earth as it orbits the Sun. The Earth at left shows June 21. The Earth at right shows December 21.

1. The white line going through the North Pole and the South Pole is Earth's **axis**. Does the axis go straight up and down, or is it tilted?



2. Your **latitude** indicates how far you are from the **equator**, a line around Earth's middle. The person in the Gizmo has the same latitude on each date.

   Turn on **Show Sun rays** and slowly drag the person on the left Earth toward the North Pole. What do you notice about how the Sun rays hit the person as she is moved northward?

3. The half of Earth north of the equator (the "top" half) is called the northern **hemisphere**. (Hemisphere means "half a sphere".) The southern half is the southern hemisphere.

   A. Which hemisphere receives more direct sunlight on June 21?

   B. Which hemisphere receives more direct sunlight on December 21?

Activity A: **Reasons for seasons**	Get the Gizmo ready: • On the SPACE tab, drag the person to 40° N latitude. (This is the latitude of New York City.) • Check that **Show Sun rays** is on.	

Introduction: A **season** is a major division of the year, based on regular weather changes. Most of the world has four seasons – winter, spring, summer, and autumn (fall). The **summer solstice** is the first day of summer. The **winter solstice** is the first day of winter. The solstice dates usually (but not always) fall on June 21 and December 21.

Question: Why is it colder in winter than summer?

1. Form hypothesis: In the Northern Hemisphere, why do you think it is colder in December than in June?

2. Collect data: Select the EARTH tab. Record the following data for the 40° N location:
   - The number of Sun rays hitting the solar panel on June 21 and December 21.
   - The temperature on each date.
   - The **June 21 hours of daylight** and **December 21 hours of daylight**.
   - The angle of the Sun's rays on each date. (To do this, turn on the Show **protractor**. Choose a ray to measure, and align the arrow with the "T" in the middle of the protractor. Estimate the angle where the ray crosses the edge of the protractor.)

Date	Rays on panel	Temp. (°C)	Daylight hours	Sun ray angle
June 21				
December 21				

3. Analyze: Look at your data table.

   A. On which date are there more hours of daylight?

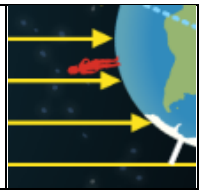
   B. On which date does more sunlight hit the solar panel?

   C. How does the angle of sun rays relate to the temperature?

4. Draw conclusions: Why is it colder in winter than summer? Give *two* reasons.

   1.

   2.

Activity B: **Southern seasons**	Get the Gizmo ready: • On the SPACE tab, drag the person latitude 40° S. (This is close to the latitude of Wellington, New Zealand.)	

Question: What are seasons like in the southern hemisphere?

1. Form hypothesis: Look at how the Sun rays hit the person in the southern hemisphere on June 21 and December 21. Which date do you think is warmer? Why?

2. Collect data: Select the EARTH tab. Fill in the information for the latitude 40° S, on June 21 and December 21. (To measure the Sun ray angle, select **Show protractor**. The angle will be between 0 and 90 degrees.)

Date	Rays on panel	Temp. (°C)	Daylight hours	Sun ray angle
June 21				
December 21				

3. Analyze:

   What is the first day of winter in the southern hemisphere?

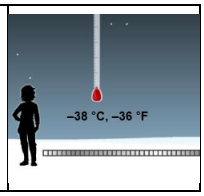
   What is the first day of summer in the southern hemisphere?

4. Draw conclusions: How are seasons in the southern hemisphere related to seasons in the northern hemisphere?

5. Extend: On the SPACE tab, drag the **axis** to 0° (straight up and down). How does this affect seasons on the EARTH tab?

6. Apply: What would seasons be like if Earth's axis were tilted *more* than 23.5°?

Use the Gizmo to test your prediction. Were you correct?

Activity C: **Extreme seasons**	Get the Gizmo ready: • Click **Reset tilt** to change the axis tilt back to 23.5°. • On the SPACE tab, drag the person to the North Pole (90° N).	

Question: What are seasons like at the poles and equator?

1. Collect data: Select the EARTH tab. Fill in the data for the North Pole, on June 21 and December 21. (To measure the Sun ray angle, select **Show protractor**.)

Date	Rays on panel	Temp. (°C)	Daylight hours	Sun ray angle
June 21				
December 21				

2. Analyze: What do you notice about the seasons on the North Pole?

3. Collect data: Click on the SPACE tab, and drag the person to the equator (latitude 0°). Select the EARTH tab and fill in the data table for this location.

Date	Rays on panel	Temp. (°C)	Daylight hours	Sun ray angle
June 21				
December 21				

4. Analyze: What do you notice about the seasons on the equator?

5. Draw conclusions: Describe what June 21 and December 21 would be like on the North Pole and the equator.

Built a Concept Map!

Connect the direction of Earth's tilt in relation to the Sun to the length of day and night in each season.

Instructions:

1. Cut out these squares.
2. Glue on blank page and add arrows to show connections

Shorter Day	Towards Sun	Winter
Summer	Season	Longer Night
Shorter Night	Earth	Away from Sun
Longer Day	Tilt	

Acting Out the Moon

Activity Link

	Description	Drawing
New Moon		
Waxing Crescent Moon		
First Quarter Moon		
Waxing Gibbous Moon		
Full Moon		
Waning Gibbous Moon		
Last Quarter Moon		

Waning Crescent Moon		
New Moon		

Moonrise, Moonset, and Phases

Directions: Follow the instructions to go through the simulation. Respond to the questions and prompts in the orange boxes.

Vocabulary: horizon, Moon phase, moonrise, moonset

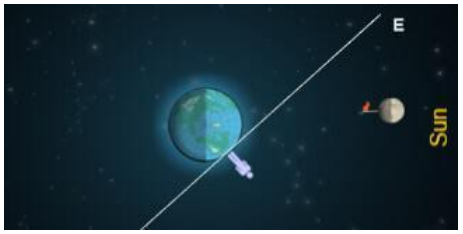
Prior Knowledge Questions (Do these BEFORE using the Gizmo.)

1. When is the last day and approximate time of day you recall seeing the Moon?

Click on the box to the right, select edit and draw what you saw.

2. Does the Moon always rise and set at the same time?

Gizmo Warm-up



The Moon is not always in the same position in the sky at a given time. Sometimes the Moon rises in the early evening, sometimes in the middle of the night, and sometimes during the day. The *Moonrise, Moonset, and Phases* Gizmo allows you to determine how the **Moon phases** are related to the timing of **moonrise** and **moonset**.

To begin, turn on **Show horizon**. The Gizmo shows Earth, the Moon, and an observer on Earth. The Sun is located far away to the right of Earth. The long white line is the **horizon**.

1. Click **Play** ( ). Look at the VIEW OF MOON FROM EARTH pane. What do you see?

2. Click **Reset** ( ) and set the **Speed** to **Slow**. Click **Play**, and then click **Pause** ( ) when the Moon is aligned with the eastern horizon (**E**).

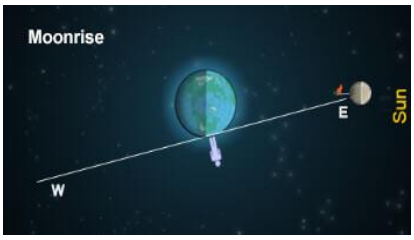
   Look to the upper left. What time is it? _____ This is the time of moonrise.

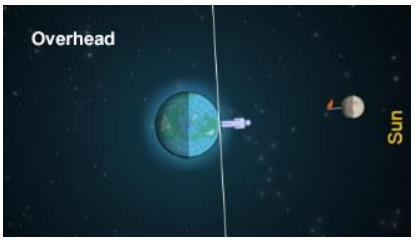
3. Click **Play** and then **Pause** when the Moon is aligned with the western (**W**) horizon.

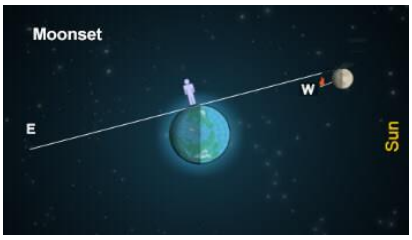
   What time is it? _____ This is the time of moonset.

Activity: **Moonrise and moonset**	Get the Gizmo ready: • Click **Reset**. • Check that **Show horizon** is on and the **Speed** is set to **Slow**.	

Introduction: For an observer on Earth, moonrise occurs when the Moon is just over the eastern horizon. Moonset occurs when the Moon has gone below the western horizon. Between moonrise and moonset the Moon will pass overhead.







Question: How do Moon phases relate to the timing of moonrise and moonset?

1. Observe: Drag the Moon to the left side of Earth. You will see a Full Moon on the VIEW OF MOON FROM EARTH pane. Use the Gizmo to find the time of moonrise and moonset.

   A. What is the time of moonrise? _____

   B. At what time is the Moon directly over the observer's head? _____

   C. What is the time of moonset? _____

2. Compare: In the Warm-up activity, you measured the time of moonrise and moonset during the New Moon phase. You found that the Moon rose at approximately 6:00 A.M. and set at approximately 6:00 P.M.

   How do the times of moonrise and moonset compare for the Full Moon and New Moon?

3. Predict: How do you expect the times of moonrise and moonset to change as the Moon orbits Earth?

4. Gather data: For each Moon phase listed below, use the Gizmo to find the time of moonrise, the time that the Moon is overhead, and the time of moonset. List these in the table.

Phase	Illustration	Moonrise	Overhead	Moonset
New Moon				
Waxing Crescent				
First Quarter				
Waxing Gibbous				
Full Moon				
Waning Gibbous				
Third Quarter				
Waning Crescent				

5. Analyze: What patterns do you notice in your data?

6. Apply: What is the phase of the Moon if it rises at 4:00 A.M.?

What is the Moon phase if it reaches its highest point at 9:00 P.M.?

7. Extend your thinking: In its 29.5-day cycle, the time of moonrise changes by 24 hours. How much does the time of moonrise change each day? Check your answer using the Gizmo.

Sky Stories & Science: A Gallery Walk Lesson

Station 1

Watch this video. Fill out the following:

What are the Northern Lights?

- The Northern Lights are also called _____ _____.
- They look like _____ of bright colors in the night sky.

What causes the Northern Lights?

- The Northern Lights are caused by _____.
- Energy is the ability to _____ things.

The Journey of Energy

1. Energy comes from _____ _____ as charged particles called _____.
2. The Sun sends out a stream of plasma called the _____ _____.
3. Most of the solar wind is stopped by Earth's _____ _____.
4. Some particles get trapped and go to areas near the _____ and _____ poles.

What happens in Earth's atmosphere?

- The particles from space hit particles in Earth's _____.
- This makes the Earth particles _____.
- The excited particles release energy as _____.

Colors of the Northern Lights

- _____ particles high up make _____ light.
- _____ particles lower down make _____ light.
- _____ particles often make blue and purple light.

Station 2

Read the following story and answer the questions below

The Land of the Long Day and the Endless Night

(An Inuit and Northern First Nations Story about the Midnight Sun and Polar Night)

A long time ago, before the world was as we know it today, the Arctic did not have night and day like other places. Instead, the sun would shine for months without setting, and then, without warning, it would disappear, leaving the land in darkness for just as long. The people wondered why this happened and told a story to explain it.

The Inuit tell of a time when the Sun and the Moon were once human. The Sun was a bright and kind woman who brought warmth and life to the land, while the Moon was her mischievous brother, always chasing after her. One day, the Sun grew tired of always being followed, so she ran far ahead, staying in the sky for many months at a time. This is why summer in the Arctic has endless daylight—the Sun is trying to escape. But after a while, she grows tired and must rest, slipping away below the horizon. That is when the Moon finally catches up, ruling over the long winter night.

Some First Nations groups also say that long ago, the Earth and Sky were out of balance. The animals and people of the North asked the great spirits for help because they needed both light and dark to live. The spirits listened and agreed to divide time into seasons—half of the year with long, golden days and the other half with deep, starry nights. In doing so, they created the cycle that still guides the lives of those who live in the far North today.

Even now, the people of the North prepare for these great changes. In summer, when the Sun never sets, they hunt and fish, gathering food while there is warmth and light. In the long, dark winter, they tell stories, share meals, and look up at the sky, waiting for the Sun to return.

1. How does this story explain the Midnight Sun and the Polar Night?

2. Why do you think stories were used to explain natural events before people understood them scientifically?

3. How do you think life would be different if we had months of daylight or darkness?

Station 3

Examine the following information about the Thirteen Moons. Check out this video too!

1. What are some similarities between the thirteen moons and our calendar hanging on our wall?

2. Why are celestial events important for marking time?

3. How do the moon phases or seasonal shifts influence planting and harvesting?

Station 4

Read and/or watch this legend. Answer the questions below.

Summarize what is Legend of Night and Day?

What does this legend have to do with our learning of Space?

Solstices and Equinoxes

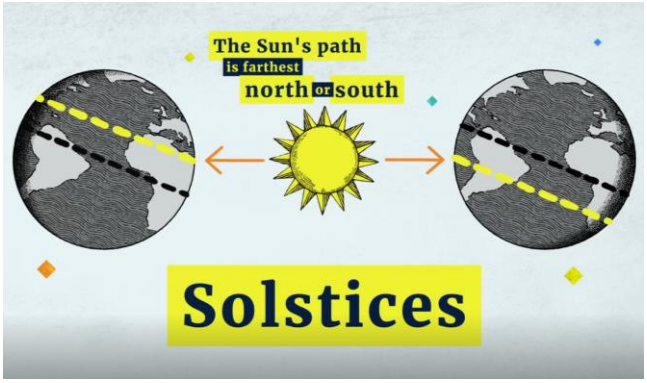
Watch this video

_____Hemisphere

Equator

_____ Hemisphere

Solstices



Occurs when?

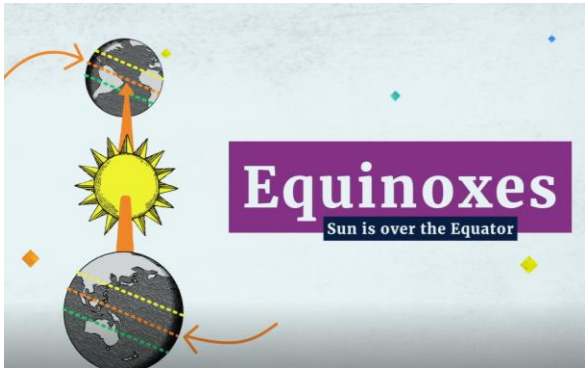
Summer Solstice: beginning of summer and the longest day of the year.

Winter Solstice: beginning of winter and the shortest day of the year.

Which Solstice occurs on which day DEPENDS on which HEMISPHERE you live in!

	Northern Hemisphere (us)	Southern Hemisphere (Australia)
Summer Solstice		
Winter Solstice		

Equinoxes



Occurs when?

Marks the beginning of SPRING or AUTUMN!

Which Equinox occurs on which day DEPENDS on which HEMISPHERE you live in!

	Northern Hemisphere (us)	**Southern Hemisphere (Australia)**
Vernal Equinox		
Autumnal Equinox		

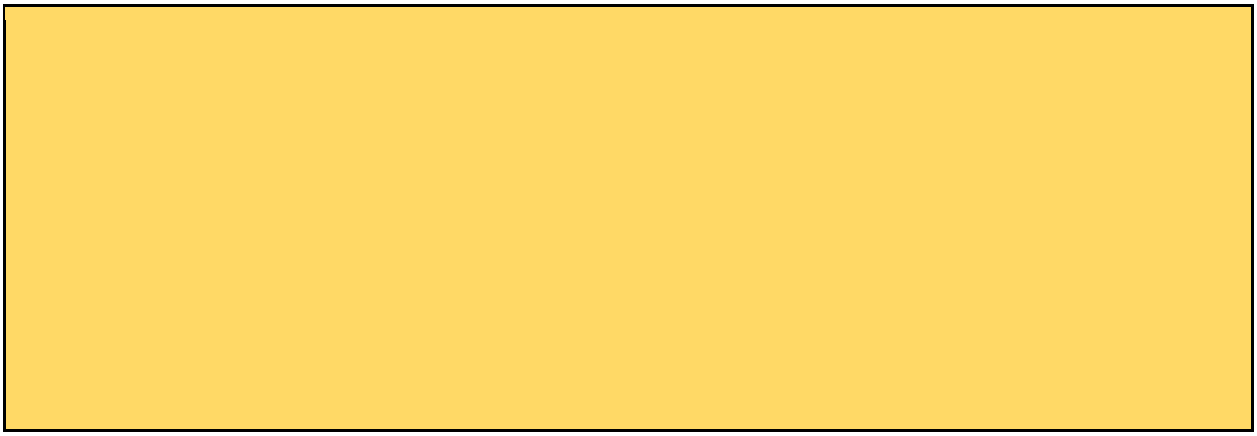
Day and Night on these days lasts the SAME amount of time!

Solar and Lunar Eclipses

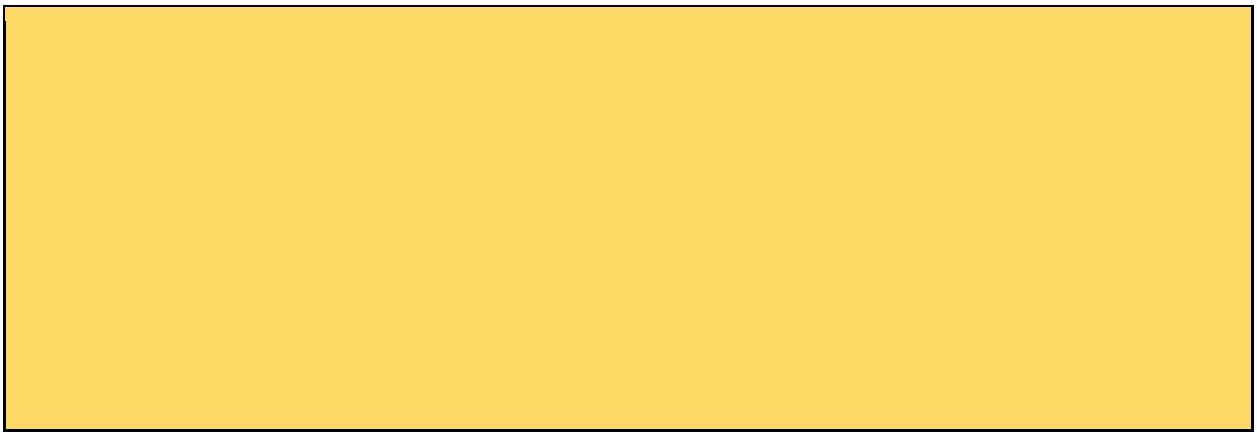
Check out this site and this video

Include the sun, earth, and moon in your drawings below

Solar Eclipse



Lunar Eclipse



What is the image on the left? Explain.

Planning your Space Scratch Project

Decision Time: Which will it be?

Will it be an **animation** (e.g., a solar eclipse simulation)?	An **interactive model** (e.g., clicking on planets for facts)?	A **game** (e.g., guiding a spaceship through an asteroid field)?

Before coding, you will need to sketch your ideas for your project below: