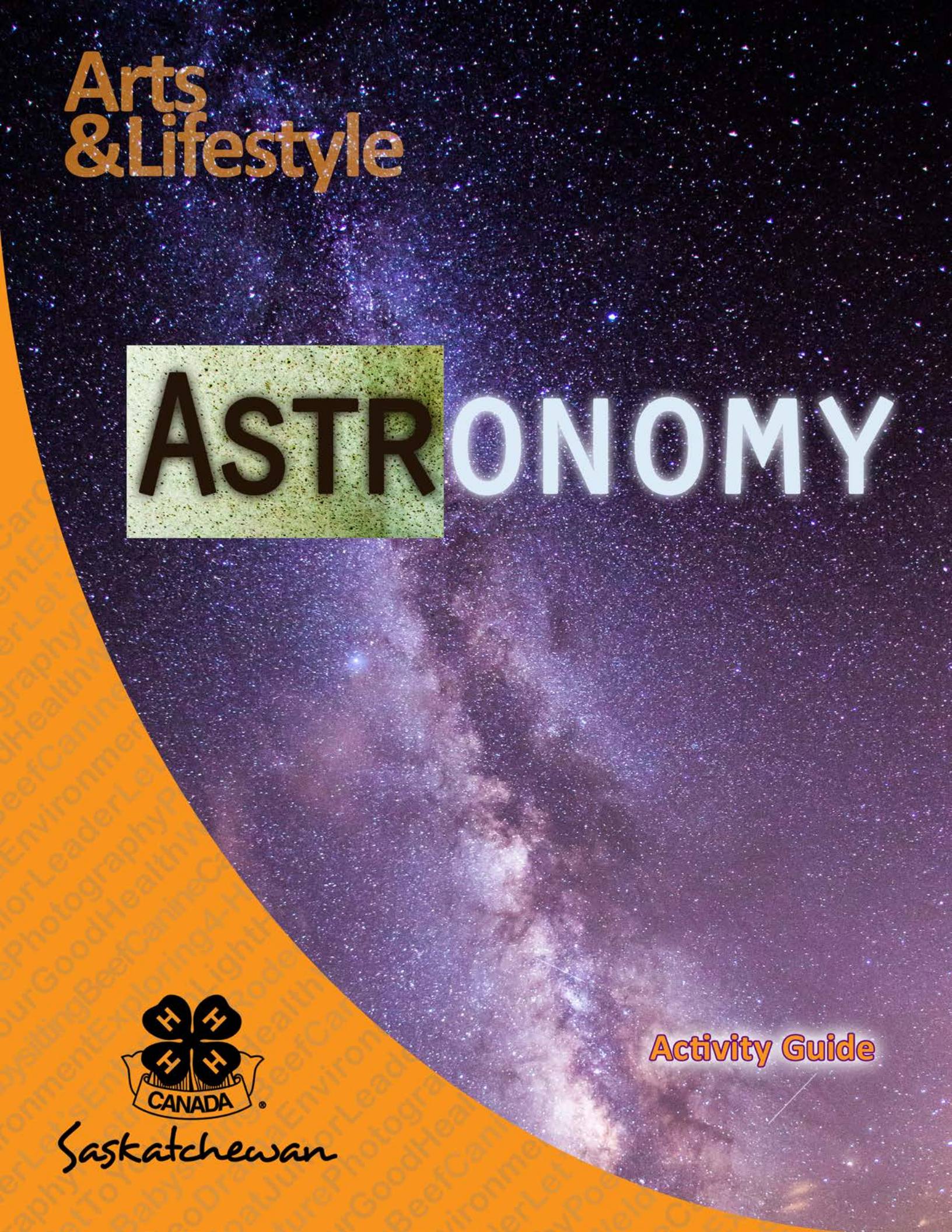
Arts &Lifestyle

# ASTRONOMY



Activity Guide

4-H CANADA

Saskatchewan

## 4-H MOTTO

Learn to do by doing.

## 4-H PLEDGE

I pledge
My HEAD to clearer thinking,
My HEART to greater loyalty,
My HANDS to larger service,
My HEALTH to better living,
For my club, my community and my country.

## 4-H GRACE

(Tune of Auld Lang Syne)

We thank thee, Lord, for blessings great
On this, our own fair land.
Teach us to serve thee joyfully,
With head, heart, health and hand.

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**Writer: Paul Lehmkuhl**

Agriculture and Agri-Food Canada
Agriculture et Agroalimentaire Canada
AGRICULTURE COUNCIL OF SASKATCHEWAN INC.

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# Activity 1 Set Project Goals

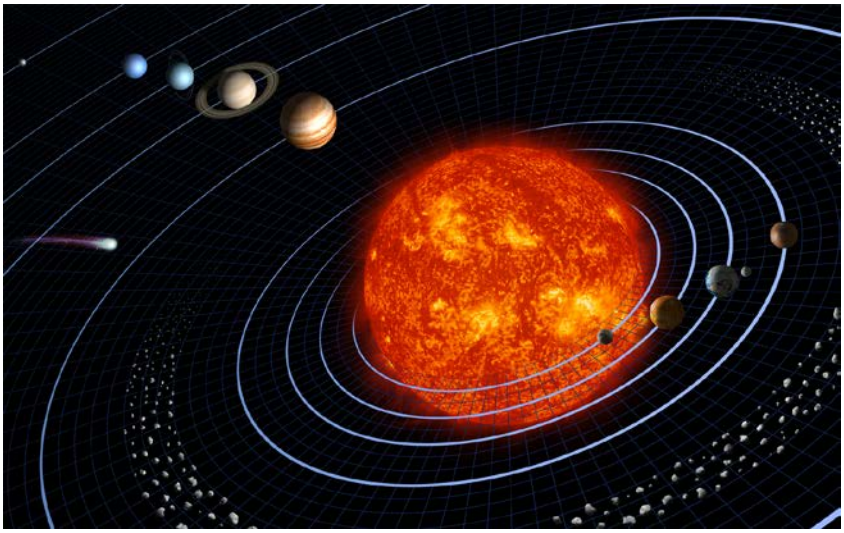
**Objective**: To set your goals for this astronomy project

**Materials**: Record Book, your thoughts on what you would like to learn about astronomy, some paper and a pen or pencil

**Background**: It is important to consider your goals and think about what you want to learn as you work through this project. Listed below are some of the possible goals for the astronomy Project. Consider what you are most interested in or what you would like to learn as you work through this project:

- Basic understanding of how to use a telescope
- Understand what it means to be an astronomer
- Understand the differences between astronomy and astrology
- Understand how to locate the North Star
- Understand the difference between circumpolar and seasonal constellations
- Understand moon phases
- Be able to navigate through the night sky
- Be able to locate some common stars in the night sky
- Understand what a deep sky object is and how to locate at least three
- Visit an observatory and/or connect with an astronomy expert
- Any other goals that you may have…

**Instructions**: In your record book, fill in the section on setting your project goals.



# Activity 2 Discussion: Visit an Observatory Near You or Participate in a Star Party and Summarize/Reflect

**Objective**: Visit an observatory within your community or partake in a star party.

**Materials**: Access to an observatory near you or a star party, a family member or guardian that will accompany you on your trip, pen/pencil, notepad

**Background**: Many larger centres in the county have observatories that are open to the public, usually free of charge. Also, many communities have astronomy clubs, often run through the RASC that hold star parties. This activity is aimed at having you visit an observatory or participate in a star party.

**Instructions**:

1. Talk to an adult and ask around to see if there is an observatory near you, or if there are any upcoming star parties.
2. Ask a family member or guardian to accompany you.
3. Record your thoughts in a notepad (refer to the discussion questions below).

*Campus Observatory,*
*University of Saskatchewan (Saskatoon),*
*courtesy of Jeff Swick*

**Discussion:**

- Did you visit an observatory or participate in a star party?

- What did you observe while you were there?

- What did you learn?

- What did you find interesting?

- What did you find challenging about this activity?

*Public summer star parties, courtesy of Jeff Swick - Cypress Hills (left) and Sleaford Observatory (right)*

# Activity 3 Discussion: Talk to an Expert

**Objective**: Talk to someone about astronomy and learn three new facts.

**Materials**: Someone to talk to about astronomy, your questions, pen or pencil and paper

**Background**: A lot of information that we acquire comes through learning from other people. This exercise is aimed at having you find somebody to question about a topic that you are interested in related to astronomy. The person you find can be anyone, a parent or other family member, family friend, teacher, club leader; just make sure they have some knowledge related to astronomy to share with you.

**Instructions:**

1. Write down some questions that you want to ask before you meet with your expert.
2. Have a conversation with your chosen expert and take notes to summarize what you found out.
3. Refer to the discussion questions below to reflect on your discussion with the expert.

**Discussion:**

- Who did you find to talk to?
- What did you ask or discuss with the expert?
- What did you find out?
- What did you find interesting about this activity? What did you find challenging about this activity?

*Images courtesy of Jeff Swick*

## Activity 4

# Discussion: Show a Friend or Family Member an Object or Constellation That They did not Know About

**Objective**: Teach and show someone about an astronomical object in the sky or an astronomical concept that they did not know about before.

**Materials**: Binoculars, a telescope or just your eyes, a friend or family member to take observing, pen/pencil, notepad

**Background**: Part of the joy of astronomy is sharing it with other people. The main reason that astronomy clubs hold star parties is to share their knowledge with the public. This activity is meant for you to share your knowledge with anybody you would like and to teach them something new.

**Instructions:**

1. Refer to the reference book and choose one or more constellations or objects in the sky to show to somebody you know.
2. Take this person out observing to show them the constellation(s) or object(s) that you have chosen.
3. Answer the discussion questions below.

Or

1. Read through the reference book and take note of a topic that you find interesting.
2. Teach this concept to somebody you know. Try to find somebody that has not heard about your chosen topic.
3. Answer the discussion questions below.

**Discussion:**

- What did you show your friend or family member?

- What did they find interesting?

- What did you find fun or interesting about this experience?

- What did you find challenging about this activity?

*Arrow pointing at the red giant star, Betelgeuse, WikiCommons, Hubble ESA, 2009*

## Activity 5

# Research A Famous Astronomer

**Objective**: Pick an astronomer either from history or the present day and find some interesting facts.

**Materials**: Internet, textbooks, experts to talk to or other resources, pen or pencil, paper

**Background**: We wouldn't know as much as we do about the universe if it wasn't for some people that made revolutionary advancements in the subject of astronomy. Below is a list of people in history and from the current day that are primary figures in astronomy and space exploration. This list is by no means comprehensive, but is just a few of the important figures in the subject of astronomy:

- Nicolaus Copernicus
- Galileo Galilei
- Edmund Halley
- Johannes Kepler
- Isaac Newton
- Margaret Burbidge
- Edwin Hubble
- Henrietta Swan Levitt
- Albert Einstein
- Valentina Tereshkova
- Carl Sagan
- Stephen Hawking
- Neil DeGrasse Tyson
- Chris Hadfield

**Instructions**: You may choose an astronomer from the list above or come up with your own. Once you have chosen someone to research, start looking online to understand why they became so well known. Things to consider when you are researching are:

1. When was this person alive?
2. What did this astronomer do?
3. How did they make a difference in our understanding of the universe?

**Discussion:**

- Who did you research?

- Why did you choose to research this person?

- What did you find interesting?

- What did you find challenging about this activity?

## Activity 6

# Research Constellation Mythology

**Objective**: Pick one or more constellations that you are interested in and research its mythology.

**Materials**: Internet, textbooks, experts to talk to or other resources, pen or pencil, paper

**Background**: Constellation mythology is interesting because it tells a story about the night sky. Greek mythology was set on attributing meaning to the stars and often the constellations were there to represent gods, people, monsters or other objects.

**Instructions:**

1. Choose one or more constellation that you are interested in.
2. Research the mythology of your chosen constellation(s) and write down the story.
3. Be sure to make it creative and engaging by drawing pictures, make it colourful, or print out images to reinforce your story.


**Discussion**:

- What constellation(s) did you choose? Why?
- What did you find interesting about this activity?
- What did you find challenging about this activity?

# Activity 7 Research a Day in the Life of an Astronomer

**Objective**: Find out what it is like to be an amateur or professional astronomer.

**Materials**: Internet, textbooks, experts to talk to or other resources, pen or pencil, paper

**Background**: If you have ever considered becoming an astronomer it is a good idea to research what path you will need to take to achieve this goal. Also, it is a good idea to research what the work is like because there are many different directions to go in when you are considering a career in astronomy.

**Instructions**: Consider these two questions while you are researching:

- What types of jobs are there related to astronomy?
- What is the work like?

1. Start researching potential jobs in astronomy that interest you. Do some research online, find some books to read, or ask an expert. You can also refer to your reference book to read about the different career paths that you can take in astronomy.
2. Write down answers to the above questions.
3. Answer the discussion questions below.

**Discussion:**

- What did you find out about pursuing a career in astronomy?

- Do any jobs interest you? Why or why not?

*Jeff Swick (amateur astronomer)*

- Did you find anything else interesting after doing some research?

- What did you find challenging about this activity?

*Chris Hadfield (Canadian Astronaut), Wikipedia, 2001*

# Activity 8 Research: Find a Quality Telescope at a Reasonable Price

**Objective**: To search for and find a quality telescope that has a reasonable price.

**Materials**: Internet, textbooks, experts to talk, reference book, any other resources, pen or pencil, paper

**Background**: If you are considering purchasing a telescope it is a good idea to ensure that it is the best possible quality at the cheapest price. As mentioned in the reference book you should look for a telescope with the most light gathering power rather than magnification. In other words you want to find a telescope with the largest lens diameter. If you are planning to purchase a telescope you can go online or check out your local newspaper. There is also the possibility of borrowing a telescope from a local astronomy club, which is something to consider.

**Instructions:**

1. First consider what you are looking for when you are buying a telescope:
   - Do you want a refracting or reflecting telescope?
   - Do you want to buy a mount with your telescope?
   - Do you plan to look at just planets and the moon or do you want to look at dimmer objects?
   - Do you want to have this telescope for the long term or do you want to upgrade eventually?
   - Do you want the telescope to have a motor for tracking?
   - Would you consider using binoculars instead of a telescope for observing?
   - Think of some other questions that you may have.
2. In the reference book (chapter two) for this project there is a list of websites that you can visit to find a new or used telescope. Go online and visit some websites to see what you can find for the best and cheapest telescope. Also check out your local newspaper classified ads. You may also go online to the RASC website and see if your community has a local astronomy club, that way if you become a member you may choose just to rent their telescopes.
3. Answer the discussion questions below.

**Discussion:**

- What type of telescope do you want to have?

- What do you plan to use your telescope for?

- Would you consider renting from the RASC?

- Did you find this activity useful or interesting?

- What did you find challenging about this activity?

- What do you think about using binoculars in astronomy?

*Celestron Refracting Telescope, WikiCommons, fractal.scatter, 2009*

# Activity 9 Concept: Which of These Objects Reflect Light and Which Generate Light?

**Objective**: Think about some common objects and say if they reflect or generate light.

**Materials**: Random objects that either reflect or generate light, this activity sheet, pen or pencil

**Background**: All objects that you look at in the night sky either reflect light or generate light. For example, the moon and the planets reflect light whereas, the sun and all the stars generate their own light. This activity will get you thinking about everyday objects to tell if they generate or reflect light.

**Instructions**: Think about the objects that are around you right now or, other objects that are in the world. Anything that reflects light needs to have a source. For example, you can see a book because it is reflecting light from a lamp; the lamp is what generates the light. Try to come up with 10 objects that reflect light and 10 that generate light and fill out the following chart:

| Objects that Reflect Light | What is the Source of the Light? | Objects that Generate Light |
|---|---|---|
| Example: A book | Light bulb in the lamp | Street light |
| | | |
| | | |
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**Discussion:**

- What did you find interesting about this activity?

- What did you find challenging about this activity?

*Sunrise, Wikipedia, Jessie Eastland, 2012*

# Activity 10 Concept: Calculating Astronomical Distances

**Objective**: Calculate distances to some common astronomical objects.

**Materials**: This worksheet, calculator, pen or pencil

**Background**: Objects in the universe are so far away that astronomers use light years to show how far away something is. Recall that when you look at an object in outer space you are seeing it as it was back in time. For example, the closest star to us (besides the sun) is Proxima Centauri located 4.2 light years away. So when you look at Proxima Centauri you are seeing it as it was 4.2 years ago since it has taken light that long to reach your eye.

A light year is the distance that light travels in one year. Recall that light travels at 300,000 kilometres per second. There are two parts to this activity. First, we will find out how many kilometers there are in a light year, then we will use this number to find out how many kilometers there are to the nearest star, Proxima Centauri.

**Instructions:**

1. Find the number of kilometres in a light year
    a. We first need to find out how many seconds there are in one year. Fill in the blanks below and multiply these numbers together to get an answer:

    ____ days per year x ____ hours per day x ____ minutes per hour x ____ seconds per minute = _____ seconds per year

    b. To find the number of kilometers in a light-year we need to multiply the number of seconds in a year by the speed of light:

    _____ seconds per year x _____ kilometres per second = _____ kilometres per light year

2. Now let's find the distance to Proxima Centauri in kilometers. From part a) we know that there are _____ kilometres in one light year. Let's multiply this number by the number of light years to Proxima Centauri:

   _____ kilometres per light-year x _____ light years =

   _____ kilometres!

**Discussion:**

- What did you find interesting about this activity?

- What did you find challenging about this activity?

*Proxima Centauri, Wikipedia, ESA/Hubble & NASA, 2013*

# Activity 11 Concept: Magnitude Scale for Brightness

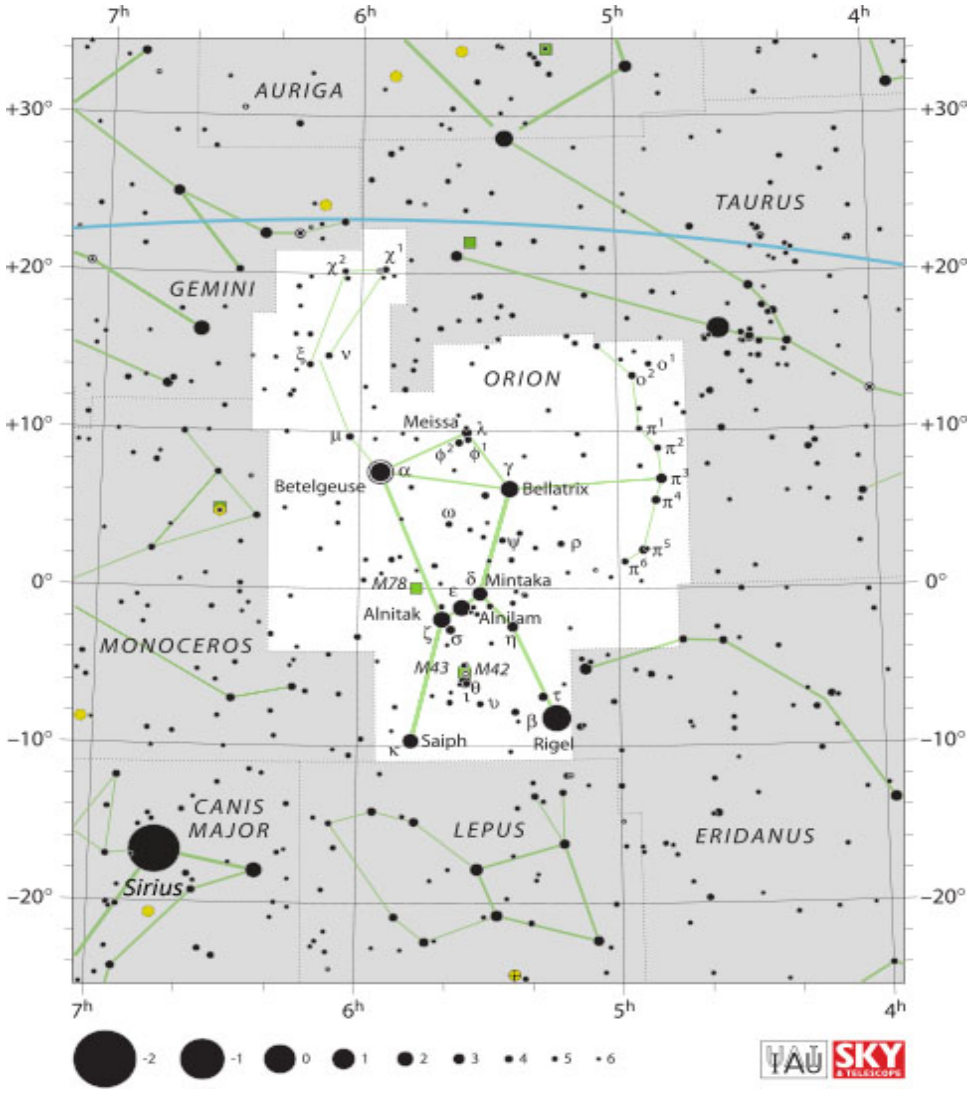
**Objective**: Compare different stars in an image to determine their relative magnitudes.

**Materials**: Star chart (found below), pen or pencil

**Background**: Recall that a star that has a negative magnitude is brighter than a star with a positive magnitude. For example the brightest star in the night sky, Sirius, has a magnitude of -1.5 while the star Spica has a magnitude of +1.0. Sirius is brighter because its magnitude is negative and the magnitude of Spica is positive. Brighter objects in the sky have more negative magnitudes. For example the Sun has a magnitude of -26.7, which is the brightest object in the sky.

**Instructions**: The following is a star chart of the constellation Orion. The stars are different sizes in the image to designate their relative magnitudes. At the bottom of the image is a magnitude scale. Using the scale, try to tell what the magnitude is for the stars that are listed in the table (the first one has been completed):

| Object name | Magnitude |
|---|---|
| Betelgeuse | +0.5 |
| Bellatrix | |
| Rigel | |
| Saiph | |
| Meissa | |
| Alnilam | |
| Sirius | |
| Mintaka | |




*Orion Constellation, Wikipedia, IAU and Sky & Telescope magazine, Roger Sinnott & Rick Fienberg*

**Discussion:**

- What did you learn about the magnitude scale for brightness?

- What did you find interesting about this activity?

- What did you find challenging about this activity?

## Activity 12

# Concept: Making Star Patterns and Constellation Matching

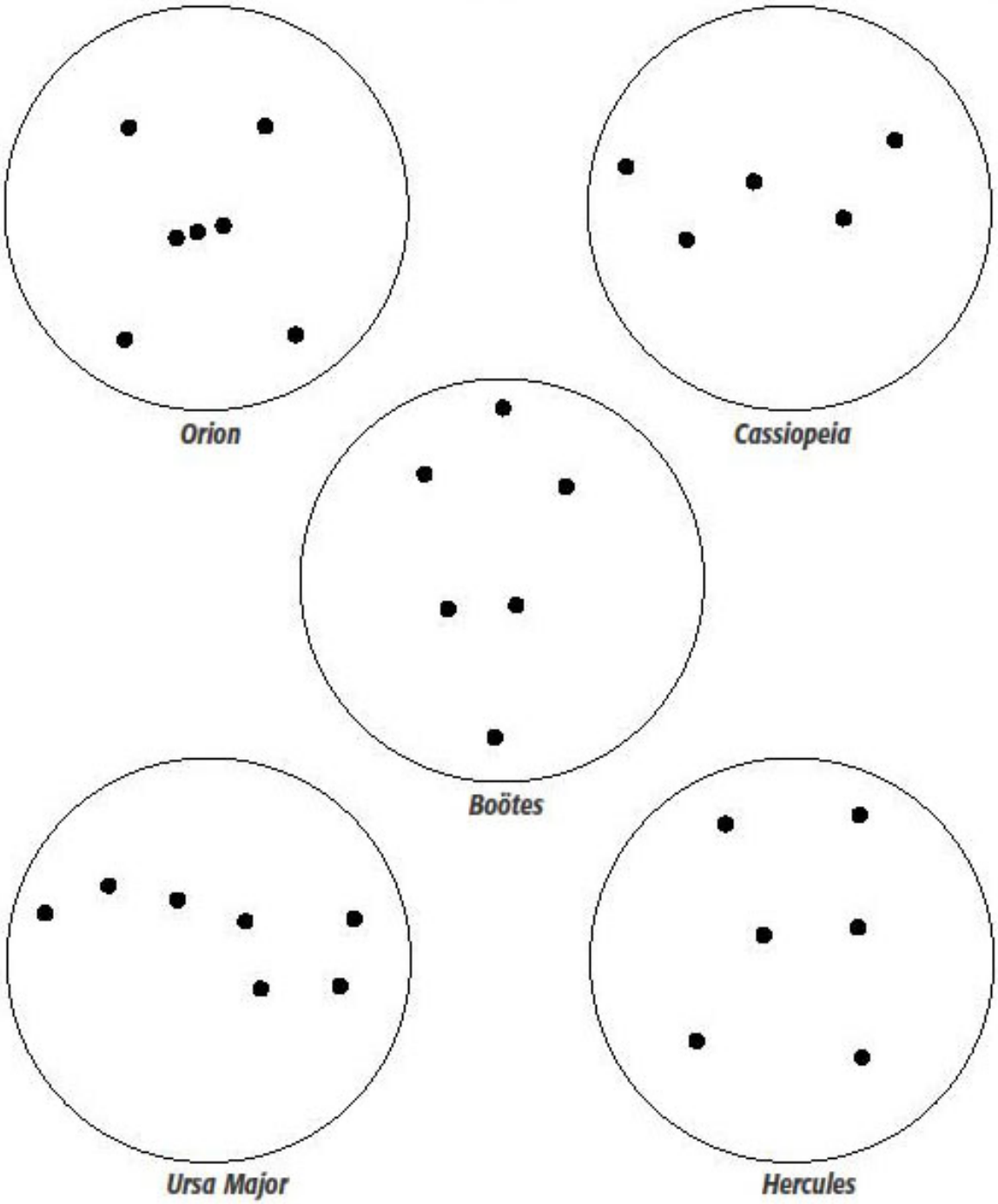
**Objective**: Part one of this activity will have you connect the lines in the star patterns to make some common constellations. Part two will have you match the constellation name with the pattern.

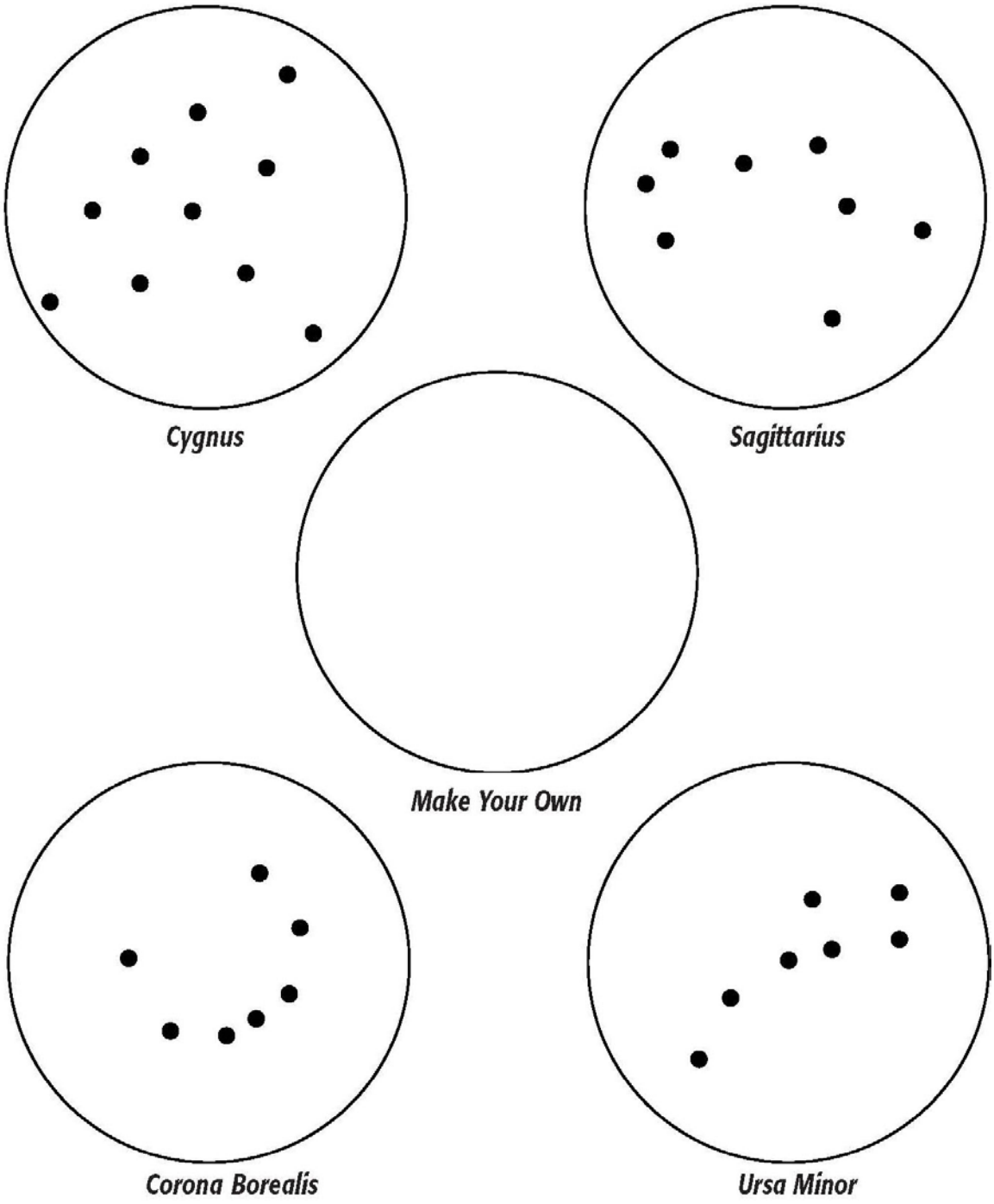
**Materials**: Star patterns (found below), reference book, pen or pencil

**Background**: Constellations are patterns in the sky. Ancient people drew lines to connect the stars and came up with stories to give them significance. It is important to learn the constellation patterns because it helps you to be able to navigate through the sky.

**Instructions:**

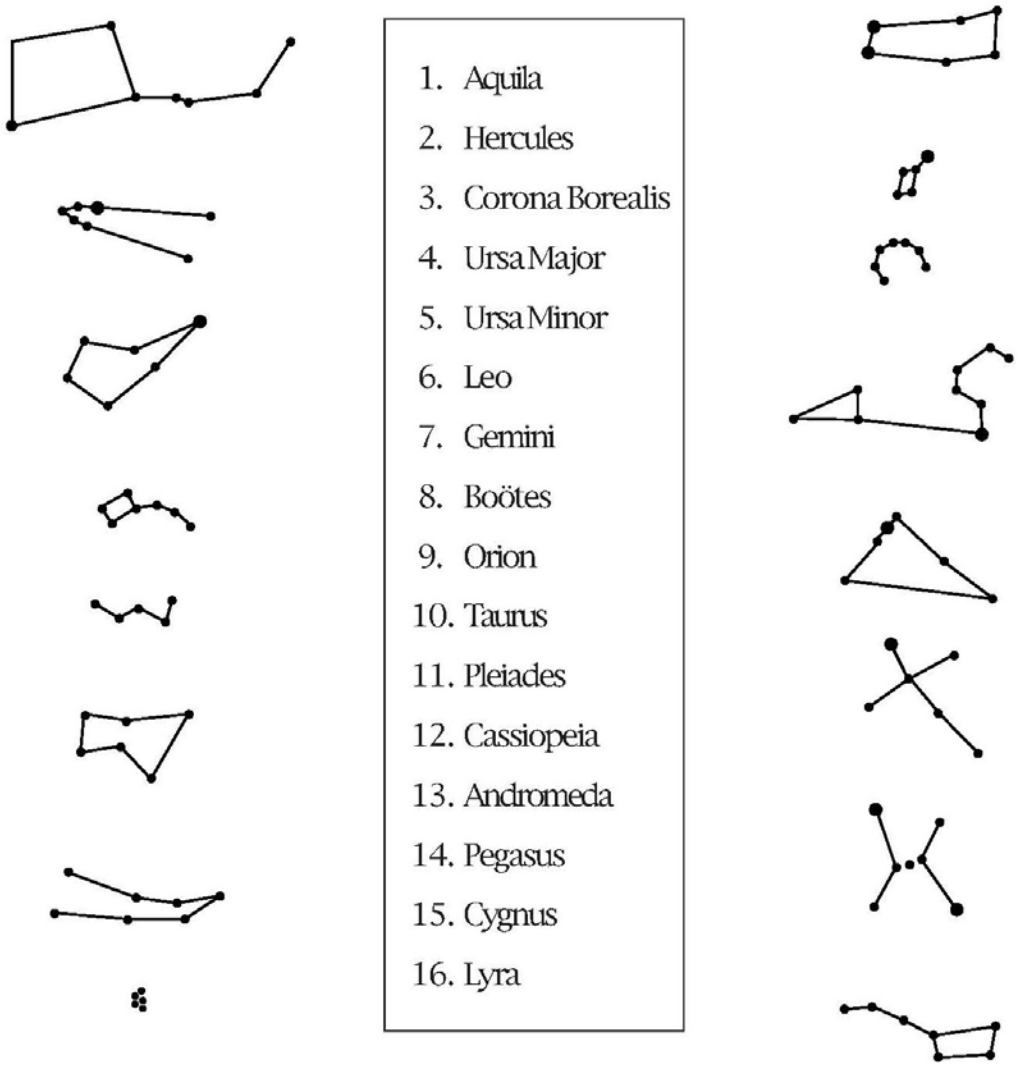
1. Draw connecting lines in the following star patterns to make the constellations.


Orion
Cassiopeia
Boötes
Ursa Major
Hercules




*Star patterns adapted from 4-H Science Toolkit, Cornell Cooperative Extension*

2. Connect the constellation names with their corresponding star pattern:



1. Aquila
2. Hercules
3. Corona Borealis
4. Ursa Major
5. Ursa Minor
6. Leo
7. Gemini
8. Boötes
9. Orion
10. Taurus
11. Pleiades
12. Cassiopeia
13. Andromeda
14. Pegasus
15. Cygnus
16. Lyra

*Constellation matching adapted from 4-H Science Toolkit, Cornell Cooperative Extension*

**Discussion:**

- Do you think that all cultures came up with the same constellations and stories about the stars?

- What was interesting about this activity?

- What was challenging about this activity?

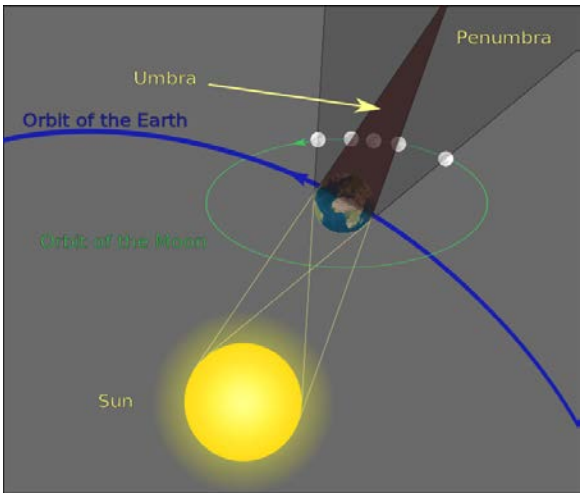
# Activity 13 Concept: Demonstrate a Solar and Lunar Eclipse

**Objective**: To demonstrate the alignment of the moon, Earth and sun for a solar and lunar eclipse

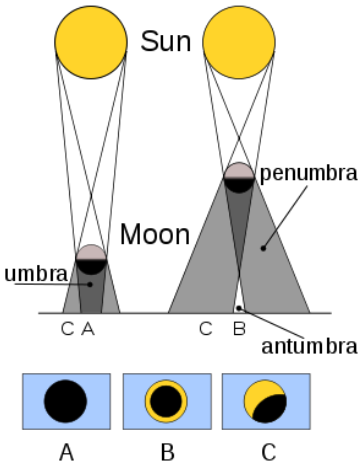
**Materials**: Any three objects (or people) to represent the moon, Earth and sun, reference book, paper, tape, markers, flashlight, camera

**Background**: Recall that a solar eclipse is where the Earth, moon and sun are aligned in that order so that the moon blocks out sunlight.

A lunar eclipse is where the moon, the Earth and the sun are aligned in that order so that the Earth casts a shadow onto the moon.




*Wikipedia, Sagredo, 2008*




*Wikipedia, Setreset,2010*

**Instructions:**

Demonstrate a Solar Eclipse

1. Choose some random objects (or find 3 friends) and label them “moon”, “Earth” and “sun”. The “sun” gets to hold the flashlight.
2. Align the “moon”, “Earth and “sun” so that you have created a solar eclipse.
3. Make sure that the flashlight is turned on and aligned so that you can see the light being blocked by the “moon” causing a solar eclipse as viewed from the "Earth".
4. Now take a picture with your camera (make sure that the labels are visible).

**Demonstrate a Lunar Eclipse**

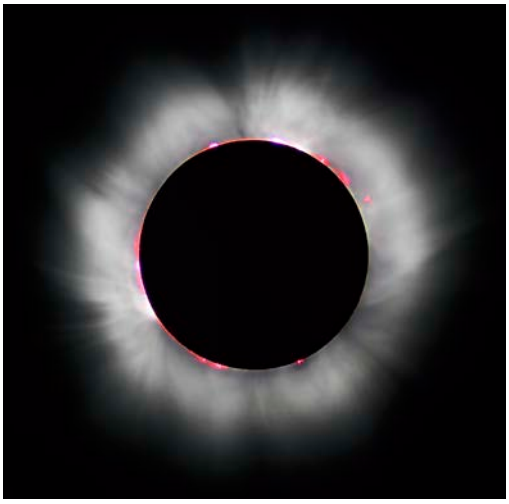
1. Using the same objects (or friends) from before align the “moon”, “Earth and “sun” so that you have created a lunar eclipse. The “sun” still gets to hold the flashlight.
2. Make sure that the flashlight is turned on and aligned so you can see a shadow being cast on the “moon” causing a lunar eclipse as viewed from the "Earth".
3. Now take a picture with your camera (make sure that the labels are visible).

**Discussion:**

- What is the difference between a solar and lunar eclipse?

- What did you find interesting in this activity?

- What did you find challenging in this activity?



*Total solar eclipse, Wikipedia, Luc Viatour, 1999*

*Lunar eclipse, Wikipedia, Jiyang Chen, 2010*

Activity 14

# Build a Constellation in a Can

**Objective**: To build a constellation in a can

**Materials**: Empty potato chips can, hammer, nail, black construction paper, constellation template (found below), pin or needle, decorating materials (optional)

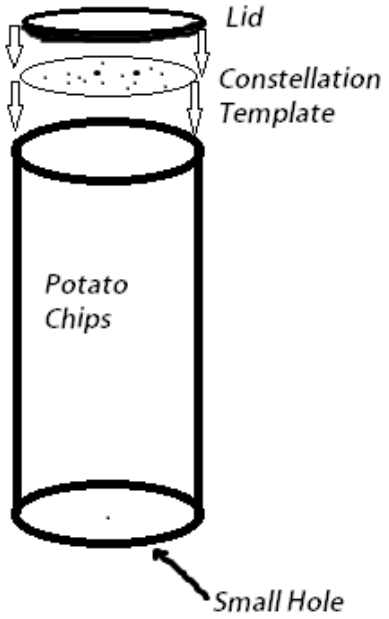
**Instructions:**

1. Punch a small hole in the bottom (metal end) of the potato chips can with the hammer and nail.
2. Place one end of the potato chips can over the construction paper and trace out a circle (do this more than once if you are making more than one constellation).
3. Cut out the circle(s) from the construction paper.
4. Take the needle and poke holes in the construction paper circle to make a constellation pattern (refer to activity 12 for some constellation patterns).
5. Place one of the circles in the plastic lid of the potato chips can and snap it back on.
6. Hold up the potato chips can to a light and look through the hole that you made in the bottom of the can. You should be able to see a constellation in a can!

**Discussion:**

- What constellation(s) did you choose to make? Why?

- How does it work that you are seeing a constellation in a can?



# Activity 15 Build a Sundial

**Objective**: To build a paper sundial

**Materials**: Sundial design template, scissors, tape, crayons or markers, the latitude at which you live (see http://jan.ucc.nau.edu/~cvm/latlon_find_location.html), compass to find north

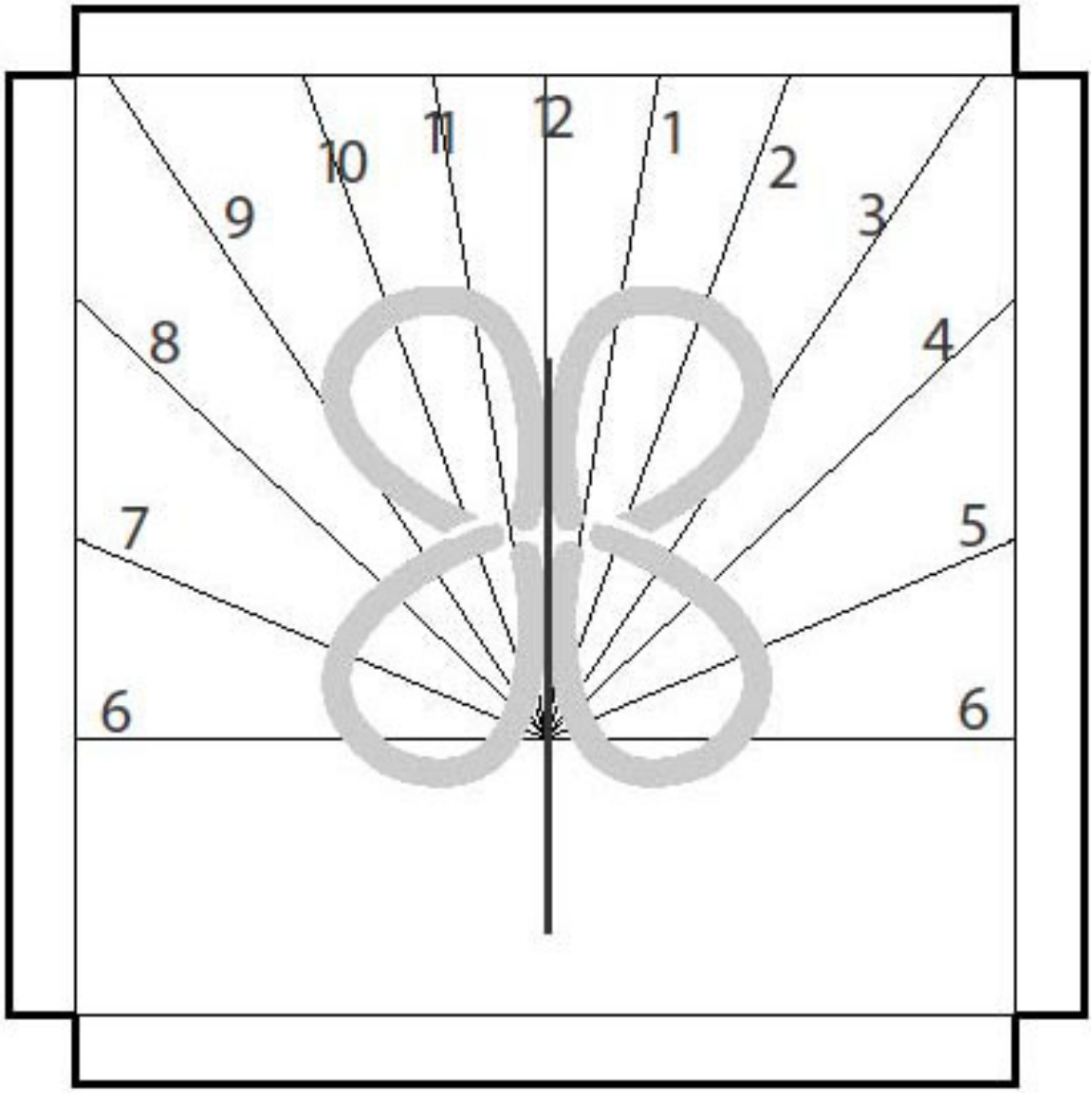
**Background**: The sun moves across the sky from morning to night. We tell time based on the position of the sun. A sundial works by placing it in sunlight and having the centrepiece, called the gnomon, cast a shadow on the base to show the passage of time. It is actually possible to tell time with a sundial instead of a watch and this is what some people in history relied on.

*Sundial on Moot Hall, Aldeburgh, Suffolk, England*

**Instructions:**

1. Cut out the paper template for the base.
2. Cut out the paper centrepiece (the gnomon).
3. Cut the centreline on the base of the sundial.
4. Fold the tabs on the base down and tape them together.
5. Cut the gnomon to the degree of latitude for your location.
6. Slide the gnomon through the slit that you made on the base of the sundial and tape it to the slits after you fold them over.
7. Take the sundial outside and point the number 12 toward North, the shadow being cast should correspond to the time.

**Template for sundial base:**

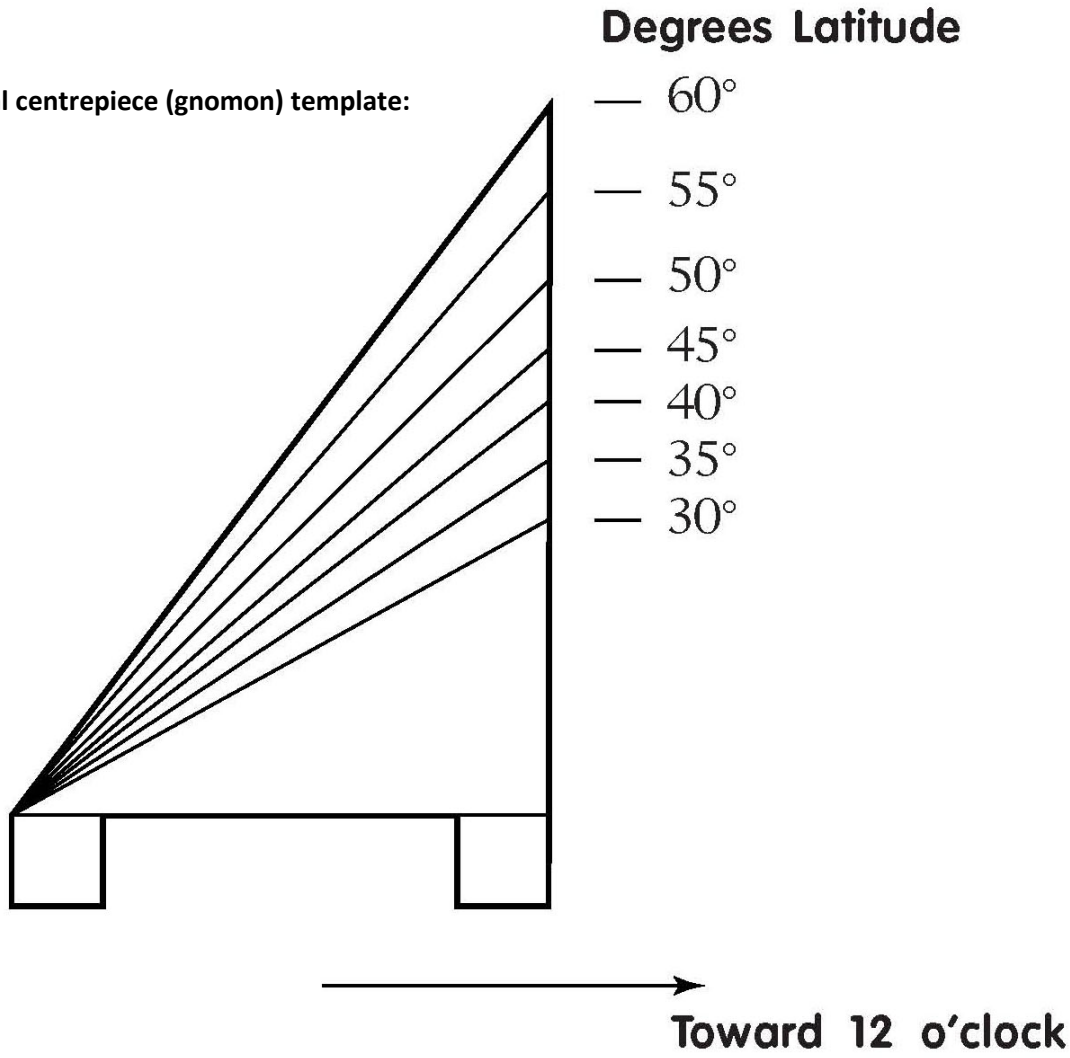



**Instructions**

1. Cut out around black lines.
2. Fold tabs down.
3. Place gnomon along black line in center of sundial.

*Sundial base adapted from 4-H Science Toolkit, Cornell Cooperative Extension*

**Sundial centrepiece (gnomon) template:**




**Instructions**

1. Cut out along dark black lines.
2. Cut the line at the correct latitude.

*Sundial gnomon adapted from 4-H Science Toolkit, Cornell Cooperative Extension*

**Discussion:**

- What do you think it would be like to have to tell the time by looking at the Sun or using a Sundial?

- What did you find interesting and challenging about this activity?

# Activity 16 Build a Pinhole Viewer

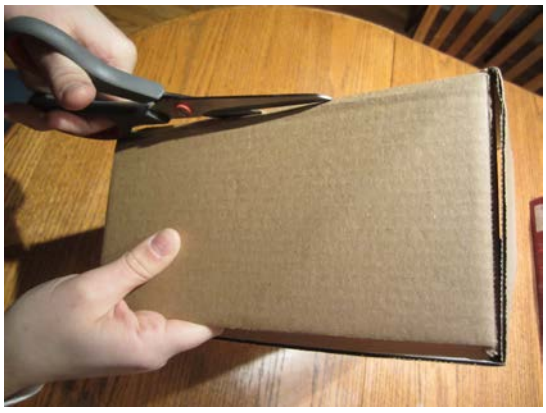
**Objective**: To build a pinhole viewer

**Materials**: Cardboard tube or box, aluminum foil, parchment paper, tape, utility knife, pin or needle, adult supervision

**Background**: A pinhole viewer is a device that allows you to project a bright object onto a screen, in this case the parchment paper. What you will notice is that the image of whatever you are looking at will flip upside down; this is the nature of how the light travels through the viewer and then gets projected. A similar phenomenon happens when you look through a telescope and you see a flipped image.

**Instructions:**

1. Ensure that you have help from an adult for this activity.
2. Take your cardboard tube or box and cut out both ends.
3. Cover one opening with aluminum foil and tape it on securely.



4. Cover the other opening with parchment paper and tape it on securely.
5. Cut a small opening into the top of the box with the utility knife (with adult supervision); this is what you will look through when using your viewer for observing.

6. With the pin, poke a hole in the middle of the side with the aluminum foil; this is where the light will travel through.
7. Hold up your viewer to an object like the full moon so that the aluminum foil side is facing the sky. Look through the opening in the top of the box. You will see an image projected onto the parchment paper!

**Discussion:**

- How did your viewer turn out? Did it work well?
- What did you find interesting and challenging about this activity?

## Activity 17

# Build a Refracting Telescope

**Objective**: To build a basic cardboard tube refracting telescope.

**Materials**: Two cardboard tubes (one should fit in the other), two lenses of differing focal length (from two different magnifying glasses for example), white glue, decorations (optional)

**Background**: A refracting telescope uses two lenses for gathering light and magnifying an image. With the right materials you can build a very basic refracting telescope with a couple cardboard tubes and two lenses that you can mount on the ends. You need to make sure that the lenses have different focal lengths because you need to have a lens for the incoming light at the end of the tube, and you need a lens for the eyepiece where the light enters your eye. As you slide the tubes, one over the other, something that you look at with the telescope will come into focus.

One option is to purchase a basic refracting telescope kit online. These kits come with all the materials needed to make a basic refracting telescope and in some cases these kits can cost less than $20. These kits show you the basics of how a refracting telescope works but it is not made to do any serious observing. Search online for “simple refracting telescope kit” and you are sure to find some reliable websites where you can make a purchase, such as amazon.ca.

**Instructions:**

1. Take the lens with the longer focal length and mount it with the glue on the end of the tube that will be sliding inside the outer tube. Ensure that you don’t get any glue on the lens.
2. Take the lens with the smaller focal length and mount it with the glue on one end of the outer tube. Again, ensure that you don’t get any glue on the lens.
3. Wait for the glue to dry.
4. Slide the tubes together, one inside the other.
5. Decorate the outside of the telescope if you wish.
6. Start observing!

**Discussion:**

- Did you purchase a kit or make your own telescope? Where did you get your materials?

- What were you able to observe with your telescope?

- Did you notice that the image was flipped upside down as you look through your telescope? Why do you think this is?

- What did you find interesting and challenging about this activity?

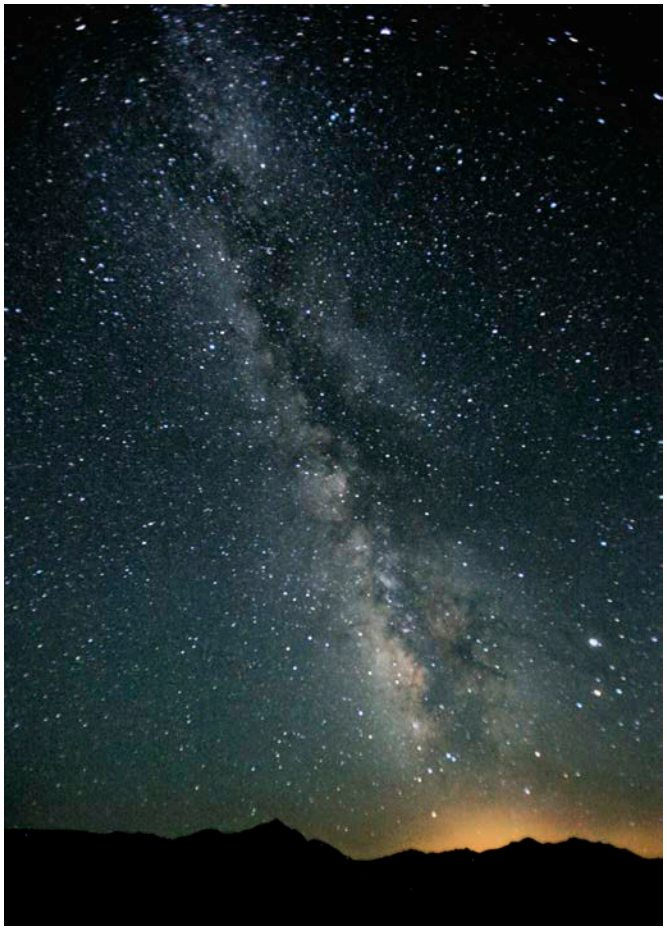
# Activity 18 Navigation: Find and Sketch the Milky Way

**Objective**: To observe and draw or take a picture of the Milky Way.

**Time of year for viewing**: Anytime

**Materials**: Observation sheet (found below), pen or pencil, camera (optional)

**Background**: If you go away from the city lights you can see an amazing band of stars run from one end of the horizon to the other. This band of stars is the Milky Way Galaxy in which the sun is just one of billions of stars. In this activity you will go out and find a place to either draw the Milky Way or take a picture of it.



*Milky Way, Wikipedia, Steve Jurvetson, 2007*

**Instructions:**

1. Find a dark area away from city lights.
2. Locate the Milky Way in the sky.
3. Fill in the observation sheet on the next page.

**Date: _____ Observation site: _____**

**Weather: _____ Trees: _____ Light pollution: _____**

Put your drawing or picture of the Milky Way in the space below.

**Discussion:**

- Describe what the Milky Way looked like.

- What did you find interesting and challenging about this activity?

# Activity 19 Navigation: Locate the North Star using the Big Dipper

**Objective**: To locate the North Star by using the Big Dipper as a reference constellation.

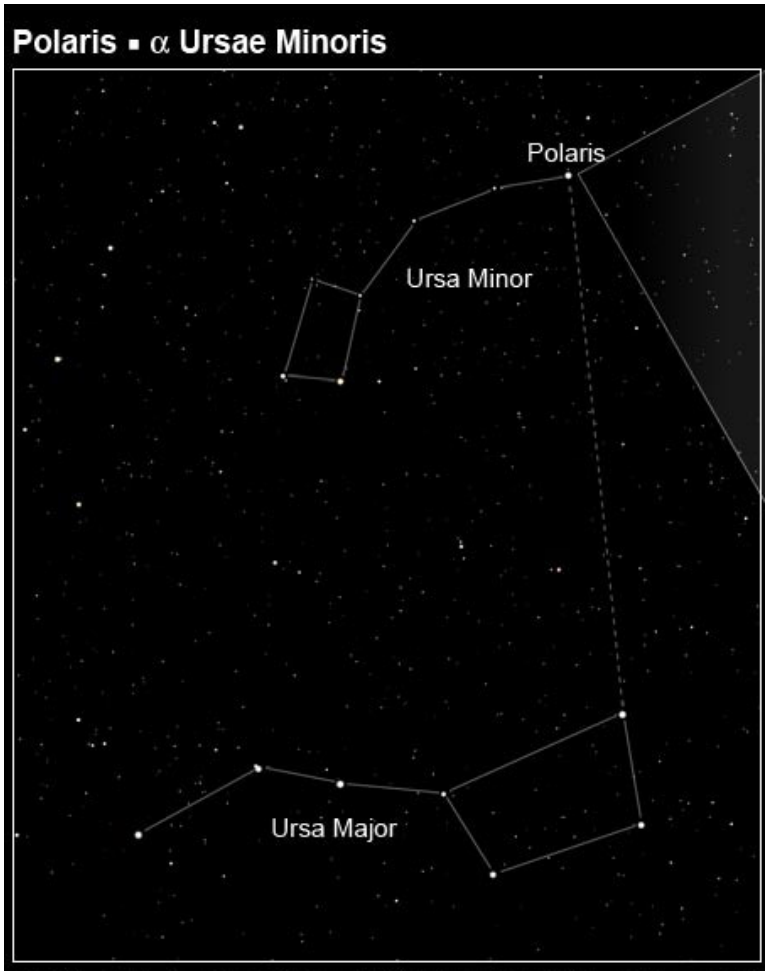
**Time of year for viewing**: Anytime

**Materials**: Observation sheet, pen or pencil

**Background**: You can locate the North Star by using the Big Dipper. The two stars at the end of the dipper point toward the North Star.

**Instructions:**

1. Find a dark area away from city lights.
2. Locate the Big Dipper in the sky and use the two stars in the trough to locate the North Star (refer to previous diagram).
3. Fill in the following observation sheet on the next page.




*Finding Polaris (the North Star) using the Big Dipper, Wikipedia, NASA, 2009*

**Date: _____ Observation site: _____**

**Weather: _____ Trees: _____ Light pollution: _____**

Draw and label the Big Dipper and the North Star as you see it (you may also want to include Ursa Minor).

**Discussion:**

- Describe your experience finding the North Star.

- What did you find interesting and challenging about this activity?

# Activity 20 Navigation: Locate Arcturus and Spica using the Big Dipper

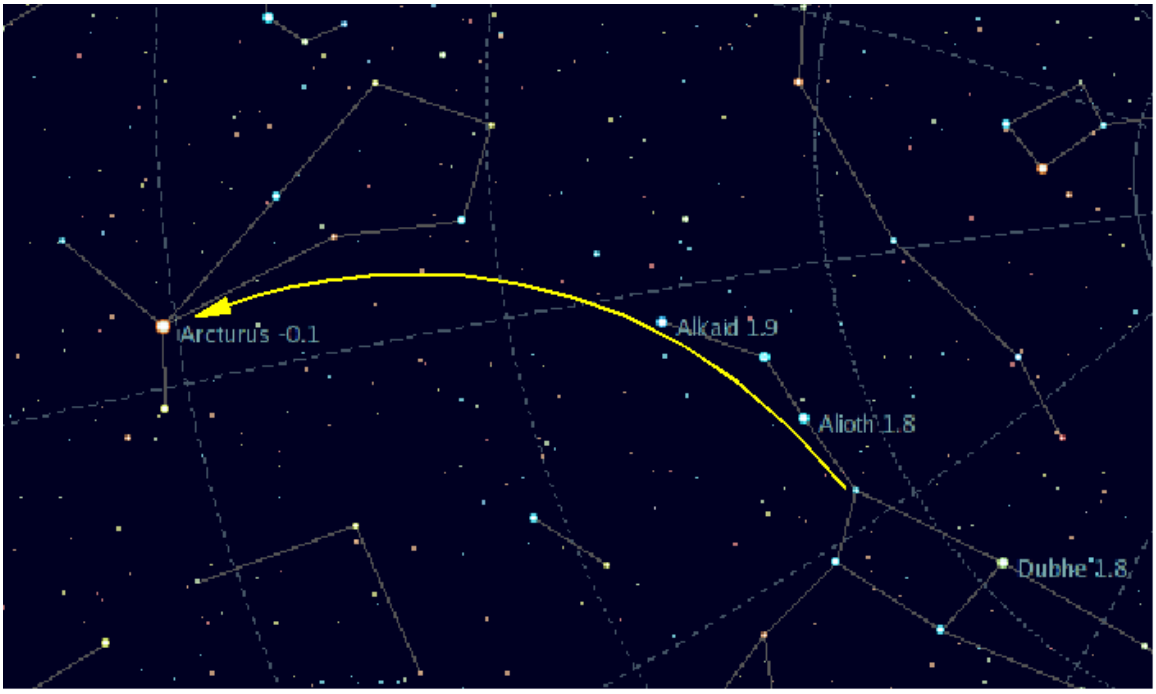
**Objective**: To use the Big Dipper to find two stars, Arcturus and Spica

**Time of year for viewing**: Spring/Summer

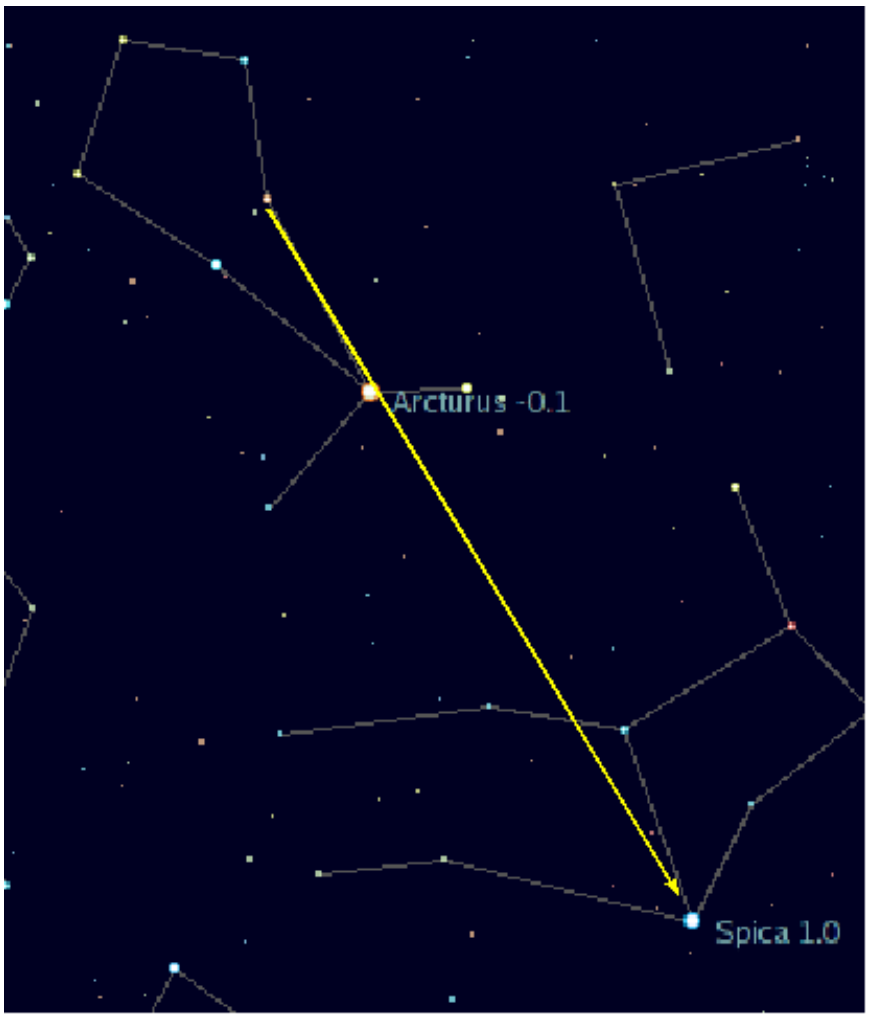
**Materials**: Observation sheet, pen or pencil

**Background**: The saying goes “Arc to Arcturus, then spike to Spica.” By following the arc of the handle of the big dipper you can find the bright stars Arcturus and Spica:

Arc to Arcturus,



then spike to Spica.




**Instructions:**

1. Find a dark area away from city lights.
2. Locate the Big Dipper in the sky.
3. Follow the arc of the handle to the bright star Arcturus (see previous diagram).
4. Move straight down from Arcturus to find the bright star Spica (see previous diagram).
5. Fill in the following observation sheet on the next page.

**Date: _____ Observation site: _____**

**Weather: _____ Trees: _____ Light pollution: _____**

Draw and label the Big Dipper with Arcturus and Spica.

**Discussion:**

- Describe your experience finding Arcturus and Spica.

- What did you find interesting and challenging about this activity?

# Activity 21 Navigation: Locate the Circumpolar Constellations

**Objective**: To locate and sketch the circumpolar constellations.

**Time of year for viewing**: Anytime

**Materials**: Observation sheet, reference book, pen or pencil

**Background**: The circumpolar constellations are the ones that never set. From the northern hemisphere you can see all the circumpolar constellations at night. Refer to your reference book (chapter four) to find out which are the circumpolar constellations. The constellation charts for each of the circumpolar constellations are also provided in chapter four of your reference book. In this activity you will go observing to locate the circumpolar constellations.

*Star trails of circumpolar constellations with North Star at the centre, Wikipedia, KevinHadley, 2012*

**Instructions:**

1. Find a dark area away from city lights.
2. Refer to chapter 4, page 29 of your reference book for a list of circumpolar constellations.
3. Locate each of these constellations using the star maps provided in the reference book (chapter four).
4. Fill in the observation sheet on the next page.

**Date: _____ Observation site: _____**

**Weather:_____ Trees: _____ Light pollution: _____**

Draw and label the circumpolar constellations as you observe them.

| | |
|---|---|
| | |
| | |
| | |

**Discussion:**

- Describe your experience locating the circumpolar constellations.

- What did you find interesting and challenging about this activity?

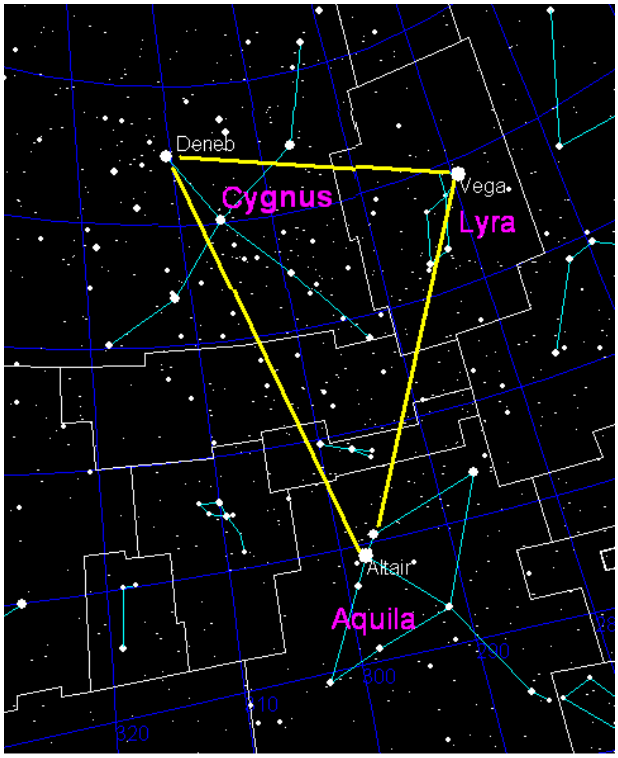
# Activity 22 Navigation: Using the Summer Triangle

**Objective**: To use the summer triangle to locate the three constellations Cygnus, Lyra and Aquila.

**Time of year for viewing**: Summer

**Materials**: Observation sheet, reference book, pen or pencil

**Background**: The summer triangle is a great navigation tool for locating three constellations: Aquila, Cygnus and Lyra. The summer triangle is made up of the stars Deneb in Cygnus, Altair in Aquila and Vega in Lyra. These are all very bright stars and easy to find in the summer months.




**Instructions:**

1. Find a dark area away from city lights.
2. Locate the summer triangle.
3. Refer to the star maps in chapter four of your reference book to find the three constellations Cygnus, Aquila and Lyra in the sky.
4. Fill in the following observation sheet on the next page.

**Date: _____ Observation site: _____**

**Weather:_____ Trees: _____ Light pollution: _____**

Draw and label the summer triangle and include Cygnus, Lyra and Aquila in your sketch.

**Discussion:**

- Describe your experience locating the Summer Triangle.

- What did you find interesting and challenging about this activity?

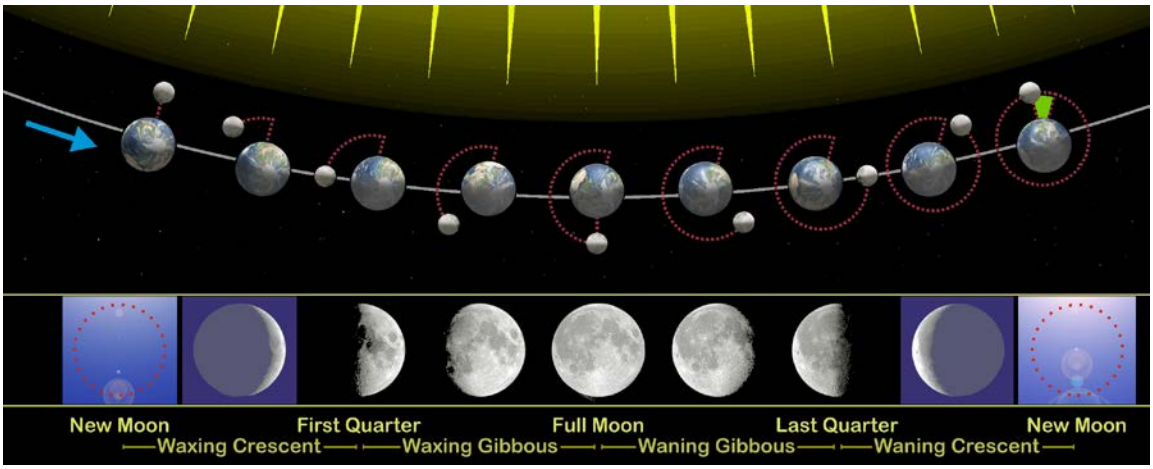
# Activity 23 Solar System Observation: Track the Phases of the Moon

**Objective**: To observe the moon and draw it's phases through a full month.

**Time of year for viewing**: Any

**Materials**: Observation sheet, pen or pencil

**Background**: As the moon orbits the Earth it goes through phases depending on its position in its orbit. In this activity you will track the Moon over one month and draw each of its phases in the space provided on the observation sheet.




*Phases of the moon, Wikipedia, Orion 8, 2010*

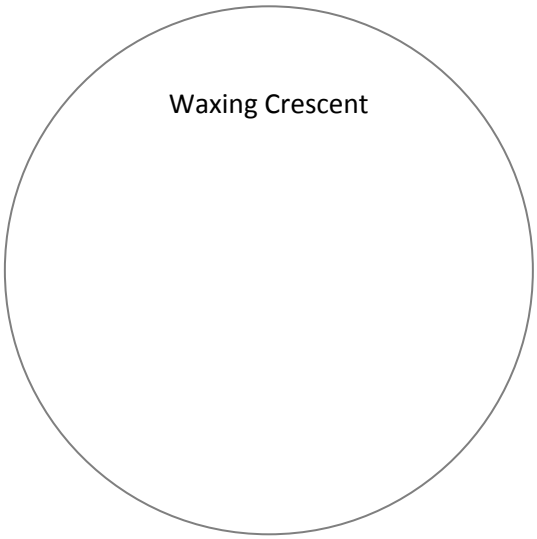
**Instructions**: Fill in the following observation sheet on the next page.

**Observation site: _____**

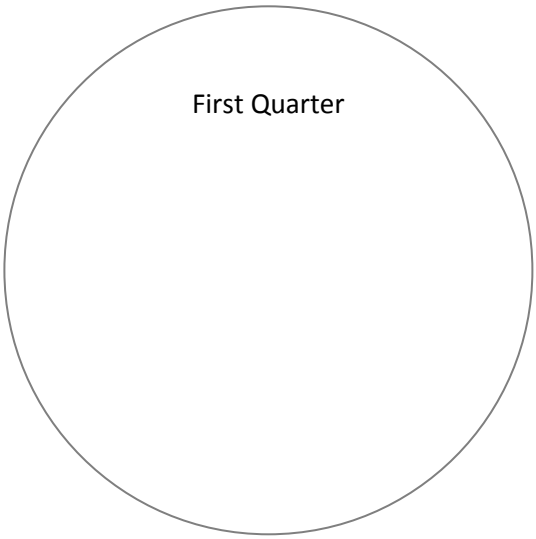
**Weather:_____ Trees: _____ Light pollution: _____**

Draw each of the phases of the moon in the spaces provided.

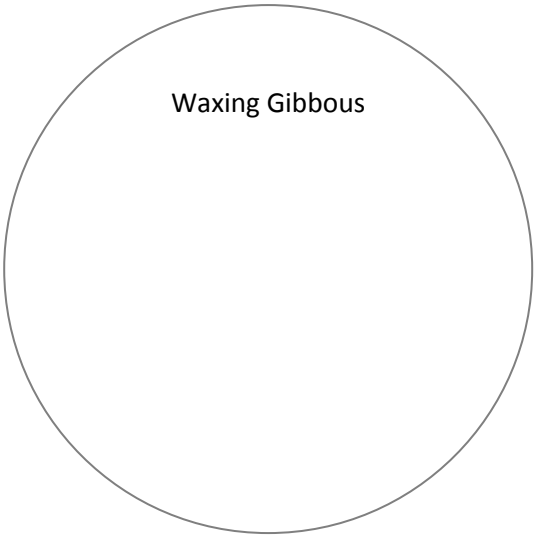
Date:



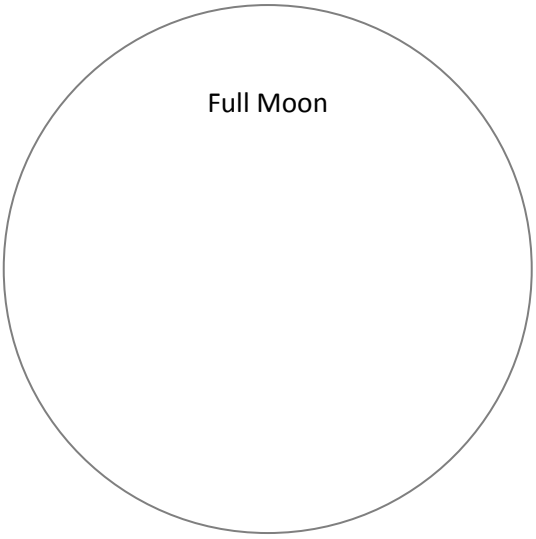

Date:




Date:

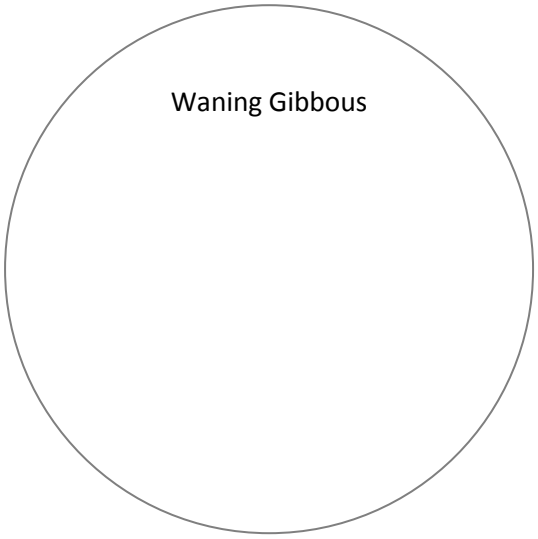



Date:



Date:

Waning Gibbous

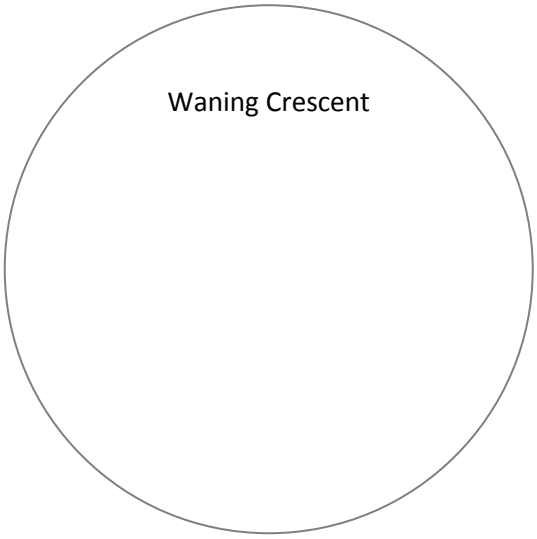


Date:

Last Quarter

Date:

Waning Crescent



**Discussion:**

- Describe your experience tracking the moon phases.

- What did you find interesting and challenging about this activity?

# Activity 24 Solar System Observation: Venus, Mars, Jupiter and Saturn

**Objective**: Observe one or more planets with your naked eye, with binoculars or with your telescope.

**Time of Year for Viewing**: Varies from year to year

**Materials**: Observation sheet, pen or pencil, reference book, telescope or binoculars (optional)

**Background**: The easiest planets to locate are, Venus, Mars, Jupiter and Saturn. The planets are visible at different times depending on the year but there are several ways you can find out when the planets will be up. First there are many online resources that you can turn to; refer to the reference book for a list of websites that you can visit (chapter three), or try a Google search. Second there are many apps that are available for download that are programmed to show you what planets are up at any given time; a list of apps are provided in chapter three of the reference book. Lastly you can ask a local astronomy club or observatory for information on when the planets will be up in the sky.

Keep in mind that some planets are very obvious since they are so bright in the sky. Venus for example is extremely bright when it is up and is hard to mistake for a typical star. Refer to chapter six of the reference book for more information on each of the planets.

*Venus at Dusk, Wikipedia, Brocken Inaglory, 2008*

**Instructions**: Fill in the following observation sheet on the following page.

**Observation site: _____**

**Weather: _____ Trees: _____ Light pollution: _____**

Draw, label and date the planet(s) that you observe.

**Discussion:**

- Describe your experience finding one or more planets.

- What did you find interesting and challenging about this activity?

# Activity 25 Solar System Observation: A Meteor Shower

**Objective**: To observe a meteor shower and count the number of meteors that you see.

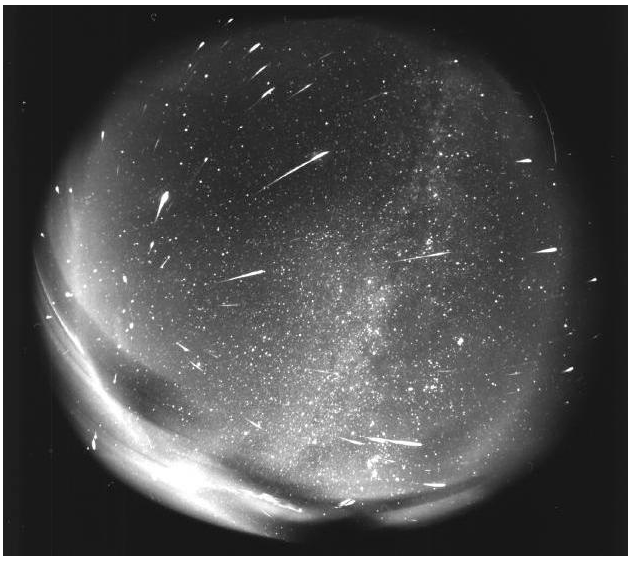
**Time of year for viewing**: Varies depending on meteor shower

**Materials**: Observation sheet, pen or pencil, reference book, binoculars (optional)

**Background**: Meteor showers occur periodically throughout the year. Refer to your reference book (chapter six) for a list of prominent meteor showers that occur during particular months; you can also look at chapter three for a list of online links that have updated astronomy news and information.

**Instructions:**

1. Look online to find out when the next meteor shower is and plan to go observing on the night of its peak frequency.
2. Look towards the constellation which the shower has been named after. For example, if you are watching the Orionids, then you will need to look towards the Orion constellation to see the most meteors. Plan to go observing for at least 20 minutes to ensure that you see plenty of meteors.
3. Fill in the observation sheet below and keep track of how many meteors you see during your observing session.



*Long exposure image of Leonid meteor shower, Wikipedia, Juraj Tóth, 1998*

**Date:** _____

**Weather:** _____ **Trees:** _____ **Light pollution:** _____

Draw and label the constellation you were observing and draw what the meteors looked like.

Length of observing session: _____ minutes

Number of meteors observed: _____

**Discussion:**

- How long was your observing session and how many meteors did you see?

- What did you find interesting and challenging about this activity?

Activity 26

# Star Observation: The Quadruple Star System Alcor and Mizar

**Objective**: Observe the star system Alcor and Mizar with your naked eye, binoculars and/or your telescope.

**Time of year for viewing**: Anytime

**Materials**: Observation sheet, pen or pencil, binoculars or telescope (encouraged)

**Background**: Alcor and Mizar is a quadruple star system in the constellation Ursa Major. This system is the second star in from the edge of the handle of the Big Dipper and is visible with your naked eye. However, if you have access to binoculars or a telescope it will make viewing much better. When you look at this system with your naked eye you will see two stars, but with a telescope you will be able to resolve a third star (the fourth star is too close to its companion to be resolved).


*Alcor and Mizar in the Big Dipper, WikiCommons,Shawn E. Gano, 2012*

**Instructions:**

1. Find a dark area away from city lights.
2. Locate the Big Dipper in the sky and find the second star from the end of the handle.
3. Use a telescope or binoculars if you have them.
4. Fill in the following observation sheet below.

**Date: _____ Observation site:_____**

**Weather: _____ Trees: _____ Light pollution: _____**

Draw and label what you see when you look at Alcor and Mizar.

| With your naked eye: |
| --- |
| With binoculars or a telescope: |

**Discussion:**

- Describe your experience locating the Alcor and Mizar. Did you use binoculars or a telescope?

- What did you find interesting and challenging about this activity?

# Activity 27 Star Observation: The Red Giant Star, Betelgeuse

**Objective**: Observe the star Betelgeuse with your naked eye, binoculars and/or your telescope.

**Time of year for viewing**: Winter

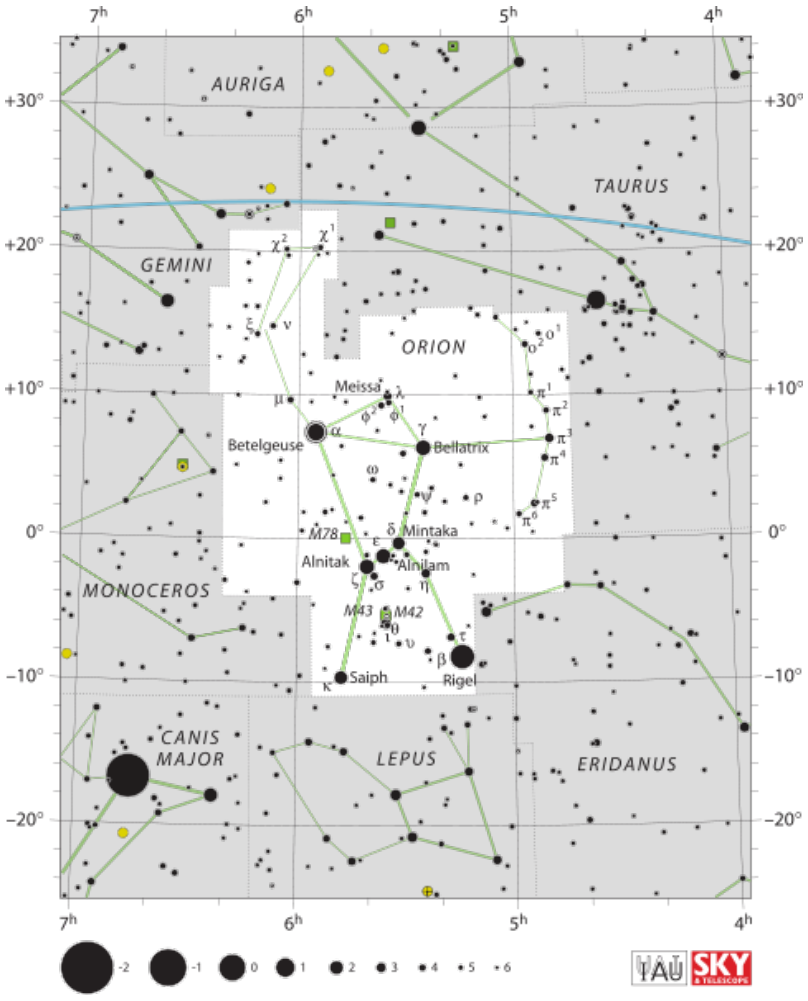
**Materials**: Observation sheet, pen or pencil, binoculars or telescope (encouraged)

**Background**: Betelgeuse makes up the armpit of the Orion constellation. It is a red supergiant star and is a beautiful sight, even to your naked eye. Betelgeuse is a star that has exhausted all of its hydrogen fuel and is now in its red giant phase. Essentially it is an expanding shell of gas spewing out into space.

**Instructions:**

1. Find a dark area away from city lights.
2. Locate the Orion constellation in the sky and then find Betelgeuse.
3. Use a telescope or binoculars if you have them.
4. Fill in the following observation sheet below.

*Arrow pointing at the red giant star, Betelgeuse, WikiCommons, Hubble ESA, 2009*




*Wikipedia, IAU and Sky & Telescope magazine, Roger Sinnott & Rick Fienberg, 2011*

**Date: _____Observation site: _____**

**Weather: _____Trees: _____Light pollution: _____**

Draw and label Betelgeuse in the Orion constellation.

| With your naked eye: |
| --- |
| With binoculars or a telescope: |

**Discussion:**

- Describe your experience locating Betelgeuse.

- What did you find interesting and challenging about this activity?

# Activity 28 Star Observation: The Brightest Star in the Sky, Sirius

**Objective**: Observe the star Sirius with your naked eye, binoculars and/or your telescope.

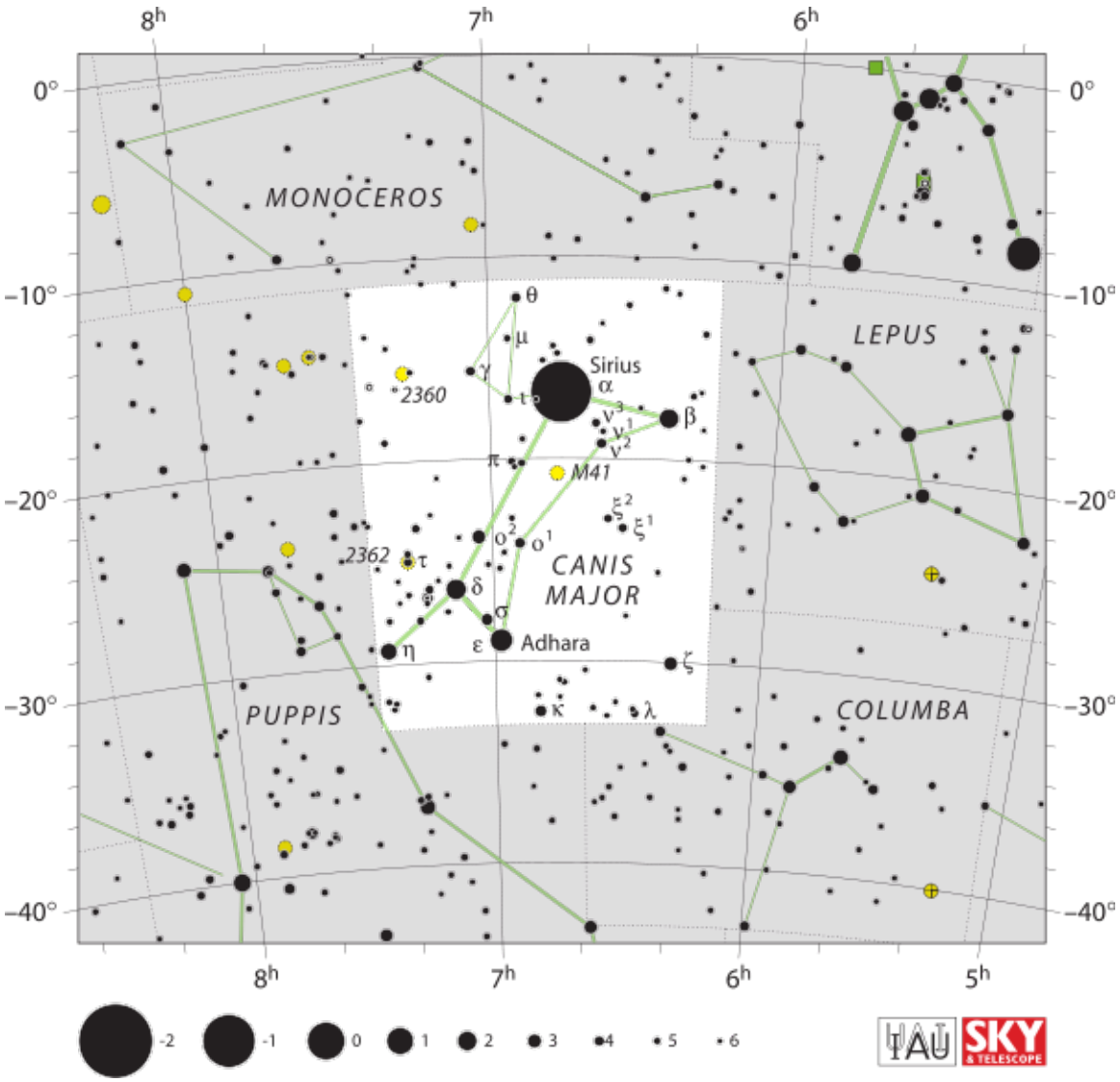
**Time of year for viewing**: Winter

**Materials**: Observation sheet, pen or pencil, binoculars or telescope (encouraged)

**Background**: Sirius is the brightest star in the night sky and is located in the constellation Canis Major. In mythology, Canis Major is the "Great Dog", one of the dogs that is following Orion the Hunter. For this reason Sirius is known as the "Dog Star". Perhaps a little low along the southern horizon, Sirius is a fairly easy target for binoculars or a telescope since it is so bright. Canis Major is near Orion so you can use the belt of Orion as a reference point.

**Ins tructions:**

1. Find a dark area away from city lights.
2. Locate the constellation Canis Major in the sky and then find Sirius (you may find Sirius first because it is so bright!).
3. Use a telescope or binoculars if you have them.
4. Fill in the following observation sheet on the following page.




*Wikipedia, IAU and Sky & Telescope magazine, Roger Sinnott & Rick Fienberg, 2011*

**Date: _____ Observation site:_____**

**Weather: _____ Trees: _____ Light pollution: _____**

Draw and label Sirius in the constellation Canis Major.

| With your naked eye: |
| --- |
| With binoculars or a telescope: |

**Discussion:**

- Describe your experience locating Sirius in Canis Major.

- What did you find interesting and challenging about this activity?

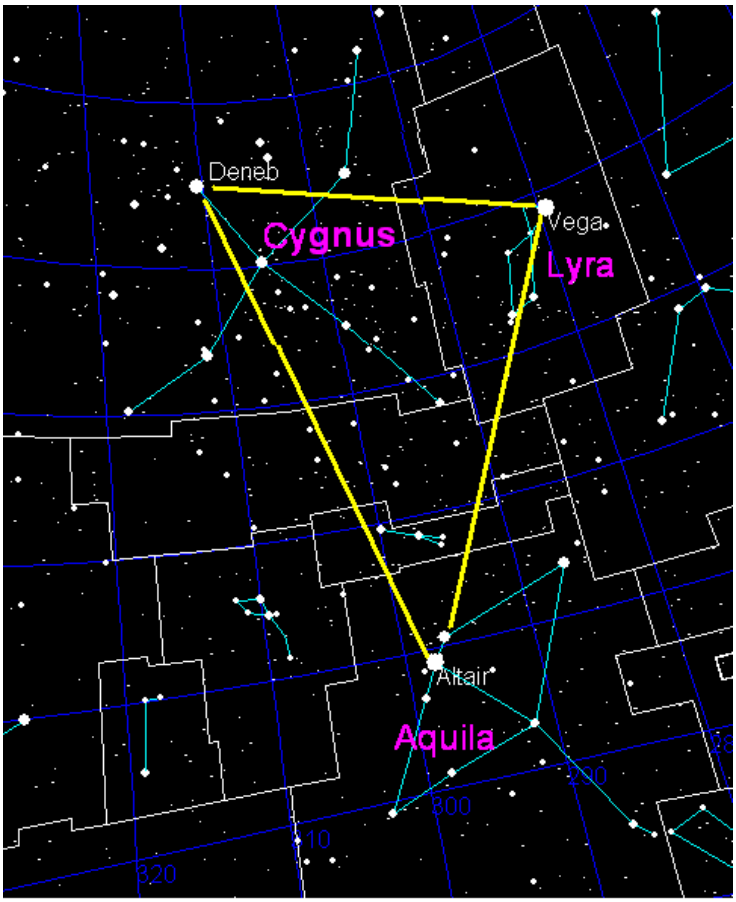
# Activity 29 Star Observation: The Binary Star System Albireo

**Objective**: Observe the Binary Star System Albireo with your naked eye, binoculars and/or your telescope.

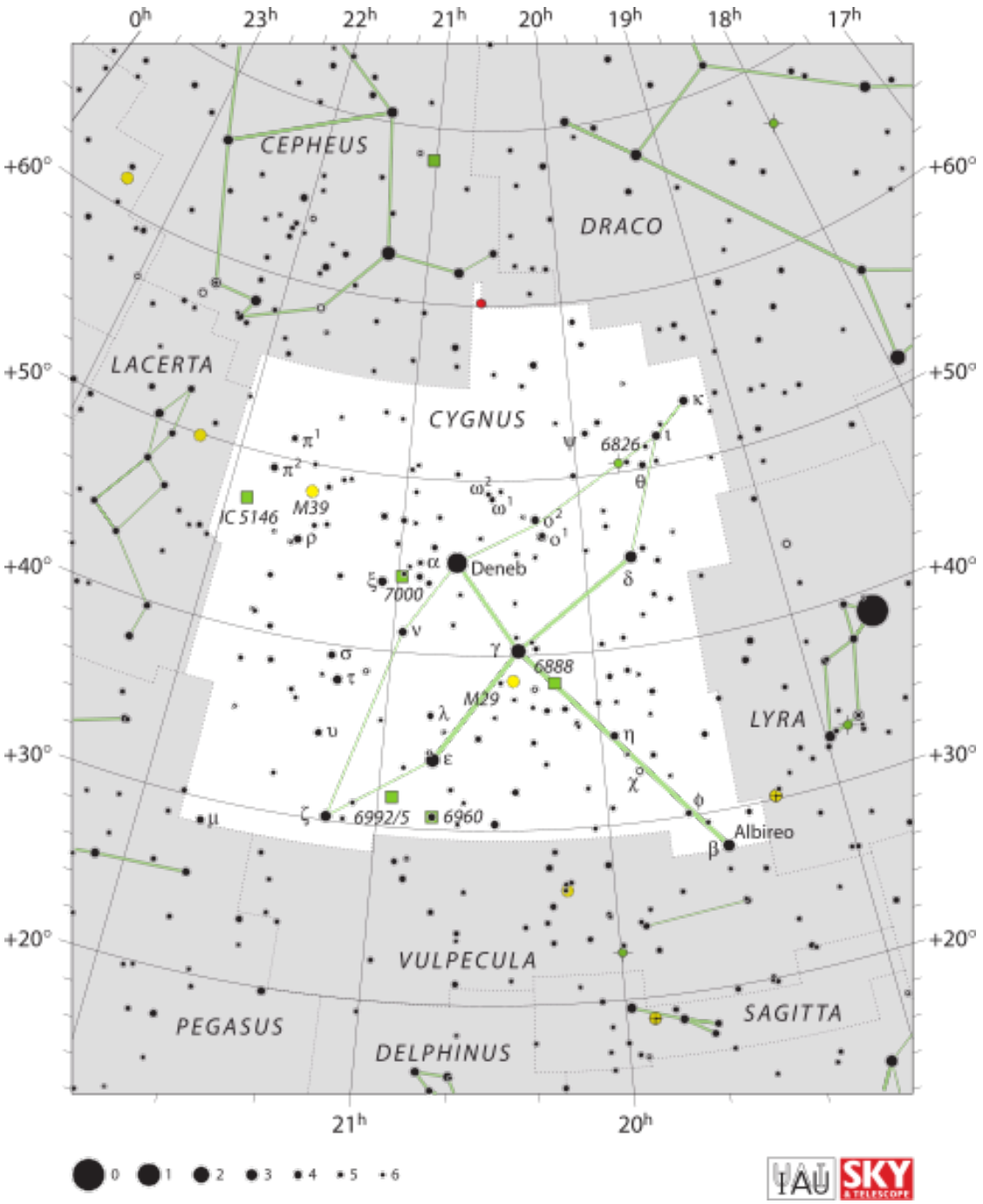
**Time of year for viewing**: Summer

**Materials**: Observation sheet, pen or pencil, reference book (optional), binoculars or telescope (strongly encouraged)

**Background**: Albireo is a double star system in the constellation Cygnus the Swan. Cygnus can be found using the summer triangle (see chapter four in the reference book). Albireo makes up the head of the swan and appears as a single star with your naked eye. With a telescope or a decently powered pair of binoculars you can resolve Albireo into a beautiful double star. One star in the system has a red tinge and the other is bluish-white.




*Double star Albireo in Cygnus resolved with a telescope,Wikipedia, Jim Spinner, 2004*




*Wikipedia, IAU and Sky & Telescope magazine, Roger Sinnott & Rick Fienberg, 2011*

**Instructions:**

1. Find a dark area away from city lights.
2. Use your reference book or the previous maps to locate Cygnus and then find Albireo.
3. Use a telescope or binoculars if you have them.
4. Fill in the following observation sheet.

**Date: _____ Observation site: _____**

**Weather: _____ Trees: _____ Light pollution: _____**

Draw and label Albireo in the constellation Cygnus.

| With your naked eye: |
| --- |
| With binoculars or a telescope: |

**Discussion:**

- Describe your experience locating Albireo.

- What did you find interesting and challenging about this activity?

## Activity 30

# Deep Sky Object Observation: The Pleiades Star Cluster (M45)

**Objective**: Observe the Pleiades open star cluster with your naked eye, with binoculars and/or with your telescope.

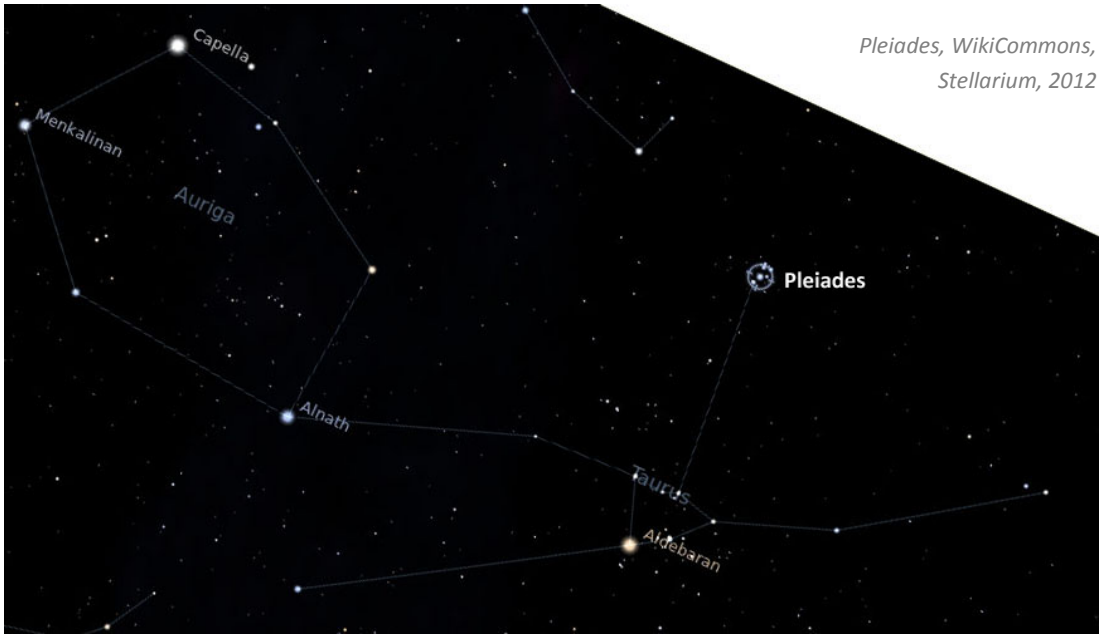
**Time of year for viewing**: Fall/Winter

**Materials**: Observation sheet, pen or pencil, binoculars or telescope (encouraged)

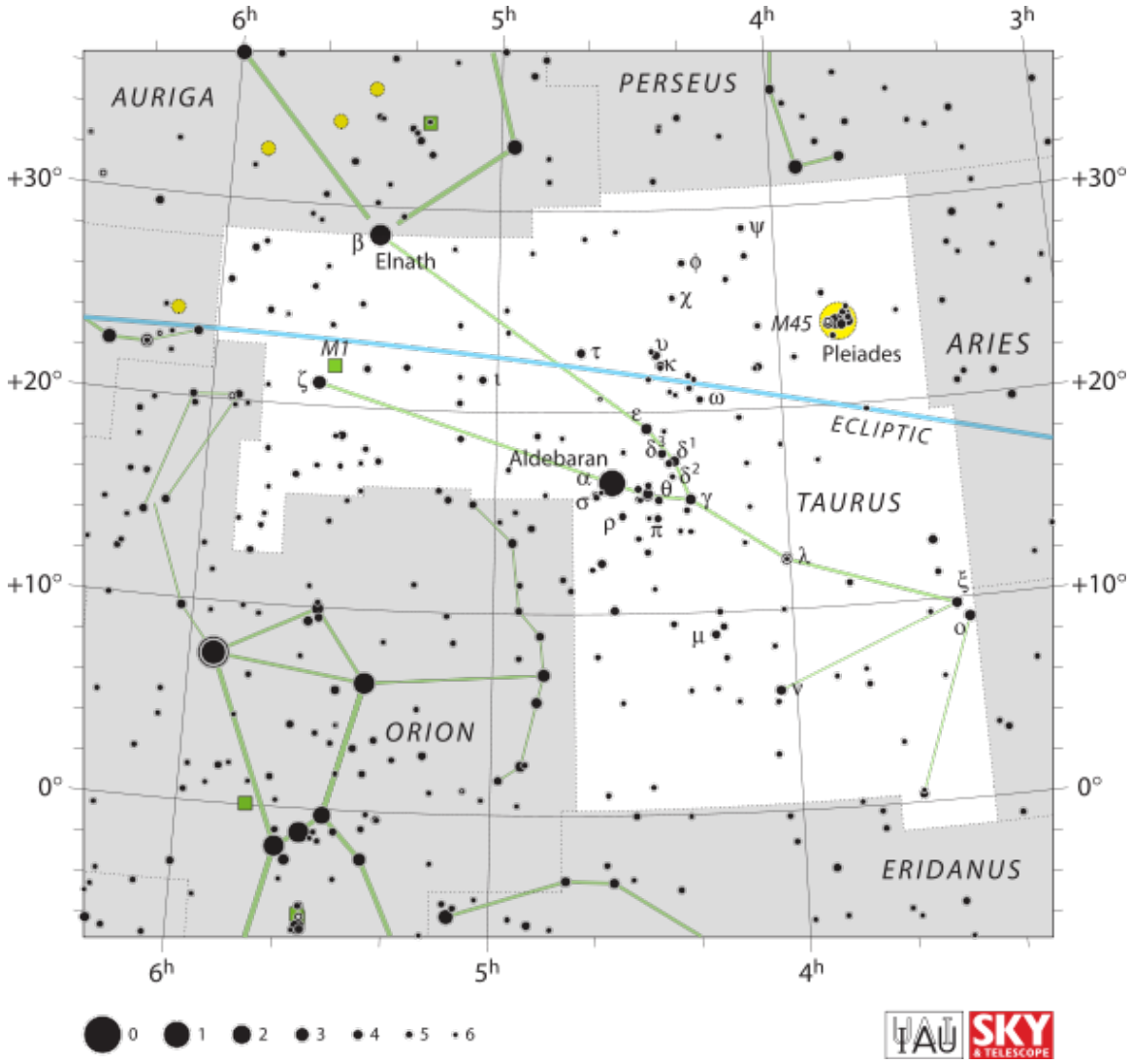
**Background**: The Pleiades is an open star cluster that is visible in the fall and winter months. It is clearly visible with your naked eye, binoculars or telescope and is located in the Taurus constellation.

**Instructions:**

1. Find a dark area away from city lights.
2. Locate the constellation Taurus in the sky and then find the Pleiades (you may find the Pleiades first because it really sticks out in the sky!).
3. Use a telescope or binoculars if you have them.
4. Fill in the following observation sheet.




*Pleiades, WikiCommons, Stellarium, 2012*




*Wikipedia, IAU and Sky & Telescope magazine, Roger Sinnott & Rick Fienberg, 2011*

**Date: _____ Observation site:_____**

**Weather: _____ Trees: _____ Light pollution: _____**

Draw and label the Pleiades star cluster in the constellation Taurus.

| With your naked eye: |
| --- |
| With binoculars or a telescope: |

**Discussion:**

- Describe your experience locating the Pleiades.
- What did the cluster look like and is it what you expected?
- What did you find interesting and challenging about this activity?

## Activity 31

# Deep Sky Object Observation: The Hercules Globular Cluster (M13)

**Objective**: Observe the Great Globular Cluster in Hercules with your telescope.

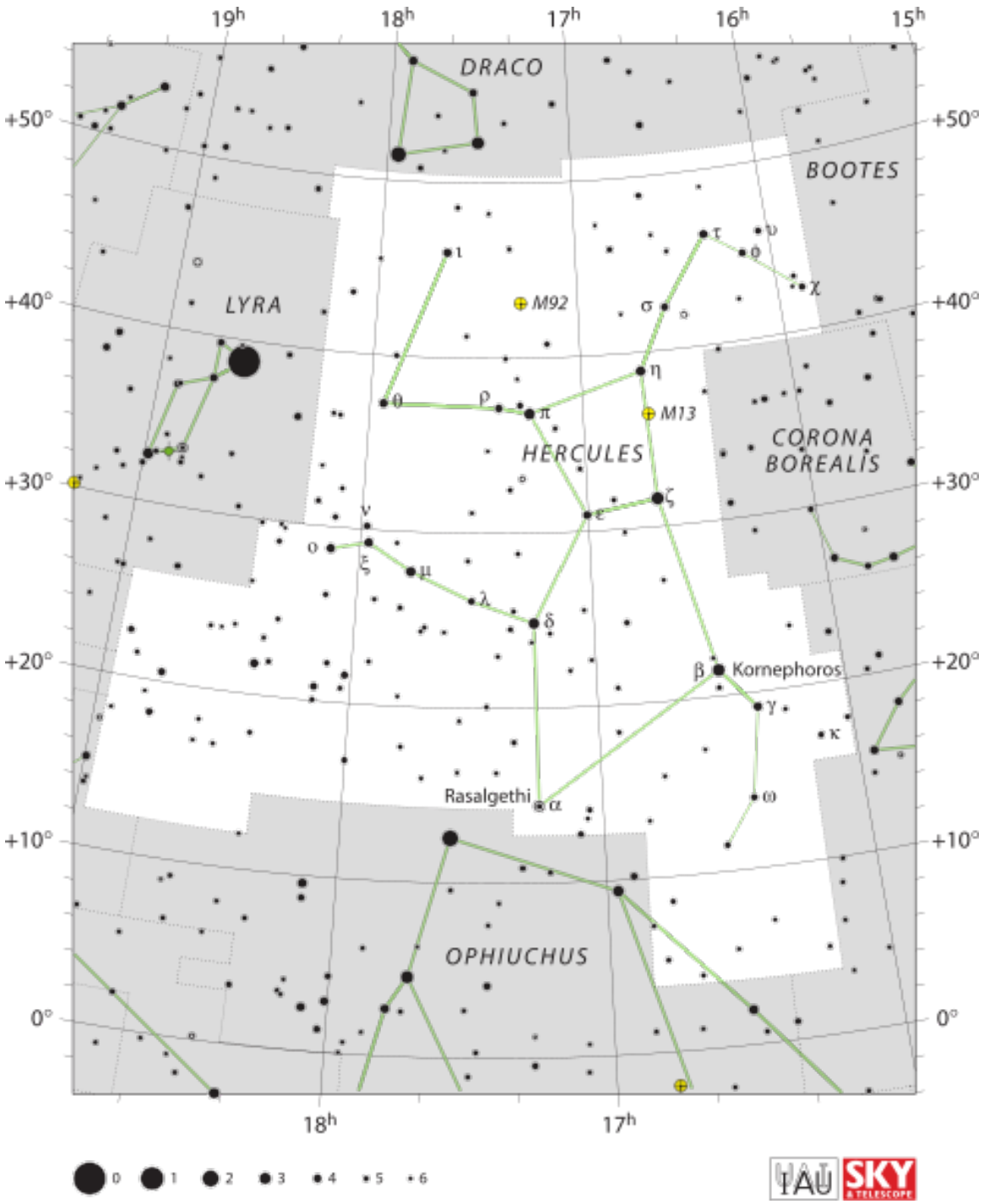
**Time of year for viewing**: Summer

**Materials**: Observation sheet, pen or pencil, binoculars or telescope

**Background**: The Hercules Globular Cluster (M13) is a primary globular cluster to observe for amateur astronomers. Unless you are in a very dark location, M13 requires a telescope to observe it. When you look at M13 with a modestly powered telescope it will look like a fuzzy haze of light, and you may be able to resolve some individual stars. M13 is found on the right side of the torso of Hercules.

**Instructions:**

1. Find a dark area away from city lights.
2. Locate the constellation Hercules in the sky and then find the two stars on the side of the torso. The Hercules cluster is located between these two stars (refer to previous star chart).
3. Use a telescope to line up M13.
4. Fill in the following observation sheet below.




*Wikipedia, IAU and Sky & Telescope magazine, Roger Sinnott & Rick Fienberg, 2011*

**Date: _____Observation site: _____**

**Weather:_____Trees: _____Light pollution: _____**

Draw and label M13 in the constellation Hercules.

**Discussion:**

- Describe your experience locating M13.

- What did you find interesting and challenging about this activity?

## Activity 32

# Deep Sky Object Observation: The Andromeda Galaxy (M31)

**Objective**: Observe the Andromeda Galaxy with your naked eye, binoculars and/or your telescope.

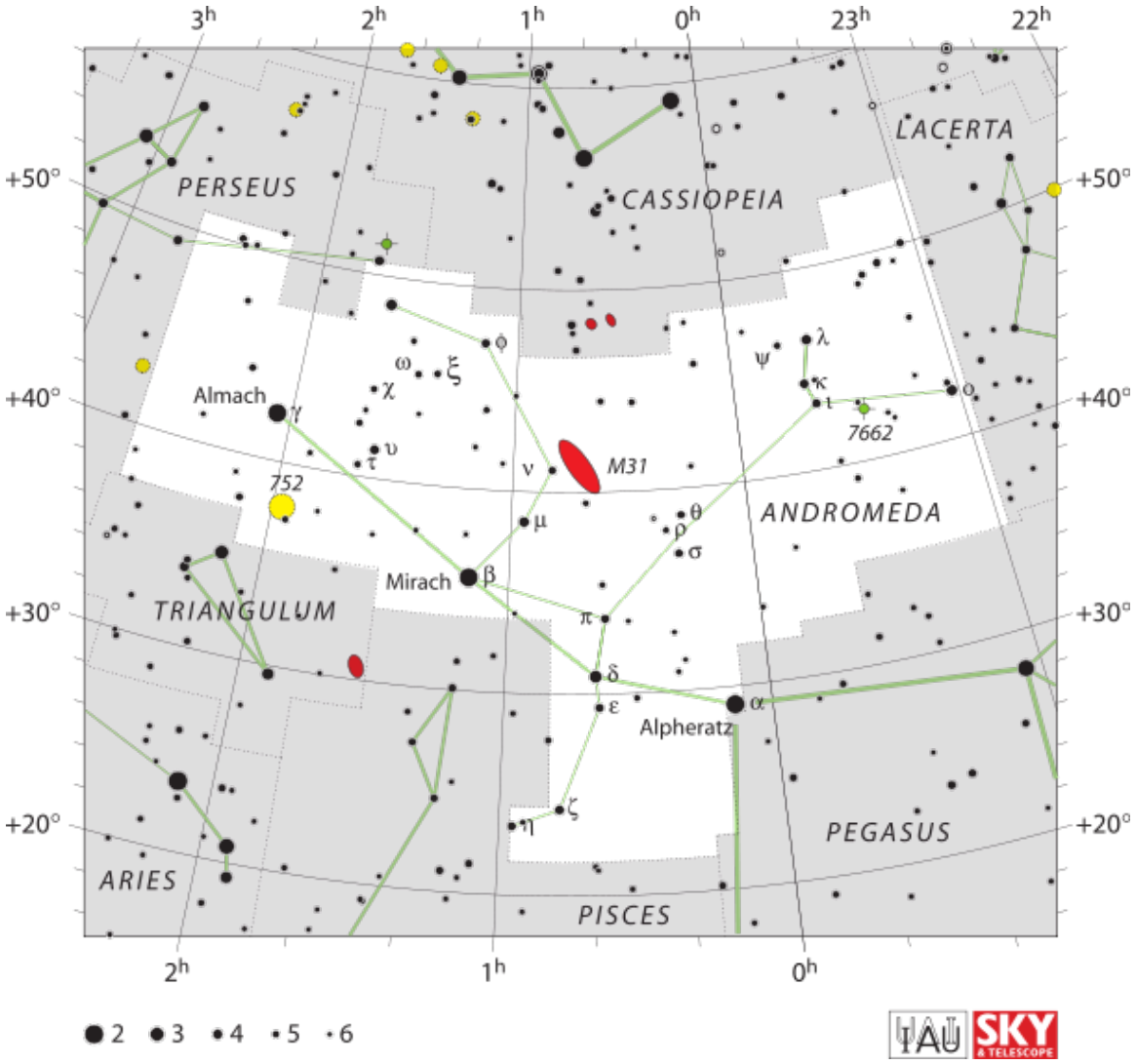
**Time of year for viewing**: Fall

**Materials**: Observation sheet, pen or pencil, reference book, binoculars or telescope

**Background**: Although the Andromeda Galaxy (M31) is visible with your naked eye, this is an object that you will want to see with binoculars or a telescope as well. Refer to chapter four of your reference book if you want more information on how to find the Andromeda constellation in which the galaxy resides. If you are in a very dark place you can make out a fuzzy patch of light within the Andromeda constellation, which is where you want to point your telescope or binoculars.

**Instructions:**

1. Find a dark area away from city lights.
2. Use your reference book (chapter four) or the map provided to locate the Andromeda constellation. (Recall a trick to locating the Andromeda constellation is to first find the square of Pegasus, then follow the line of stars along the top of the square.)
3. Find Mirach, a star which you can use as a reference point.
4. Move straight up from Mirach. If you are in a dark enough area you should see a fuzzy haze of light in the sky which is M31.
5. Use a telescope or binoculars if you have them.
6. Fill in the following observation sheet.




*Wikipedia, IAU and Sky & Telescope magazine, Roger Sinnott & Rick Fienberg, 2011*

**Date: _____ Observation site:_____**

**Weather: _____ Trees: _____ Light pollution: _____**

Draw and label M31 in the constellation Andromeda.

**Discussion:**

- Describe your experience locating M31.

- What did you find interesting and challenging about this activity?

## Activity 33

# Deep Sky Object Observation: The Orion Nebula (M42)

**Objective**: Observe the Orion Nebula with your naked eye, binoculars and/or your telescope.

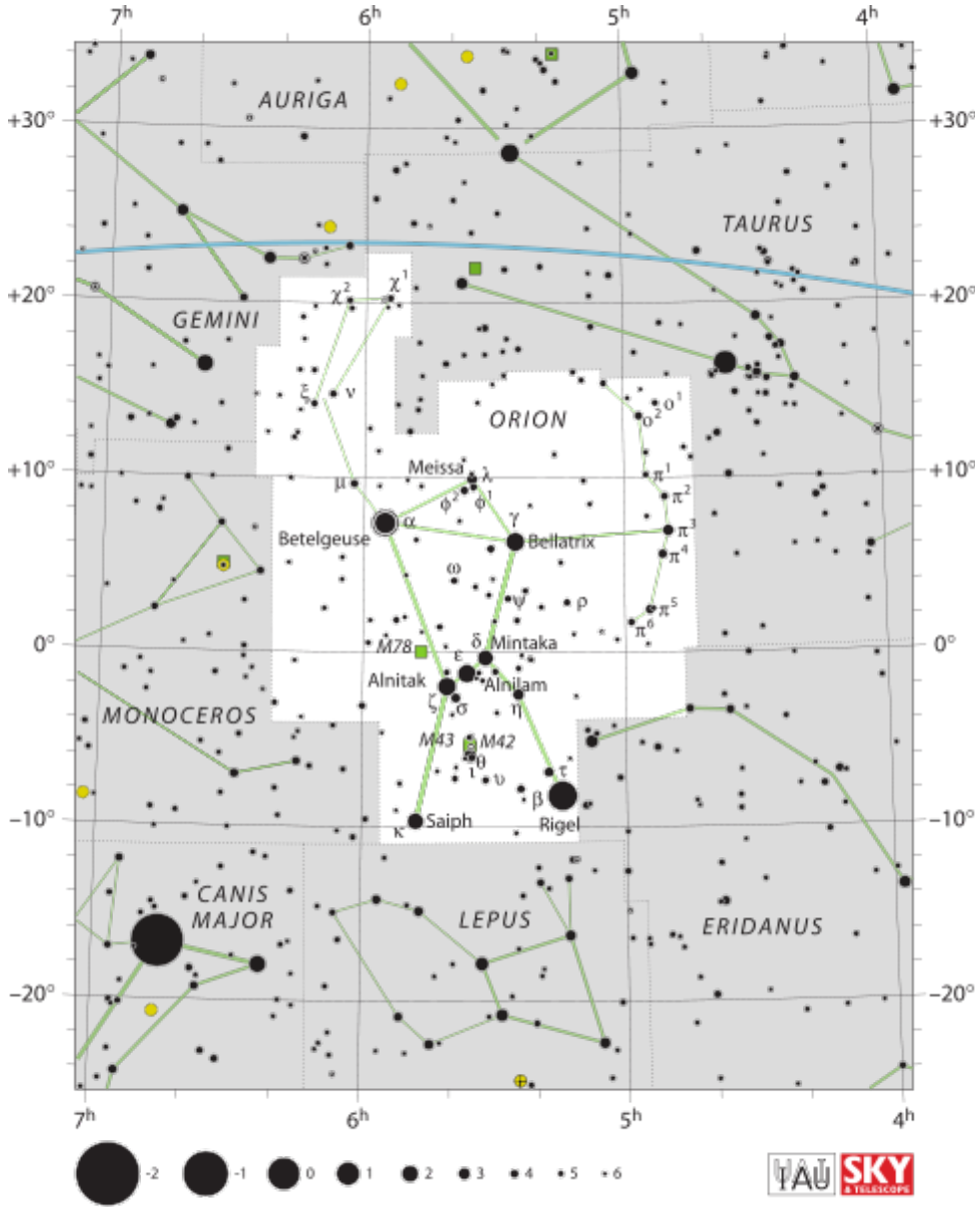
**Time of year for viewing**: Winter

**Materials**: Observation sheet, pen or pencil, binoculars or telescope

**Background**: The Orion Nebula (M42) is another deep sky object that is visible with your naked eye but to see it in full effect you will want to use binoculars or a telescope. The Orion Nebula is located in the sword of Orion.

**Instructions:**

1. Find a dark area away from city lights.
2. Locate the Orion constellation with the previous star chart.
3. Find Orion's belt which is the three bright stars that stand out in the constellation.
4. Move straight down from Orion's belt to find the sword. The Orion Nebula is right in the middle of the sword where you will see a fuzzy patch of light; point you telescope here.
5. Fill in the following observation sheet below.




*Wikipedia, IAU and Sky & Telescope magazine, Roger Sinnott & Rick Fienberg, 2011*

*Orion Nebula (M42), courtesy of Jeff Swick*

**Date: _____Observation site: _____**

**Weather:_____Trees: _____Light pollution: _____**

Draw and label M42 in the constellation Orion.

**Discussion:**

- Describe your experience locating M42.

- Is it what you expected to see? Describe what it looked like through a telescope.

- What did you find interesting and challenging about this activity?

## Activity 34

# Deep Sky Object Observation: The Ring Nebula (M57)

**Objective**: Observe the Ring Nebula with your telescope.

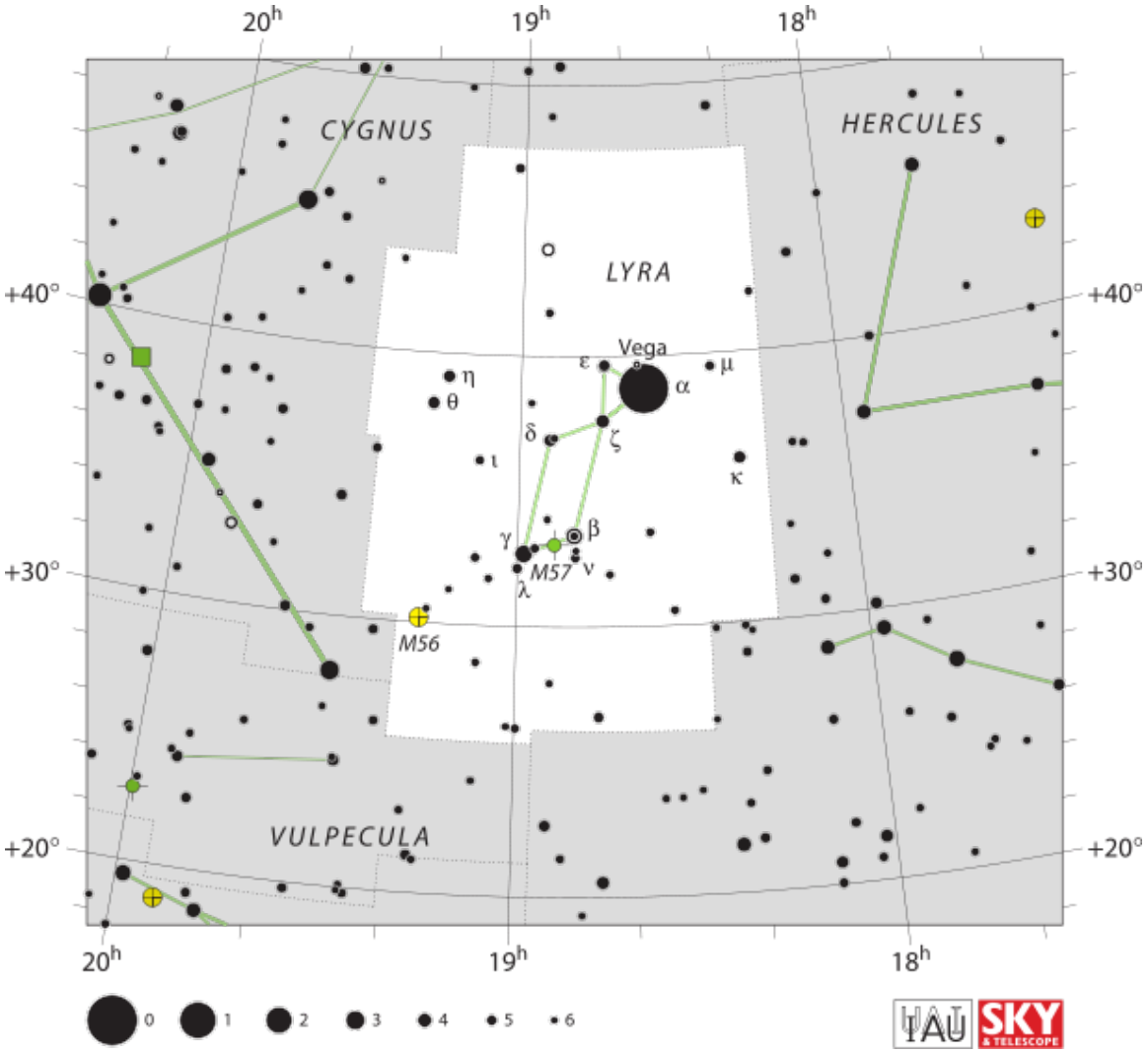
**Time of year for viewing**: Summer

**Materials**: Observation sheet, pen or pencil, reference book, telescope

**Background**: The Ring Nebula (M57) is probably the most difficult object to locate in this activity guide. You will also need to ensure that you are in a very dark area away from any light pollution. M57 is located in the constellation Lyra. Lyra is not too difficult to locate if you know how to use the summer triangle (refer to chapter four of your reference book), but the Ring Nebula itself is fairly dim and you will need to ensure that your telescope is well calibrated. The Ring Nebula is located in between two bottom stars in the constellation; point your telescope here and make some find adjustments as needed.

**Instructions:**

1. Find a dark area away from city lights.
2. Locate the Lyra constellation with the star chart provided.
3. Find Vega which is the brightest star in the constellation (it also is one of the stars in the summer triangle – refer to chapter four of your reference book for more information).
4. Move down from Vega to the two bottom stars in the constellation. Within these two stars is M57. Point your telescope here.
5. Fill in the following observation sheet.




*Wikipedia, IAU and Sky & Telescope magazine, Roger Sinnott & Rick Fienberg, 2011*

**Date: _____ Observation site:_____**

**Weather: _____ Trees: _____ Light pollution: _____**

Draw and label M57 in the constellation Lyra.

**Discussion:**

- Describe your experience locating M57.

- Is it what you expected to see? Describe what it looked like.

- What did you find interesting and challenging about this activity?

# Activity 35 My Project Evaluation

**Objective**: To reflect on this project and think about what you learned, what you found useful, interesting and challenging.

**Materials**: Your record book, your thoughts and reflections, paper, pen or pencil

**Instructions**: At the end of your record book you will see a title that says “My Project Evaluation”. Reflect back on the year and answer the questions that are listed in your record book.

*Large Magellanic Cloud, Wikipedia, HubbleSite, 2006*

*Saskatchewan Skies, courtesy of Jeff Swick*


3830 Thatcher Avenue
Saskatoon, Saskatchewan S7R 1A5
306-933-7727 • 306-933-7730 (fax)
www.4-h.sk.ca • info@4-h.sk.ca