

CONSTELLATION ADVENTURE

Starry Night™



Boy Scouts of America ASTRONOMY Merit Badge Guide

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 IMAGINOVA.

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I. Introduction

Astronomy is one of the oldest sciences. In ancient cultures, an understanding of astronomy was needed to predict the coming of the seasons and when to plant and harvest crops. At sea, sailors used the position of objects in the sky to track where they were on Earth. Before the invention of clocks, people used the position of the Sun to tell the time.

Astronomy is also a young science. In the last decades, we have learned a great deal about the universe we live in and are part of. From the size and age of the universe to exotic objects such as black holes.

The sky is just as fascinating to explore as it was in ancient times. But how many of us can tell the difference between a star and a planet? Or find the Big Dipper and north star? In the modern world we've lost the connection with the sky. But by earning the astronomy merit badge you can reconnect with the sky and become an expert backyard astronomer. It's fun, especially with the help of *Starry Night Constellation Adventure*.

The astronomy merit badge requires that you learn something of how the sky works. **Starry Night Constellation Adventure** can speed you to success with helpful tips and information. You'll be able to plan your sky observations to get the most out of them. **Starry Night Constellation Adventure** lets you be the scientist. You can ask questions, plan observations and test your ideas. When you're done, the sky will be as familiar to you as your own neighborhood.

Acquiring your merit badge requires some effort. The experience will be more enjoyable if you listen to the suggestions provided by your counselor. Your counselor is familiar with the many resources available in **Starry Night Constellation Adventure** and how to best apply them to meet your astronomy merit badge requirements.

II. Tools of the Astronomer

Astronomers always start their research by learning as much as possible about their subject ahead of time. This means you'll need a good book to get started. You'll need your eyes and your brain, a pair of binoculars and maybe a telescope. You'll need a notebook to keep track of your observations and to record your measurements.

When you travel to new places, it helps to have a map. In this case, sky charts are what you need. Another useful item is a red-light flashlight. It lets you read your sky chart at night without destroying your night vision.

Knowing ahead of time what you can see in the sky is a real time-saver. Before there were artificial lights, people saw the stars and learned the Moon's phases at a young age. Now it's hard to see the stars through all that light at night. This is where computer programs like **Starry Night Constellation Adventure** can help. They let you predict what you will see tonight, next week, next month, or next year. This means you can plan your observations ahead of time.

Starry Night Constellation Adventure is the perfect helper for your astronomy merit badge. It is sky simulation software that lets you test your ideas, plan your observations, and print your own sky charts. It will help you find and identify stars, constellations, planets and more. It comes with a field guide to the night sky and a handy red-light flashlight. It's a complete sky watcher's package that can take you beyond the basic requirements of your astronomy merit badge.

III. Using Constellation Adventure

Using the software is easy. The Quick Start Guide included with the package will get you up and running in minutes. You can control the **Starry Night Constellation Adventure** screen with the menus and toolbar buttons at the top of the screen. To learn all about the program controls, click on the *Starry Night Basics* chapter in the *SkyGuide* pane of **Starry Night Constellation Adventure**. Then go ahead and set the sky for where and when you like!

Starry Night Constellation Adventure gives you even more resources:

★ **Starry Night Constellation Adventure:** Beside the main window is the *SkyGuide* pane.

SkyGuide contains software tutorials and interactive guided tours on many astronomy topics. You'll find the answers to a lot of your badge requirements in *SkyGuide*, plus a whole lot more.

★ **Star Charts:** **Starry Night Constellation Adventure** lets you print your own star charts. You can use the software to find when and where certain stars, constellations and planets will appear in the sky. Then you can print customized charts for your location and for the best time to view your chosen objects. *SkyGuide* has tips and directions on how to make star charts in the *Starry Night Basics* section.

★ **Under a Starry Night Field Guide:** **Starry Night Constellation Adventure** comes with a 48-page astronomy field guide. It's divided into sections on finding your way around the sky, measuring the sky, stars and constellations, the Moon and planets, eclipses, telescopes and more. It even has seasonal sky maps to help you find your place under the stars. Take it out under the stars with you when you go observing.

IV. The Astronomy Merit Badge Requirements

Requirement 1: Observing Tips & Safe Solar Observing

Describe the proper clothing and other precautions for safely making observations at night and in cold weather. Tell how to safely observe the Sun, objects near the Sun, and the Moon.

Always dress for the weather. It can get very cold at night so be prepared to bundle up with extra layers of clothing. A warm hat, mitts and sturdy insulated boots are a must. A thermos of hot soup or cocoa can also help keep you warm.

The Sun's rays can burn your retina and cause permanent eye damage. **Never look directly at the Sun**

or observe the Sun with binoculars or a telescope without a 100% safe solar filter and adult supervision. Small green-glass Sun filters that attach to the eyepiece of a telescope can shatter from heat build-up in the telescope. They are not safe. Never use them. Small Sun filters supplied with department store telescopes are not safe and should never be used to view the Sun. If your eyes are accidentally exposed to unfiltered sunlight through binoculars or a telescope, seek immediate medical attention.

Safe solar filters are usually made of specially coated optical glass or Mylar film and can be purchased from specialty shops such as **Orion Telescopes and Binoculars** – www.oriontelescopes.com. The Sun can also be safely observed using the pinhole projection technique.

Observing objects in the sky that appear close to the Sun can only be safely done once the Sun is below the horizon.

Solar Resources

Daily Sun Images from the SOHO Space Observatory
sohowww.nascom.nasa.gov

Space Weather
spaceweather.com

Requirement 2: Light and Air Pollution

Explain what light pollution is and how it and air pollution affect astronomy.

Light pollution is the glow of upward-directed artificial light. It brightens the night sky and blocks the light of stars and other celestial objects. Air pollution is a mixture of different particles of gas, dust, smoke and smog in the air that comes from human activity. It makes the air less transparent so it is harder to see faint stars in the nighttime sky.

Light Pollution Resources

Dark Sky Association (IDA)
www.darksky.org

Clear Sky Clock
cleardarksky.com/csk/

Requirement 3: Binoculars & Telescopes

With the aid of diagrams (or real telescopes if available), do each of the following:

- A) Explain why binoculars and telescopes are important astronomical tools. Demonstrate or explain how these tools are used.*
- B) Describe the similarities and differences of several types of astronomical telescopes.*
- C) Explain the purposes of at least three instruments use with astronomical telescopes.*

Chapter 4 and 5 of the *Under a Starry Night* field guide tells you about binoculars and telescopes. You'll find comparisons, user tips and what to expect when looking through each of these instruments. Most telescopes are supplied with a few extra pieces of equipment. Aiming devices and "finder scopes" help you find objects in the sky. Motors can drive the telescope so it tracks the motion of the sky as you observe. Different eyepieces provide varying magnification. Many telescopes can be fitted with adaptors that allow you to attach different kinds of cameras to the telescope so you can photograph what you see.

SkyGuide has information and lists of objects suitable for viewing with binoculars. Click on Guided Tours> Quick find> Objects for binoculars in the *SkyGuide* pane.

Requirement 4: Stars, Constellations & the Milky Way

- A) Identify in the sky at least 10 constellations, at least four of which are in the Zodiac.
- B) Identify at least eight conspicuous stars, five of which are of magnitude 1 or brighter.
- C) Make two sketches of the Big Dipper. In one sketch, show the Big Dipper's orientation in the early evening sky. In another sketch, show its position several hours later. In both sketches, show the North Star and the horizon. Record the date and time each sketch was made.
- D) Explain what we see when we look at the Milky Way.

Chapter 1 and 2 in the *Under a Starry Night* field guide are full of tips on how to find your way around the sky. Chapter 3 tells you about constellations and using star maps. Use them along with the **Starry Night Constellation Adventure** software and you will be finding and identifying stars and constellations with ease. Explore these chapter sections in *SkyGuide* to locate stars and constellations:

Guided tours> Quick find> The stars

Guided tours> Quick find> The constellations

Guided tours> Quick find> The constellations> The Zodiac

Starry Night Constellation Adventure also comes with a Dipper Clock. The Dipper Clock is a fun and easy way to tell time by looking at the Big Dipper. Or you can use it to predict where you will see the Big Dipper in the sky at any time of night and at any time of the year. You can also use the software to do the same thing and then compare results.

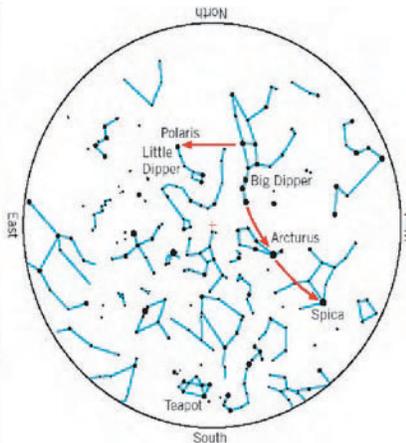
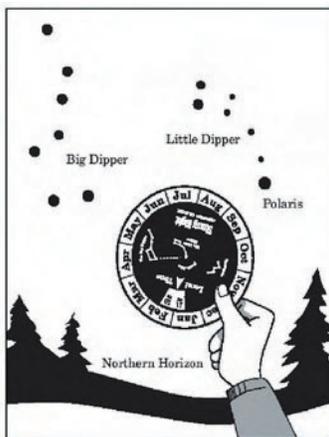


Figure 1. Starry Night Constellation Adventure comes with a Dipper Clock and star charts so finding your way around the sky is a snap.

The Stars and Beyond section of chapter 5 in *Under a Starry Night* will introduce you to galaxies and the Milky Way. More about the Milky Way can be found in the following *SkyGuide* chapter:

Guided Tours> Our solar system, the stars and galaxies> Our Galaxy

Requirement 5: Planets

- A) *List the names of the five most visible planets. Explain which ones can appear in phases similar to lunar phases and which ones cannot, and explain why.*
- B) *Find out when each of the five most visible planets that you identified in requirement 5a will be observable in the evening sky during the next 12 months, then compile this information in the form of a chart or table. Update your chart monthly to show whether each planet will be visible during the early morning or in the evening sky.*

Chapters 3, 4 and 5 in the *Under a Starry Night* field guide are your planet primers. This is where you can find out how a planet's position in the solar system affects how it looks to us on Earth. You can use **Starry Night Constellation Adventure** software to find planets in the sky and to track their motion in the sky over time. Find in-depth planet tutorials by clicking on these *SkyGuide* chapters:

Guided tours> Quick find> The planets

Guided tours> Our Solar system, the stars and galaxies> Planets

Requirement 6: Observing Planets

At approximately weekly intervals, sketch the position of Venus, Mars or Jupiter in relation to the stars. Do this for at least four weeks and at the same time of night. On your sketch, record the date and time next to the planet's position. Use your sketch to explain how planets move.

The Way Out Wanderers section in Chapter 3 of the *Under a Starry Night* field guide will help you figure out planet motions. With **Starry Night Constellation Adventure** software you can speed up time and watch days, weeks or months of planetary motion in just minutes! It will help you plan your observing and make this part of your merit badge simple. More information and animations can be found in the following *SkyGuide* chapter:

Guided tours> Our Solar system, the stars and galaxies> Planets

From here you can explore each of the planets in great detail.

Requirement 7: Moon

- A) *Sketch the face of the moon and indicate at least five seas and five craters. Label these landmarks.*
- B) *Sketch the phase and the daily position of the Moon at the same hour and place, for a week. Include landmarks on the horizon such as hills, trees, and buildings. Explain the changes you observe.*
- C) *List the factors that keep the Moon in orbit around the Earth.*
- D) *With the aid of diagrams, explain the relative positions of the Sun, Earth, and the Moon at the times of lunar and solar eclipses, and at the times of new, first-quarter, full, and last-quarter phases of the moon.*

You can find everything you need to know about the Moon in different sections of chapters 3 and 4 in the *Under a Starry Night* field guide. You'll even find a Moon map that shows the main features on the Moon. In *SkyGuide* you'll learn how gravity affects the Earth and Moon. Not only does it raise tides on our oceans, but it also slows down the rotation of both Earth and Moon. Click on Guided tours> Our Solar system, the stars and galaxies> The Moon> The Moon's effect on Earth to discover more. You can use **Starry Night Constellation Adventure** software to observe the changing phases of the Moon, to determine its phases, and to see how moonrise and moonset times change through the month.

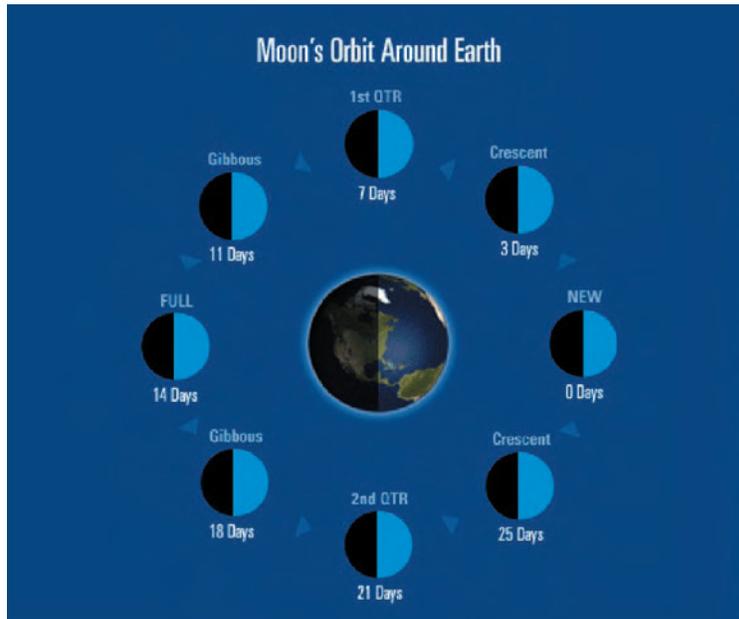


Figure 2 a. As the Moon moves in its orbit around the Earth, our view of the sunlit and shadowed halves of the lunar sphere changes, causing the monthly phases of the Moon. In this view from high above Earth's North Pole, the Sun is shining from the right. Note: diagram is not drawn to scale.



Figure 2 b. The Earth-based view of the sunlit and shadowed portions of the Moon's sphere progress from new moon through full moon and back to new moon over the course of one lunar cycle.

You can also use **Starry Night Constellation Adventure** software to see how lunar and solar eclipses happen. These *SkyGuide* chapter sections are good places to start:

- Guided tours> Our Solar system, the stars and galaxies> The Moon
- Guided tours> Our Solar system, the stars and galaxies> Lunar Eclipses
- Guided tours> Our Solar system, the stars and galaxies> Solar Eclipses

Requirement 8: Sun & Star Colors

A) Describe the composition of the Sun, its relationship to other stars, and some effects of its radiation on Earth's weather. Define sunspots and describe some of the effects they may have on solar radiation.

B) Identify at least one red star, one blue star, and one yellow star (other than the Sun). Explain the meaning of these colors.

Our Sun is one star among billions of stars. It's bigger, hotter and brighter than many stars, but also smaller, cooler and dimmer than some stars. It's the closest star to Earth. This means we can learn a lot about stars by studying the Sun. These *SkyGuide* chapters can get you started on solar science:

Guided tours> Quick find> The Sun and Moon

Guided tours> Our Solar System, the stars and galaxies> The Sun

Guided tours> Our Solar System, the stars and galaxies> The Earth> Our home

The color of a star is related to its temperature. With **Starry Night Constellation Adventure** you can click on a star to select it. Then click on the info pane to get information about that star. Can you tell which color stars are the hottest and the coolest?

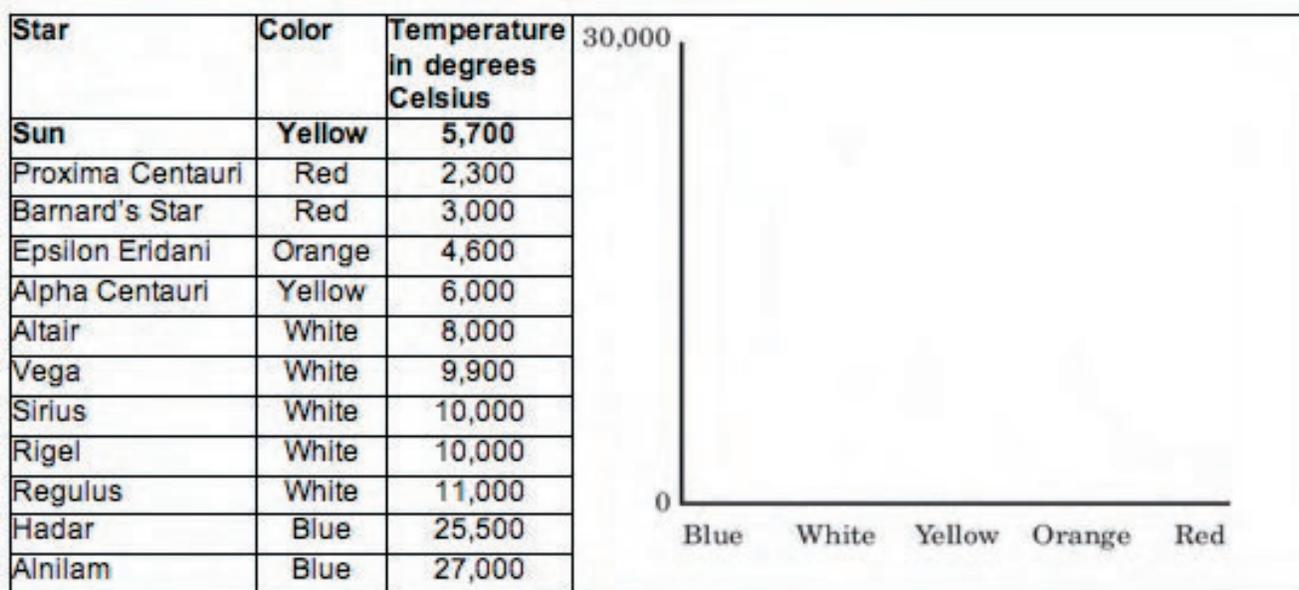


Figure 3. Try plotting star temperature versus star color to see if you can discover the relationship between these two factors.

Requirement 9: Planetarium, Observatory & Star Party

With your counselor's approval and guidance, do ONE of the following:

A) Visit a planetarium or astronomical observatory. Submit a written report, a scrapbook, or a video presentation afterward to your counselor that includes the following information:

1. Activities occurring there
2. Exhibits and displays you saw
3. Telescopes and instruments being used
4. Celestial objects you observed.

B) Plan and participate in a three-hour observation session that includes using binoculars or a telescope. List the celestial objects you want to observe, and find each on a star chart or in a guidebook. Prepare an observing log or notebook. Show your plan, charts, and log or notebook to your counselor before making your observations. Review your log or notebook with your counselor afterward.

C) Plan and host a star party for your Scout troop or other group such as your class at school. Use binoculars or a telescope to show and explain celestial objects to the group.

D) Help an astronomy club in your community hold a star party that is open to the public.

E) Personally take a series of photographs or digital images of the movement of the Moon, a planet, and asteroid or meteoroid, or a comet. In your visual display, label each image and include the date and time it was taken. Show all positions on a star chart or map. Show your display at school or at a troop meeting. Explain the changes you observed.

Starry Night Constellation Adventure software can help you plan observing sessions and star parties. You can use it to find out if the Moon will be full and bright, or if it will be a thin crescent that sets early and doesn't outshine the dimmer stars. You'll be able to tell what bright planets are up in the sky and where they can be found. You can locate and prepare lists of deep sky objects you want to observe like nebulae, star clusters and the brighter galaxies. You can print customized star charts to help you find objects in binoculars or a telescope. You can impress your friends by using the Dipper Clock to tell the time. Before you know it, you'll be an expert stargazer who really knows their way around the sky!

Requirement 10: Careers

List at least three different career opportunities in astronomy. Pick the one in which you are most interested and explain how to prepare for such a career. Discuss with your counselor what courses might be useful for such a career.

There are many different career tracks in astronomy. Most astronomers do research of some kind at universities or large research institutions. Many astronomers also teach at the university level. Others go on to become managers and administrators in large university departments, observatories or research institutions. Some astronomers work in science centers and planetariums. Some work as writers and science communication specialists.

Other astronomers started out in other fields of study like geology, meteorology, mathematics or physics, and found that their research interest steered them toward astronomy. Other careers that connect with astronomy are computer science, engineering, space systems and space technology, and robotics. Modern space science also includes the life sciences and health sciences.

People interested in science careers take as many math, science and technology courses as they can in school. After public school they enter universities and technical or engineering schools. Many go on to the expert PhD level and become lead investigators in a wide range of subject area specialties. In astronomy and space science, the sky imposes no limits!

Careers in Astronomy Resources

American Astronomical Association
www.aas.org/education/careers.html

The Astronomy Café
www.astronomycafe.net/qadir/acareer.html

V. Summary

Starry Night Constellation Adventure has everything you need to become an expert backyard astronomer, and to have fun earning your astronomy merit badge at the same time. You can use the sky charts it provides and you can make your own customized charts. You can plan and organize your observations. *Under a Starry Night* field guide and the interactive *SkyGuide* give you expert help along the way. Good luck earning your badge, and most important, have fun out in the starry night!

At Starry Night®, we have an entire family of astronomy products for you to enjoy. Visit <http://www.starrynight.com> to see the latest versions of the “World’s Leading Astronomy Software.”

There’s something for everyone with Starry Night, the most trusted name in astronomy software!

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STARRY NIGHT PRO PLUS

If you demand the utmost in realism, richness of detail, breadth of observational tools and depth of information in astronomy software, Starry Night Pro Plus features a full-color photograph of the entire night sky and much more for an unrivaled desktop planetarium experience.



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