



Navigating the Night Sky Project

Leader Info

Have you ever wanted to stargaze, but didn't know where to start? Astronomy is a science that studies the sun, moon, stars, planets and other objects and phenomena in space. In this project, members will learn how to navigate the night sky with easy to use tools such as a paper star finder, binoculars and mobile apps. In this project, members will learn about the how the earth's movement determines time and seasons; the different phases of the moon; and be able to locate planets, constellations and stars in the night sky.

Project Completion Requirements (PCR)

- Members will complete at least five (5) project activities.
- Members will complete the Phases of the Moon Observation Chart and place in a folder.
- Members will complete the Astronomy Log Book including sketches for 2 planets, 5 circumpolar constellations, 5 seasonal constellations, and 5 stars. These log sheets will be placed in a folder.
- Members will complete the Constellation Shadow Box.
- Document all activities or project meeting topics on the **Project (1) Page specific to Home Economic or Life Skill Projects**

Exhibition Requirements

Constellation Shadow Box

Members are strongly encouraged to participate in the 4-H Classes at PEI Fairs & Exhibitions. Please check with your Project Leader or visit www.pei4h.ca for more Exhibition information.

4-H Year Completion

In order to complete the 4-H year members are required to:

- Complete the **PCR's (Project Completion Requirements)** as outlined above
- Complete a **Communication** (public speaking) Project
- Complete a **Community Service** Activity
- Complete an **Agriculture Awareness** Activity
- Complete the **Member Documentation** (4) pages found in member's Portfolio or on the website
- Compile all documentation and PCRs to have on display at Club Achievement Day

Note: As the project leader you are only responsible for facilitating the first requirement for the members of your group, the remaining requirements are the responsibility of the member.

GETTING STARTED

*The resources below can be found on 4-H PEI website (www.pei4h.ca) on the page dedicated to this project.

What you need:

- ⇒ This **Leader Booklet**
- ⇒ A copy of the **Project Information Page**. This will give you the most up to date information on requirements for the project.
- ⇒ **Binoculars**
- ⇒ **Device such as cellular phone or tablet** (either Apple or Android products)
- ⇒ **Materials for Constellation Shadow Box**
- ⇒ **Star Finder** (description in activity 1D)
- ⇒ **Exhibition Information**—this is updated on the 4-H PEI website in May of each year so be sure to review the information again at that time.

Optional resources:

- ⇒ **Astronomy Activity Guide - 4-H Saskatchewan:** http://www.gov.pe.ca/photos/original/4h_astronomyAG.pdf
- ⇒ **Astronomy Resource Book 4-H Saskatchewan;** http://www.gov.pe.ca/photos/original/4h_astronomyR
- ⇒ Various other resources as they become available, such as 4-H resources from other provinces, and links to online videos, articles, activities, and project related organizations, clubs, and events.

** Please do not feel obligated to cover everything in all of the provided optional resources. It is completely each leader's prerogative which of these resources, if any, they utilize if planning and leading their project meetings.*



THE PROJECT LEADER'S JOB

To begin, thank you for volunteering your time to be a 4-H project leader! We appreciate your time and willingness to teach today's youth a new skill and share your knowledge.

Becoming a project leader can feel overwhelming at first, but we hope that this page will make your "job" clear and offer some tips to help you be successful.

Responsibilities:

1. **Become a screened leader:** You may have already completed this step, but it is a very important one. The best place to go is to the 4-H PEI website and visit this page: <https://www.pei4h.ca/4-h-leaders>, to see if you have completed all the necessary requirements. Project meetings cannot begin until you have received a "conditional letter" from the Provincial 4-H Office.
2. **Set project meeting dates:** The amount and length of project meetings is determined by you, the project leader. That being said, you are responsible for covering **all the Project Completion Requirements** for this project with your group. You may decide that you'd like to have five meetings - covering one requirement per meeting, or you may decide to spend two 5 hour sessions with your group and cover multiple topics or activities in one meeting. This will also depend on the project you are leading. For instance, if you are leading a quilting project, then the member will be focused on one large item with multiple steps and skills involved. However, a rabbit project may require multiple meetings (and even locations) to cover different activities and topics. Meetings can begin anytime after November 15th.

Whatever the case, we highly recommend that Project Leaders **set dates in advance of members signing up for the project**. This method will ensure the members know what they are signing up for, or enable them to make a decision to not sign up if they cannot commit to the dates listed. We also hope that this will avoid a lot frustration for you, because working around multiple schedules is almost impossible!

3. **Choose topics and activities:** You may choose to work on this step before setting dates for project meetings. Some topics and activities may be able to be covered in one project meeting, while others may need their own meeting. Regardless, we ask that you document your project meetings and topics covered so that the 4-H Specialist can refer to this information at Achievement Day if necessary.
4. **Materials & supplies:** While you are responsible for determining what materials and supplies are needed, you **are not** responsible for covering these costs. Options to consider:
 - A) 4-H Canada has a FCC 4-H Club Fund that all leaders are welcome to apply to. These grants are valued at \$500 each. Applications are accepted August through to the end of October.
 - B) Asking for supplies. Depending on what project you are leading, just putting a call out for the supplies you need to friends, family, etc. may be successful.
 - C) Determine an estimate total for the materials and supplies needed and set a "project fee" that all members will pay to help cover the additional costs.
5. **4-H year completion and project completion requirements:** The project leader **is not** responsible for 4-H Year Completion (these components will be completed at the club level) though each member **must** complete these components. Project leaders should focus on the Project Completion Requirements, found on the front cover of this guide. These are the items that the 4-H Specialist will expect to see on display at the Club's Achievement Day (typically scheduled for June-July).
6. **Club meetings & events:** Project leaders are not expected to attend monthly club meetings, but are more than welcome to attend if they'd like to know what is going on at the club, provincial, or national levels of 4-H. Similarly, club events and activities are open to project leaders, but it is not necessary to attend. Project leaders are encouraged to attend Achievement Day. This is an event that wraps up the Club's 4-H year and a celebration of member success.

4-H LEADER POLICIES

To learn more about what being a 4-H leader please take a look at the [4-H in Canada Volunteer Leader Guide](https://bit.ly/3oldUaE) (<https://bit.ly/3oldUaE>). Of special importance are pages 46 through 51 which covers our Youth Safety and Risk Management Policy, and Code of Conduct.

Rule of Two: There must always be a least **one trained leader** present, plus at least **one other screened volunteer**, who are not spouses, at any 4-H gathering (including project meetings).

You can find the **Youth Safety at 4-H in Canada Policy Manual & FAQs**, and **Youth Safety Reporting System** (i.e. Activity Plan and Incident Report forms) on the [Youth Safety at 4-H in Canada](https://4-h-canada.ca/youth-safety) page (<https://4-h-canada.ca/youth-safety>).

If you need guidance in completing your 4-H leader screening, understanding our policies, or at any point while leading a 4-H project, do not hesitate to reach out to your regional 4-H Specialist.

You can find their contact information on our website's Contact Us page: <https://www.pei4h.ca/contact-us>



Helpful Resources!

<https://projects.upei.ca/astronomy/getting-started-in-astronomy/>

<https://skyandtelescope.org/astronomy-equipment/binoculars-for-astronomy/>

<https://earthsky.org/human-world/top-tips-for-using-ordinary-binoculars-for-stargazing/>

<https://www.youtube.com/c/crashcoursekids/videos>

<https://earthsky.org/human-world/top-tips-for-using-ordinary-binoculars-for-stargazing/>

<https://www.constellation-guide.com/constellation-map/zodiac-constellations/>

Remember...

The multiple intelligence theory teaches us that people learn in at least 8 different ways. All individuals will be stronger in some ways of "intelligence" and weaker in others. It follows that the more ways we teach, the more members we will reach. Teaching projects using a broad blend of writing, reading, hands on work, artwork, self evaluation, discussion, and so on, will help increase the learning potential of all members.

Projects are designed to teach many skills. However, the 4-H member is always more important than the subject matter. Stress cooperation in the activities where possible to develop teamwork and cooperation skills. These are valuable skills that will assist them in a number of settings. Ensure the work is completed in a manner that members feel good about themselves and their efforts. This can be done by assigning appropriate tasks or roles based on member's individual abilities. Modeling and expecting supportive behaviour (i.e. no "put-downs") amongst members, or by other adults, also contributes to a positive experience.



IMPORTANT NOTES FOR LEADERS!

This astronomy project requires members to navigate the night sky using their eyes, binoculars and Astronomy apps on a device. **The project meetings will need to take place in the evenings when it is dark and on a CLEAR nights, with no cloud cover.**

For Activity 2: It is recommended that members observe the moon during 1st or 3rd Quarter moons. See this website for accurate moon phases: www.timeanddate.com/moon/phases/

Attached to this leader guide are Star Finders, Phases of the Moon observation sheets, and log sheets for constellations, planets and stars.

For all activities, the YouTube videos that are listed may not be accessible at the time you are offering this project. If this occurs, please use the title of the video to find the correct video.

PROJECT ACTIVITIES

Activity 1 - Members will learn about the Earth's rotation, revolution and tilt and how these affect time and seasons. Members will learn how to navigate the night sky using 3 easy tools: Star Finder, Binoculars and Astronomy Apps downloaded onto a device.

Activity 2 - Members will learn about the moon, the phases of the moon, and how to observe the moon in the night sky. Members will learn about the Solar System and how to observe planets in the night sky.

Activity 3 - Members will learn about constellations and how to find and observe certain constellations in the night sky.

Activity 4 – Members will learn about stars and how to find and observe certain stars in the night sky.

Activity 5 – Members will visit the telescope at UPEI on a very CLEAR evening to learn the basics of how to use a telescope and observe certain planets, stars or constellations in the night sky.

Activity 6 – Members can use this meeting to complete achievement day requirements such as Astronomy Log Book, Phases of the Moon observation Chart and Constellation Shadow Box.

THE PROJECT LEADER'S PLAN

After reviewing the Project Completion Requirements list on the front of this guide, review the Project Activity Ideas page/s. You can also pull ideas from past experiences, books, social media, online, or you can plan to join a tour, attend an event, or book a guest speaker. The sky is the limit! It might be a good idea to ask the 4-H members in your project group what they envision before making a concrete plan. In some cases, the project group members may depict what activities or topics based on what project item they have in mind.

Topics and Activities:

1. _____

Supplies needed:

_____	_____
_____	_____
_____	_____

2. _____

Supplies needed:

_____	_____
_____	_____
_____	_____

3. _____

Supplies needed:

_____	_____
_____	_____
_____	_____

4. _____

Supplies needed:

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5. _____

Supplies needed:

_____	_____
_____	_____
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NOTES: _____

ACTIVITY 1

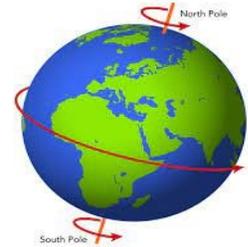
Earth's Rotation and Revolution – Seasons and Time!

In this activity, members will:

- Learn how the earth's rotation, revolution and tilt affect why the sun rises and sets, why there are 365 days in a year and why we have seasons.
- Complete the Earth's Rotation and Revolution experiment that is explained in the YouTube video (Earth's Rotation and Revolution: Crash Course Kids 8.1).
- Learn how to find North, South, East, and West to help with navigating the night sky.
- Learn how to use a Star Finder, binoculars and an Astronomy App downloaded onto their device as these 3 tools will be used in this project to navigate the night sky.

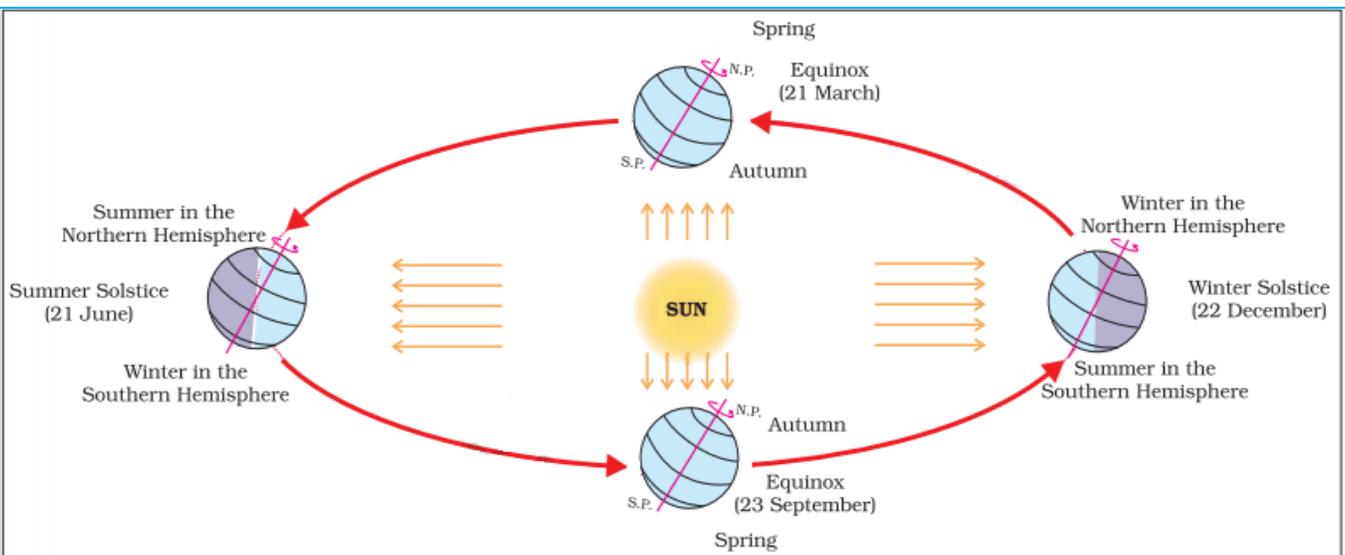
ACTIVITY 1A

Why does the sun rise and set? The answer is that the Earth is rotating. The Earth completes one rotation in 24 hours so during that time, one half of the Earth will be daytime and the other half will be night time. The Earth is rotating on an imaginary axis that runs through the North Pole and out the South Pole and is tilted by 23.5 degrees with respect to Earth's orbit. As the Earth rotates on its axis, the sun appears to move across the sky from sunrise to sunset. In reality it is just the Earth that is rotating which makes the sun appear to move across the sky.



Why are there 365 days in a year? The answer is the earth is actually moving in more ways than one. At the same time that the Earth spins on its axis, it also orbits around the Sun. This movement is called its revolution. One full orbit all the way around the Sun is one revolution and the earth takes 365 days, or one year, to complete a revolution.

Why do we have seasons? The answer is the earth is not sitting straight up or down, it is actually tilted. This tilt causes one part of the earth to lean towards the Sun, while the other part of earth is leaning away. This means that different parts of our planet surface gets different amounts of sunlight and heat. At certain times of the year, the northern hemisphere leans towards the Sun and the southern hemisphere leans away, and at other times the southern hemisphere leans towards the Sun and the northern hemisphere leans away. That is what makes seasons. When the Northern hemisphere (where we live in PEI) is leaning towards the Sun, it is warm and the days are long – this is summer. When the northern hemisphere is leaning away from the Sun, it is cold and the days are short – this is winter. And in-between, there is spring or autumn. If the earth was not tilted we would have the same season all year long. Imagine a year of winter!



ACTIVITY 1B

EXPERIMENT: On the Earth's Rotation and Revolution

Materials needed are:

- ⇒ Globe
- ⇒ Table lamp without a shade,
- ⇒ Table



Watch this video to learn about the earth's rotation and allow each member to have a turn with the experiment > <https://www.youtube.com/watch?v=l64YwNl1wr0> (Earth's Rotation and Revolution: Crash Course Kids 8.1).

Fun facts:

At the equator (the imaginary line that splits the Earth in half), there is always a high concentration of light throughout the entire year, so it generally remains quite hot.

**What countries are located on or close to the equator?
What is their weather? Do they have seasons?**

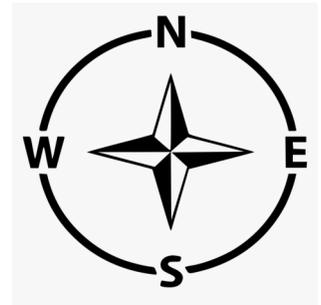
At the North and South Poles, there is always a low concentration of light throughout the entire year, so it always remains very cold.

What countries are located close to the North and South Pole? What happens to sun rise and sun set at the North Pole and South Pole?

ACTIVITY 1C

Finding North, South, East and West

In order to navigate the night sky, members need to be able to determine how to find North, South, East and West. Of course, a compass is the most common way to find these directions, but most people do not have a compass on hand. For this project, members will learn the 3 ways listed below to help with finding directions when looking into the night sky.



1. **Use the Sun** – The sun always rises approximately in the East and always sets approximately in the West. At noon local time, the sun is at its highest altitude in the sky for the day. How large its altitude is on any day will depend on the season and the location's latitude (how far it is from the equator).
2. **Use the North Star at Night** – The most accurate and reliable direction finder is right over your head. It is the North Star, or Polaris. If you can find the North Star, you will know where North is. If you can find the Big Dipper, the bowl of the Big Dipper can be used to find the North Star.
3. **Use a Mobile App** – For example, on an iPhone, the App called "Compass" is a great way to locate directions. **Note**** Before relying only a mobile App, check to make sure the App is working correctly by standing in a direction you know for certain.

ACTIVITY 1D

Learn to use a Star Finder, binoculars and an Astronomy App to navigate the night sky!

Using a Star Finder: On the webpage for this project you will find star finders to download and print. Member can cut out the two pieces of the Star Finder. Watch either of these videos to learn how to assemble your Star Finder and how to use it to navigate the night sky. If you are unable to find these videos, search “How to use a star finder”.

How to use a Star Finder – Discover the Universe: <https://www.youtube.com/watch?v=BgqICmDIT9c&t=4s>

How to use a Star Finder – RASC Halifax: <https://www.youtube.com/watch?v=6Z2dmnTWuwU>

On the disk of the star finder, you have 365 days of the year. If you look even more closely inside the disc you see there's a whole bunch of constellations. The thicker, bigger names label the constellations and the smaller names, in the smaller print, label individual stars. The shaded area in the middle is the Milky Way and the circular path represents the path of the planets.

The second part is your holder. If you look closely at it, it has times represented up from 7 p.m. to 5 a.m. indicating where the stars will be rising and setting in the night sky. You also have your horizon labeled north, south, east, and west which is all around the little window. When you put in the disc into the holder you have completed your Star Finder and you are almost ready to use.

Using Binoculars:

It is recommended for beginners to use binoculars first, rather than a telescope when learning to navigate the night sky. It is recommended to use a pair of 7x35 or 7x50 binoculars. 7 is the magnification and 35/50 is the diameter of objective or lens. Magnification of 7 is perfect as you can see 7 times more than your eyes can see in the night sky.



Other tips when using binocular includes :

- ⇒ Using smaller binoculars as they are lighter to hold and will not jitter or shake.
- ⇒ Using binoculars allows for a much wider view of the night sky than a telescope.
- ⇒ When using binoculars, everything is right side up and presented correctly.
- ⇒ Avoid using zoom binoculars as they are more complicated to use.
- ⇒ When using binoculars in standing, lean against something such as a car or a tree to keep the images steadier. Or if sitting down, use a lawn chair that will support your back.
- ⇒ The best way to use binocular is laying on the ground on a blanket!

Astronomy Apps:

If members have a Smartphone, iPod, iPad, tablet or similar device, there are some powerful apps that are very useful for navigating around the sky. In fact, most of the apps will track your location and if you hold your phone up to any direction in the sky, it will show you what constellation you are looking at or what planets or other objects are up in the sky. Also, many of the apps will overlay the mythological image overtop of the pattern you will see in the sky. This is a great way to quickly and efficiently learn where the constellations are located and to learn their mythology.

Members can choose an App to download onto their Apple or Android product. Apps are not suggested here as many of them change over time. Make sure the App has 4 star reviews or better and test the App with something that is known. For example, if the member can identify the Ursa Major constellation with their eyes, check to make sure the App can identify the same one.

ACTIVITY 2

Phases of the Moon and the Solar System

In this activity, members will:

- A. Learn about the moon and the phases of the moon by reviewing the information and watching the YouTube video.
- B. Complete the “Phases of the Moon Experiment” that is demonstrated in the YouTube Video.
- C. Use binoculars to observe the moon during “first or third quarter moons”, focusing on observing the “Maries and highlands”. Members can review the chart of each phase of the moon on page 13.
- D. Learn about the solar system by reviewing the information and watching YouTube video.
- E. Use their Mobile App and binoculars to find 2 or 3 planets, depending on the season. Members may be able to find the planets Jupiter, Saturn, Mars or Venus and are to sketch each of these planets in the Astronomy Log Book.
- F. Review the Achievement Day requirements for Activity 2.

IMPORTANT NOTE: *It is recommended that members observe the moon during 1st or 3rd Quarter moons. See this website for accurate moon phases: www.timeanddate.com/moon/phases/*

ACTIVITY 2A

The Moon:

The moon is the brightest object in the night sky. The moon is about 384 thousand kilometers away and you would have to travel all the way around the Earth nine and a half times to go the same distance as the space between the Earth and the Moon. The moon is much smaller than the Earth and if the Earth was hollow, about fifty moons could fit inside. Although we can see it shining brightly at night, the moon does not have any light of its own. Instead, the light of the moon is reflected light from the sun that bounces off of the rocky, dusty surface of the moon so we can see it from Earth.

On July 20, 1969, the astronauts of America's Apollo 11 mission landed on the moon for the first time. On July 21, Neil Armstrong became the first person to step upon the moon's surface. The moon has no atmosphere, which means there is no air to breathe. The moon also has extreme temperatures - boiling hot in the sun and freezing cold in the shadows. For this reason, astronauts need special suits and equipment to protect them on the moon, to keep them the right temperature and allow them to breathe. No one has visited the moon for more than 40 years, but the footprints made by the astronauts who walked on its surface are still there. This is because there is no wind or water on the moon to wash the footprints away. Unless a meteorite hits the moon and smashes them, those footprints might last for hundreds or even thousands of years.



Phases of the Moon:

Just like the Earth, half of the moon is always lit by sunlight and the other half is in shadow. As the moon orbits the Earth, we see a different phase of the moon. It takes about 29.5 days for the moon to orbit the Earth so we see the moon go through all eight phases within a month. That is actually where the idea of months came from - the time it takes for the moon to complete one orbit around the Earth - and the words 'moon' and 'month' come from the same root.

[Review the “Phases of the Moon Chart” on page 12 with members after watching video.](#)



Watch this YouTube Video for more detail.

Phases of the Moon: Astronomy and Space for Kids

<https://www.youtube.com/watch?v=f4ZHdzl6ZWg>

ACTIVITY 2B

EXPERIMENT: Phases of the Moon:

Materials needed are: lamp, foam ball, pencil, and dark room



Watch this video and allow each member to have a turn with the experiment. Moon Phases Demonstration:

<https://www.youtube.com/watch?v=wz01pTvuMa0>

ACTIVITY 2C

Observing the Moon:

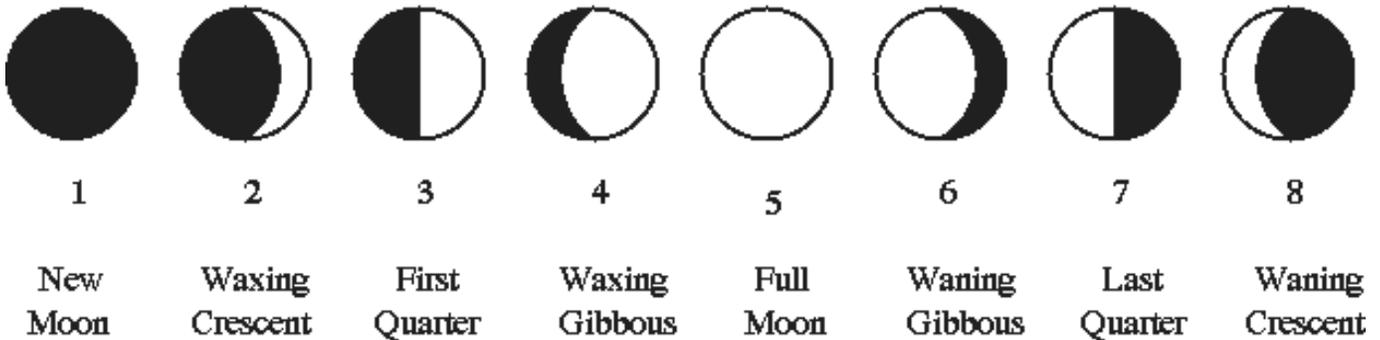
The best times to observe the moon are during First and Third Quarter moons. During these phases you can see a lot more detail on the surface of the moon because the sunlight is hitting the moon from the side, causing shadows to be cast by the mountains and craters. The Full moon is the worst time for viewing the moon as it is too bright.

When observing the moon with binoculars:

- Focus along the “terminator line” on the moon which is the line between light and dark, where features will cast long shadows that make them clearer.
- Look for maria (mare is singular) which are the flat, dark blotches on the moon. Maria are the largest topographic features on the Moon and can be seen from Earth with just your eyes. Together with the bright lunar highlands, they form the face of the “man in the moon.”
- Look for the lunar highlands, found between the maria. These are the lighter areas on the moon, and at times, you can see large craters on the moon.



PHASES OF THE MOON CHART



New Moon: The beginning phase of the lunar cycle when the moon is completely dark because the unlit side is facing the Earth. New moon is the only time in the lunar cycle when a solar eclipse could happen, because it is the only time that the moon is between the sun and the Earth.

Waxing Crescent Moon: After a few days, once the moon has moved along a little in its orbit, you will see a thin slice of light called a crescent. It is called 'waxing crescent,' because 'waxing' means 'growing.'

First Quarter moon: Is sometimes called the half-moon because it appears to us that half of the moon is lit up, but it is called 'first quarter' because the moon is one-quarter of the way through its cycle.

Waxing Gibbous moon: As the days pass, you will see more of the moon's surface as it enters the waxing gibbous. Gibbous means 'humped' or 'swollen,' and it is called waxing because it grows thicker.

Full moon: The biggest, brightest, and easiest phase of the moon to see. The moon is halfway through its orbit around the Earth, and is now on the opposite side of the Earth from the sun. The only time a lunar eclipse can happen is during a full moon because that is when the moon moves into the Earth's shadow.

Waning Gibbous: As the moon continues in its orbit, you will see less of the moon's surface, but this time it is called a waning gibbous. 'Waning' means shrinking, or getting smaller.

Third Quarter: The next phase is called 'third quarter' or sometimes 'last' or 'final' quarter because the moon is three-quarters of the way through its orbit.

Waning Crescent: As the moon reaches its final phase, you will see a thin slice again, and the moon will continue to shrink until it vanishes completely into the next new moon.

ACTIVITY 2D

Solar System:

Our planetary system is located in the Milky Way galaxy. Our solar system consists of our star, the Sun, and everything bound to it by gravity – the 8 planets Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, and Neptune; dwarf planets such as Pluto; dozens of moons; and millions of asteroids, comets, and meteoroids. Beyond our own solar system, we have discovered thousands of planetary systems orbiting other stars in the Milky Way.

What makes a planet?

A planet has to orbit the sun; has sufficient mass to be round, or nearly round; is not a satellite (moon) of another object; and has removed debris and small objects from the area around its orbit.

The Sun:

The Sun is a 4.5 billion-year-old yellow dwarf star and is a hot glowing ball of hydrogen and helium. The sun is the center of the solar system and what holds the solar system together. Its massive gravity is what keeps the earth and all the other planets circling around it instead of drifting off into space. The sun is responsible for providing light in the solar system. If it was not for the sun, there would be no plant-life as we know it on Earth. The Sun is the closest star to Earth and is about eight light minutes away or 93 million miles away, that's why it looks so small. Even though the sun is a midsized star, it is unimaginably huge. You could fit about 109 Earths side by side within the sun.



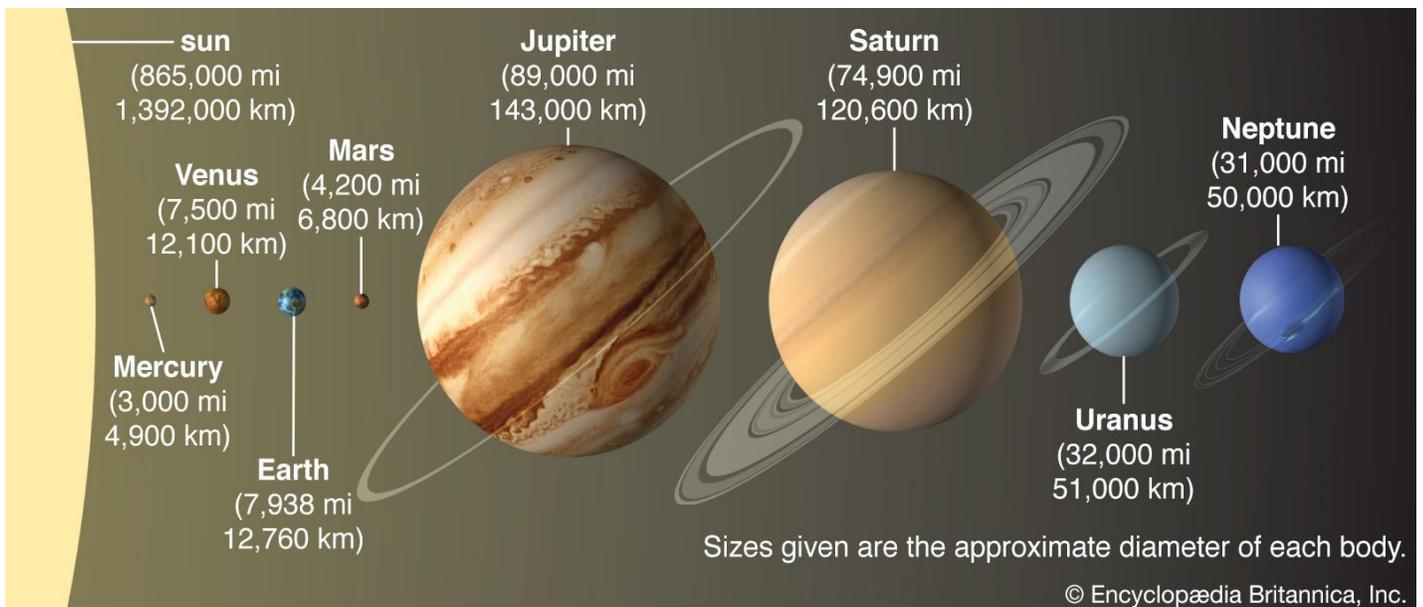
Watch this YouTube video to learn more about the Solar System.

Solar System 101: National Geographic

<https://www.youtube.com/watch?v=libKVRa01L8>

The Planets:

The four inner planets are considered “rocky planets” because they contain relatively dense, rocky material with relatively little atmosphere. The four outer planets are considered “gas giants” because they are primarily made of gases like hydrogen and helium and they are much larger than the inner four planets.



THE EIGHT PLANETS OF THE SOLAR SYSTEM:



Mercury is the first planet out from the sun and the smallest planet in the solar system, much smaller than earth. Mercury is that it is the fastest planet to go around the sun - it only takes 88 days.



Venus is the second planet from the sun. It is similar in size and gravity to Earth but they are very different on the surface. Venus is the hottest planet in the solar system as well the brightest of all the planets.



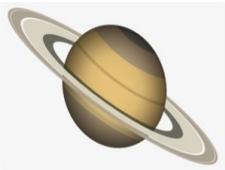
The earth is the third planet from the Sun. The Earth is the only planet that we know of that has living things. It is also the only planet we know of that has such an abundance of liquid water, an element that is required for life to thrive.



Mars is the 4th planet from the sun and known as the “Red Planet” because it appears red when you look at it. The reason that it is red is due to a high abundance of iron in its soil. As of 2022, only [rovers](#) have been on Mars. The farthest humans have been beyond Earth is the Moon.



Jupiter is the 5th planet and is so big that you would have to place 11 earths end to end just to stretch across its middle. Jupiter has at least 67 moons that circle around it. People cannot land on Jupiter because it is made of gas - there is no ground to land on!



Saturn is the 6th planet and because of its rings, is probably the most popular planet Saturn’s rings are made up of a disk of rocky and icy material. Saturn is the second largest planet in solar system.



Uranus is the 7th planet and is the coldest planet in the solar system. It can drop to a temperature of -224 degrees Celsius. Uranus rotates on nearly a 90 degree angle from the plane of orbit, making uranius to appear to spin on its side.



Neptune is the 8th planet and is the farthest planet from the Sun. Due to the fact that Neptune is so far out in space, it takes Neptune over 164 YEARS to finish an Orbit around the sun.

ACTIVITY 2E

Finding Planets in the Night Sky:

Planets will be visible at different times depending on the year and the best way for beginners to observe planets is to use their eyes or binoculars.

1. One way to find out when planets are visible is to use the “EarthSky Tonight Page” on this webpage: <https://earthsky.org/tonight/> This website will help you locate planets visible each night or during a month. On the webpage, notice if any planets are mentioned in the calendar on the Tonight Page, and if so click on that day’s link.
2. A second, less accurate, way to find a planet is to use your Astronomy app to find the planet in the night sky and the App will label which planet you are seeing.

NOTE*REMEMBER TO HAVE MEMBERS DRAW AND LABEL THE PLANETS THEY FIND ON THE LOG SHEETS AT THE BACK OF THIS LEADERS GUIDE.**

Observing the planets with binoculars:

The planets **Jupiter, Saturn, Mars and Venus** are the easiest to find and see in the night sky because they are the brightest.

- ⇒ Mars is the red planet and using binoculars will intensify the color of this object.
- ⇒ Venus is so bright, try looking in twilight instead of true darkness.
- ⇒ Jupiter is a great binocular target. If you hold your binoculars steady as you look at this bright planet, you might be able to see Jupiter's 4 largest moons as points of light on a line on either side of Jupiter.
- ⇒ Saturn - you can use your binoculars to see Saturn’s beautiful golden color.

When finding a planet, remember that planets reflect light and do not generate their own light. With your eye you will notice that planets will twinkle less than stars do. Planets look different than stars in that they look like a small disk rather than a point of light.

ACTIVITY 2F

****ACHIEVEMENT DAY REQUIREMENT****

Phases of the Moon Observation Sheet for Home:

1. Members are asked to pick one month, starting at the beginning of that month.
2. Members are asked to observe the moon each night of the month and record what the moons looks like each night.
3. Members are to fill in the Moon Observation Sheet each night and put this sheet in their Astronomy Log Book. This sheet is an Achievement Day requirement. See sheet at the back of this Leaders’ Guide.

ACTIVITY 3

Constellations

In this activity, members will:

- A. Learn about constellations - circumpolar, seasonal and zodiac and watch YouTube videos on these topics for more information.
- B. Locate 5 circumpolar constellations and locate 5 Seasonal Constellations using the star finder, binoculars and Astronomy Apps. Members will sketch each of these 10 constellations in their Astronomy Log Book and add important information.
- C. Create a “Constellation Shadow box” - instructions are located at the back of this leader guide.

ACTIVITY 3A

Constellations:

Constellations are patterns of stars in the sky connected by imaginary lines and there are 88 recorded constellations. People have used the constellations for thousands of years in navigating the seas, knowing when to plant crops and even to tell time. For many civilizations they hold a mythological significance and the constellations tell a story. In these star patterns people have imagined animals, heroic figures, gods and even monsters. All the constellations are like a map in the sky. Astronomers use the constellations to navigate around the night sky in order to find stars and other interesting objects like galaxies and nebulae.

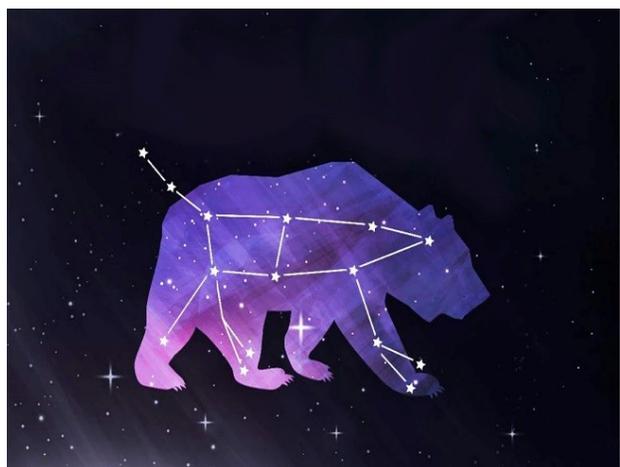
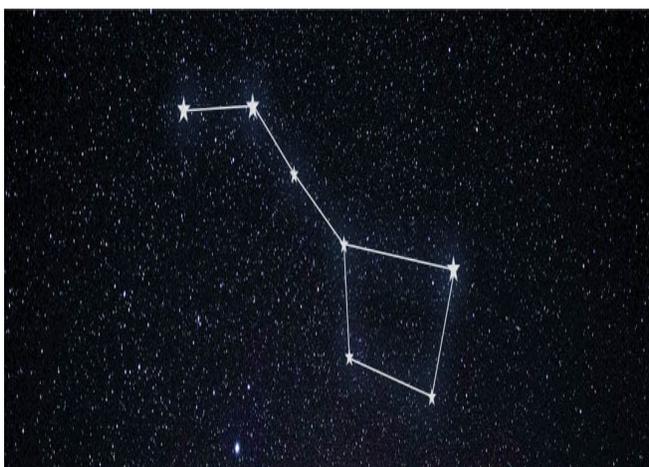


Watch this YouTube video for more information.

Super Stars (Constellations): Crash Course Kids 31.1

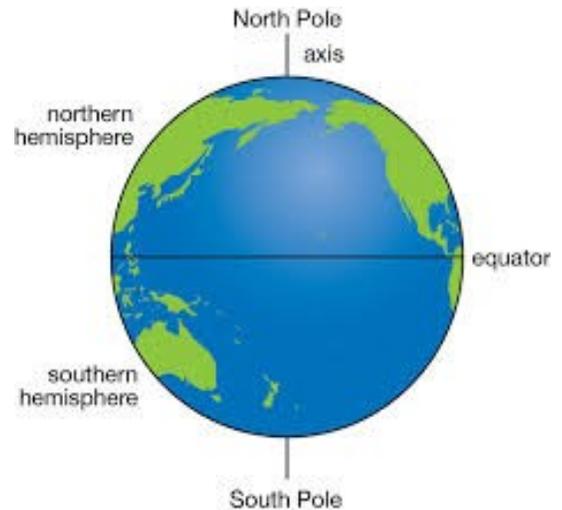
<https://www.youtube.com/watch?v=MZffhapfOgg>

For example, you might recognize the constellation below as the Big Dipper. However, the Big Dipper is actually NOT a constellation, but is known as an “asterism”, just a small portion of the larger constellation of Ursa Major. The Big Dipper portion makes up just the tail and the rear end of the Great Bear, as seen in the following pictures.



Constellations in the Northern Hemisphere:

The imaginary line that splits the Earth in half is called the equator. The equator cuts the Earth into two equal halves called hemispheres. Here in Canada we live in the northern part of the world and so we call this half of the Earth the northern hemisphere. In the northern hemisphere we can see a collection of constellations that are different than the constellations they can see in the southern hemisphere. This is because in the northern hemisphere we are looking out into a different part of space than they are in the southern hemisphere.



Watch this video to learn more:

Constellation Location: Crash Course Kids 32.1

<https://www.youtube.com/watch?v=BbzCA0Lgf3Y>

Seasonal Constellations vs. Circumpolar Constellations:

Seasonal Constellations are visible for part of the year in the northern hemisphere.

VS

Circumpolar constellations are visible in the sky year round for a particular location.

Let's look at an example of seasonal vs. circumpolar constellations using your STAR FINDER. Take your Star Finder and look for the constellation "Orion" on December 2nd at 11 p.m. on PEI, do you see this constellation? If you were to use your Star Finder to look for "Orion" on June 2 at 11pm on PEI, would you see this constellation? Orion would no longer be in that part of the sky since it would have set below the horizon. Orion, like all the constellations, is very slowly creeping across the sky as the Earth orbits the sun. For this reason, Orion is considered to be a seasonal constellation. Orion will set below the horizon in the summer months and it will rise to be visible in the winter months. Ursa Major, on the other hand, is visible year round. You may notice that Ursa Major changes its position in the sky, for example it might flip upside down in the wintertime, but you will never see Ursa Major set below the horizon. For this reason, Ursa Major is called a circumpolar constellation.

Zodiac Constellations:

There are 12 constellations that make up the signs of the zodiac. These constellations fall along the circle that is labelled "Path of the planets" on the star finder and form a pattern in the sky that makes it easier to find them. People are assigned zodiac signs based upon the Sun appearing to be in that constellation during a particular time of the year.



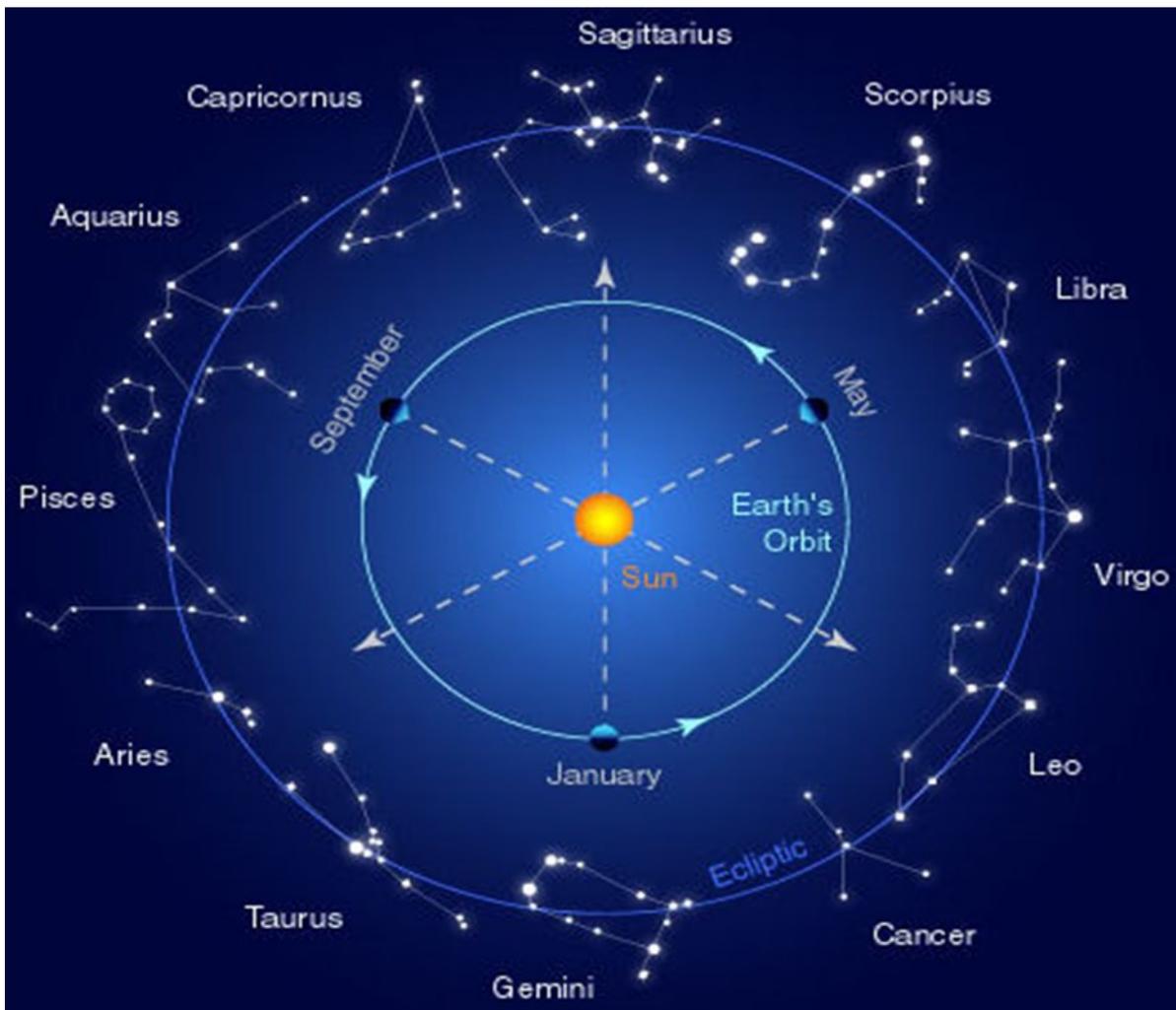
Watch this video: Zodiac Constellations: Crash Course Kids 37.1

<https://www.youtube.com/watch?v=eBIS17Va9sA>

The following chart lists circumpolar constellations, some seasonal constellations in the northern hemisphere and the Zodiac Constellations.

Circumpolar Constellations	Seasonal Constellations	Zodiac Constellations
Ursa Major (Big Dipper) Ursa Minor (Small Dipper) Draco Cepheus Cassiopeia Camelopardalis	Orion Bootes Cancer Leo Virgo Gemini	Aries Taurus Gemini Cancer Leo Virgo Libra, Scorpius Sagittarius Capricornus Aquarius Pisces

Zodiac Constellations in a circular pattern following the path of the planets.



ACTIVITY 3B

Finding Constellations in the Night Sky:

Members are asked to locate these 5 (five) “Circumpolar” constellations using the star finder, Astronomy App or binoculars. Using the Astronomy Log Book, members are to draw what constellations they see and record important information.

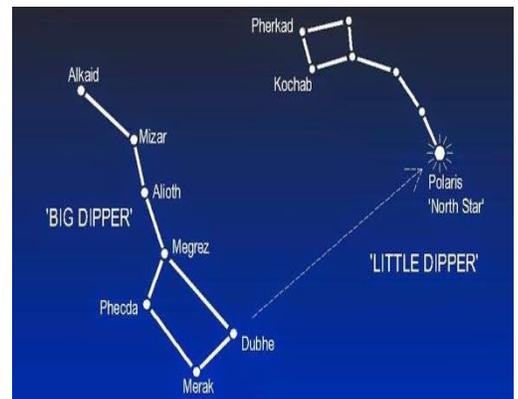
Locate the Big Dipper:

The constellation of Ursa Major, commonly known as the Big Dipper, is perhaps the most easily recognizable constellation in the night sky. It looks like a large spoon or perhaps a wheel barrow. It is composed of seven bright stars - three in the handle and four in the head of the spoon. If you look towards the North in the night sky, you will see this constellation.



Locate the Little Dipper:

Like the Big Dipper, the Little Dipper (Ursa Minor) is composed of seven stars, three in the handle and four in the head of the spoon. The Little Dipper floats above its bigger brother, and is angled as if it were pouring water into the larger spoon. Polaris, the North Star, is the last star in the handle of the Little Dipper.



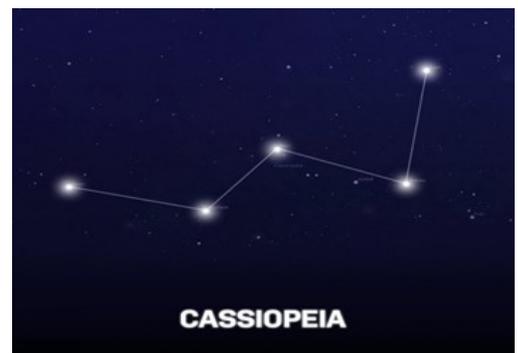
Locate circumpolar constellation Cepheus:

Cepheus is fairly close to the North Star (Polaris). If you can find the North Star then look for a pattern of stars that almost looks like a house (or an upside down house, depending on your orientation). If you find a pattern that looks like a house, that is Cepheus.



Locate the circumpolar constellation Cassiopeia:

Cassiopeia – the Queen- has the shape of a “w” and is right beside Cepheus.



Locate the circumpolar constellation Draco:

To find Draco, locate **the Big Dipper and Polaris**. Halfway between the lip of the cup and the North Star (Polaris) is the very tip of Draco's tail. His body goes between the dippers and circles halfway around the Little Dipper. Then his head turns back on his body.



Members are asked to locate 5 (five) "Seasonal" constellations of their choice (depending on the season) using the star finder, Astronomy App or binoculars. Using the Astronomy Log Book, members are to draw what constellations they see and record important information.

Here are some examples of Seasonal Constellations that are found on the Star Finder:

Orion

Pegasus (the asterism the Great Square of Pegasus)

Auriga

Taurus

Gemini

Bootes

Cancer

Leo

Virgo



ACTIVITY 3C

ACHIEVEMENT DAY REQUIREMENT

Create a "Constellation Shadow Box" with the instructions on next page.

INSTRUCTIONS FOR CONSTELLATION SHADOW BOX:

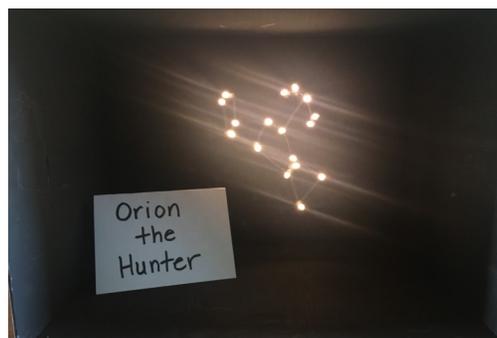
MATERIALS NEEDED:

- Cardboard Box— A strong and sturdy box that needs to be at least 12 inches wide and 10 inches high
- Scissors and Tape
- Black paint and paint brush
- Drill with a drill bit or something sharp to poke holes into cardboard box
- Copy of the Constellation on a piece of paper
- Small battery operated white lights —make sure you have enough lights to match the stars in the constellation you choose (e.g. 10 stars in constellation, need string of 10 lights)
- 4X6 Index card
- White crayon or marker



STEPS FOR COMPLETING SHADOW BOX:

1. Cut any edges or flaps off the cardboard box, making sure the front of the box looks nice and neat.
2. Paint the cardboard box BLACK both inside the box and along all sides to make it look like the night sky.
3. Take the paper copy of the Constellation and tape to the bottom of the box, make sure it is centered and correct direction.
4. Drill holes with the drill or poke holes in the box, following the pattern of the Constellation. Make sure the size of the holes are just slightly bigger than your lights in order for the lights to fit through the holes.
5. Push the lights in the holes, following the Constellation pattern. Attached the battery for the lights to the back of the box with tape and tape down any extra lights.
6. Using the white crayon or marker, connect the lights with lines to create your constellation
7. Using the 4x6 index card, type or neatly print the name of the constellation and information about the constellation.



ACTIVITY 4

Stars

In this activity, members will:

- Learn about the information on stars and watch the YouTube Video to learn more information.
- Locate 5 Stars using the star finder, binoculars and Astronomy Apps. Members will sketch each of the stars in their Astronomy Log Book and add important information.

ACTIVITY 4A

What are Stars?

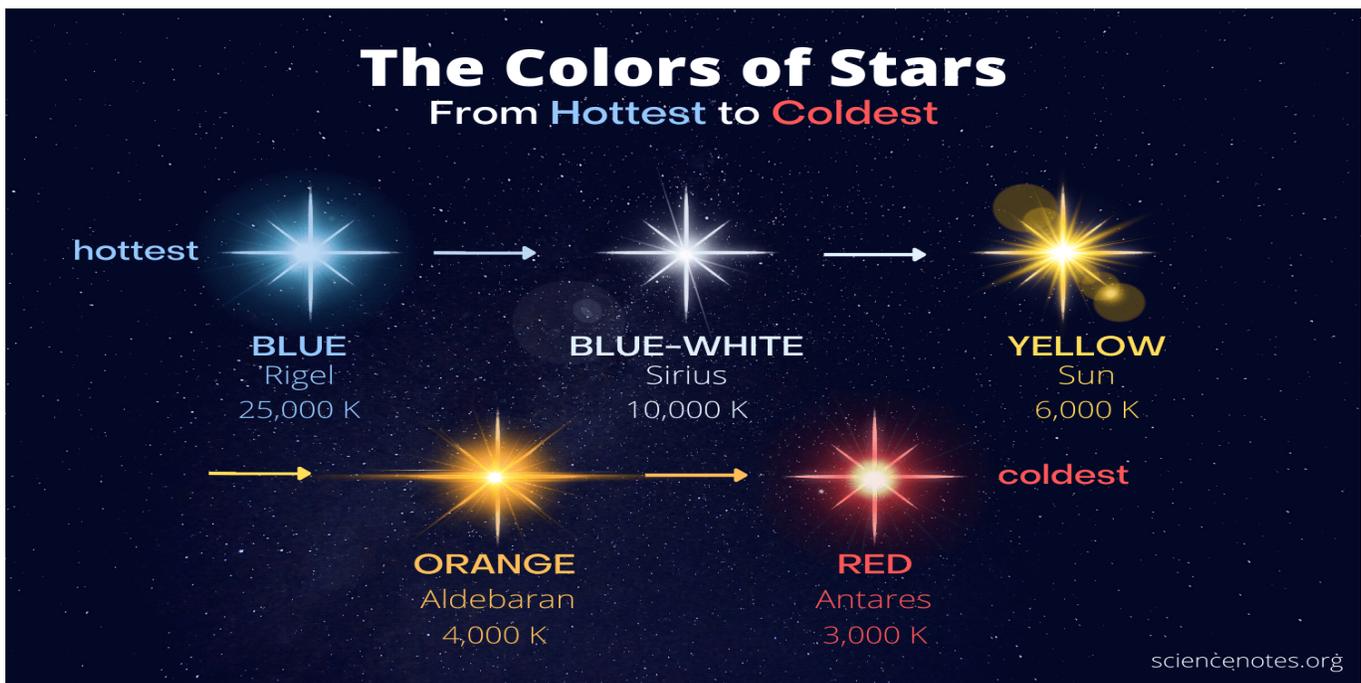
Stars come in all different sizes and colours and the colour of a star depends on its temperature. A blue or white star is burning at a higher temperature than a yellow or red star. A red giant is a star that is near the end of its life and has started to shed its outer layers and cool off. Betelgeuse is a star in the constellation Orion and is an example of a red giant star.



Watch the YouTube video:

Star Personalities: Crash Course Kids 25.2

https://www.youtube.com/watch?v=2PO_jMgmLvs



All stars, no matter colour or size have two things in common: they all give off light and they are all extremely hot. Stars are mostly made up of two elements, hydrogen and helium. At the centre of a star, there is a whole lot of hydrogen that is extremely hot. The centre of the sun is 15 million degrees Celsius! At such extreme temperatures, hydrogen can start to burn and is converted into helium. During this conversion from hydrogen to helium, light is released. The light gradually makes its way from the core of the star to the surface and then is released out into space. The sun is responsible for providing light to the solar system and thus Earth. If it were not for the hydrogen reactions taking place at the centre of the Sun, there would be nothing to provide consistent light and warmth to the Earth.

ACTIVITY 4B

Members are asked to locate 5 Stars using the star finder, binoculars and Astronomy Apps.

Members will sketch each of the stars in their Astronomy Log Book and add important information.

The Astronomy log book page is located at the back of this guide and copies will need to be made.

****NOTE: Locate Bright Stars in the Northern Hemisphere:** Finding certain stars in the sky all depends on the time of year. If a member is unable to find the stars listed below (8 stars), members can use the Star Finder as the really bright stars are listed by name on the star finder.

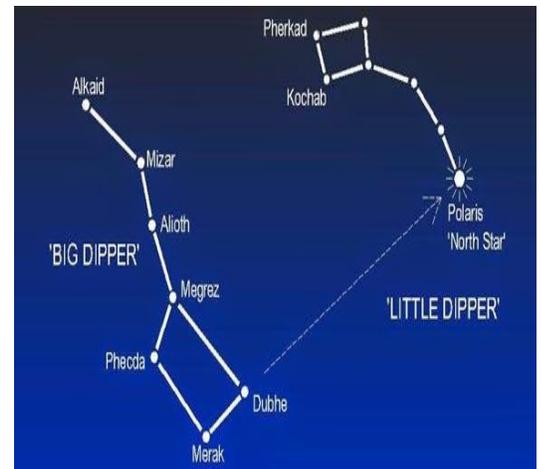
Locate the North Star using the Big Dipper:

Locating Polaris is easy on any clear night. Just find the Big Dipper. The two stars on the end of the Dipper's "cup" point the way to Polaris, and the North Star is part of the little dipper, located at the tip of the handle of the Little Dipper. The North Star will stay in the same spot in the sky all year round so if you find the North Star, you will always know which way is north



Locate Mizar and Alcor using the Big Dipper:

Mizar and its fainter companion star Alcor are one of the most famous double stars in the sky. You'll spot Mizar first, as the middle star of the Big Dipper's handle. Look closely, and you'll see fainter Alcor right next to Mizar. Apart from Alcor, Mizar by itself is a double star. In fact, it was the first double star known. An Italian astronomer brought it to the attention of Galileo Galilei in 1617.



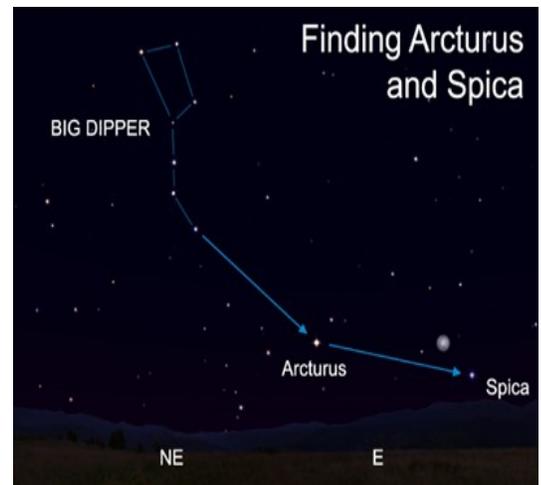
Locate stars Arcturus and Spica using the Big Dipper:

Arcturus and Spica are also two stars found using the Big Dipper.

Arcturus is located in the constellation Bootes and is an orange giant star. To find Arcturus, just remember the phrase "Arc to Arcturus." The arc is referring to the handle of the Big Dipper

Spica, although much dimmer than Arcturus, is the brightest star within the constellation Virgo. To find

spica, just remember the phase "arch to Arcturus, then spike to Spica." The arc is referring to the handle of the Big Dipper. Once you find Arcturus by following the arc, then you just need to keep following that path to find Spica.



Locate Sirius using the constellation Canis Major:

Sirius is the brightest star in the sky and it can be found in January and February. It is part of the constellation Canis Major, the Greater Dog.

Locate Betelgeuse and Rigel using the Constellation Orion:

To find Rigel, find the constellation Orion. You will notice three stars in a short, straight line. These stars mark Orion's Belt. If you look south to Orion's Belt, you will find Rigel, a bright blue star.

To find Betelgeuse, find the constellation Orion. This is an example of a red giant star. When you observe Betelgeuse it will be red in colour.



ACTIVITY 5: Visit the telescope at UPEI

In this activity, members will:

1. Members will visit the UPEI telescope.
2. Member are to use the star finder, using the date and time of the visit to the telescope, to determine what stars, constellations or planets they can locate using the UPEI telescope.
3. Members will sketch each of the objects they find in their Astronomy Log Book and add important information about those objects.

NOTE*** Leader to contact the Physics Department at UPEI to book a visit to the telescope.

<https://projects.upei.ca/astronomy/public-viewings/>

ACTIVITY 6: Complete requirements for achievement day

In this activity, members will:

1. Members will be given time during this project meeting to complete the achievement day requirements listed below:
 - Phases of the Moon Observation Sheet
 - Astronomy Log Book should have sketches and labels for:
 - 2-3 planets
 - 5 Circumpolar constellations
 - 5 Seasonal constellations
 - 5 Stars
 - Constellation Shadow Box (also exhibition requirement)

NOTE*** *If members were not able to locate planets, constellations or stars due to a missed meeting or cloudy evenings, members can complete these parts of the project during this meeting.*

PLANET LOG SHEET

Sketch Planet Observed:	Date: Time: Location: Name of Planet: Information about Planet:
Sketch Planet Observed:	Date: Time: Location: Name of Planet: Information about Planet:
Sketch Planet Observed:	Date: Time: Location: Name of Planet: Information about Planet:

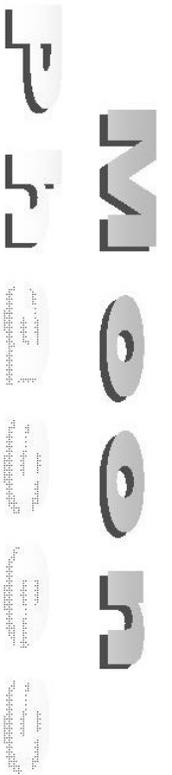
CONSTELLATION LOG SHEET

Sketch Constellation Observed:	Date: Time: Location: Name of Constellation: Information about Constellation:
Sketch Constellation Observed:	Date: Time: Location: Name of Constellation: Information about Constellation:
Sketch Constellation Observed:	Date: Time: Location: Name of Constellation: Information about Constellation:

STAR LOG SHEET

Sketch Star Observed:	Date: Time: Location: Name of Star: Information about Star:
Sketch Star Observed:	Date: Time: Location: Name of Star: Information about Star:
Sketch Star Observed:	Date: Time: Location: Name of Star: Information about Star:

Appendix B - Moon Phases



New Moon - The Moon's unilluminated side is facing the Earth. The Moon is not visible (except during a solar eclipse).

Waxing Crescent - The Moon appears to be partly but less than one-half illuminated by direct sunlight. The fraction of the Moon's disk that is illuminated is increasing.

First Quarter - One-half of the Moon appears to be illuminated by direct sunlight. The fraction of the Moon's disk that is illuminated is increasing.

Waxing Gibbous - The Moon appears to be more than one-half but not fully illuminated by direct sunlight. The fraction of the Moon's disk that is illuminated is increasing.

Full Moon - The Moon's illuminated side is facing the Earth. The Moon appears to be completely illuminated by direct sunlight.

Waning Gibbous - The Moon appears to be more than one-half but not fully illuminated by direct sunlight. The fraction of the Moon's disk that is illuminated is decreasing.

Last Quarter - One-half of the Moon appears to be illuminated by direct sunlight. The fraction of the Moon's disk that is illuminated is decreasing.

Waning Crescent - The Moon appears to be partly but less than one-half illuminated by direct sunlight. The fraction of the Moon's disk that is illuminated is decreasing.



Moon Phases Calendar

NAME: _____

Number the days of the month. For each day, observe the moon, then draw its phase.

Sun	Mon	Tue	Wed	Thu	Fri	Sat
