



Astronomy

Merit Badge Workbook



This workbook can help you but you still need to read the merit badge pamphlet.

This Workbook can help you organize your thoughts as you prepare to meet with your merit badge counselor.

You still must satisfy your counselor that you can demonstrate each skill and have learned the information. You should use the work space provided for each requirement to keep track of which requirements have been completed, and to make notes for discussing the item with your counselor, not for providing full and complete answers.

If a requirement says that you must take an action using words such as "discuss", "show", "tell", "explain", "demonstrate", "identify", etc, that is what you must do.

Merit Badge Counselors may not require the use of this or any similar workbooks.

No one may add or subtract from the official requirements found in Boy Scout Requirements (Pub. 33216 – SKU 621535).

The requirements were last issued or revised in 2013 • This workbook was updated in September 2016.

Scout's Name: _____ Unit: _____

Counselor's Name: _____ Counselor's Phone No.: _____

<http://www.USScouts.Org> • <http://www.MeritBadge.Org>

Please submit errors, omissions, comments or suggestions about this **workbook** to: Workbooks@USScouts.Org
Comments or suggestions for changes to the **requirements** for the **merit badge** should be sent to: Merit.Badge@Scouting.Org

1. Do the following:

- a. Explain to your counselor the most likely hazards you may encounter while participating in astronomy activities, and what you should do to anticipate, help prevent, mitigate, and respond to these hazards.

Hazards:

What you should do:

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- b. Explain first aid for injuries or illnesses such as heat and cold reactions, dehydration, bites and stings, and damage to your eyes that could occur during observation.

Heat reactions:

Cold reactions;

Dehydration;

Bites and stings:

Damage to your eyes:

- c. Describe the proper clothing and other precautions for safely making observations at night and in cold weather.

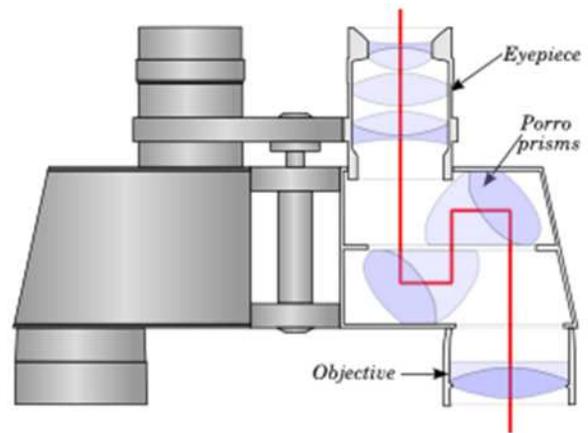
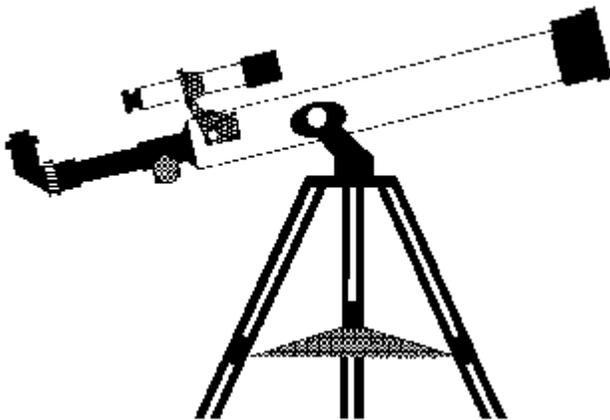
Night:

Cold Weather:

Then explain how to safely observe the Sun, objects near the Sun, and the Moon.

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

3. 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, including at least one that observes light beyond the visible part of the spectrum (i.e., radio, X-ray, ultraviolet, or infrared).

- c. Explain the purposes of at least three instruments used with astronomical telescopes.

- d. Describe the proper care and storage of telescopes and binoculars both at home and in the field.

4. Do the following:

- a. Identify in the sky at least 10 constellations, at least four of which are in the zodiac.

<input type="checkbox"/> 1.	
<input type="checkbox"/> 2.	
<input type="checkbox"/> 3.	
<input type="checkbox"/> 4.	
<input type="checkbox"/> 5.	
<input type="checkbox"/> 6.	
<input type="checkbox"/> 7.	
<input type="checkbox"/> 8.	
<input type="checkbox"/> 9.	
<input type="checkbox"/> 10.	

b. Identify at least eight conspicuous stars, five of which are of magnitude 1 or brighter.

	Name of star	Magnitude 1 or brighter?
<input type="checkbox"/> 1.		
<input type="checkbox"/> 2.		
<input type="checkbox"/> 3.		
<input type="checkbox"/> 4.		
<input type="checkbox"/> 5.		
<input type="checkbox"/> 6.		
<input type="checkbox"/> 7.		
<input type="checkbox"/> 8.		

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.

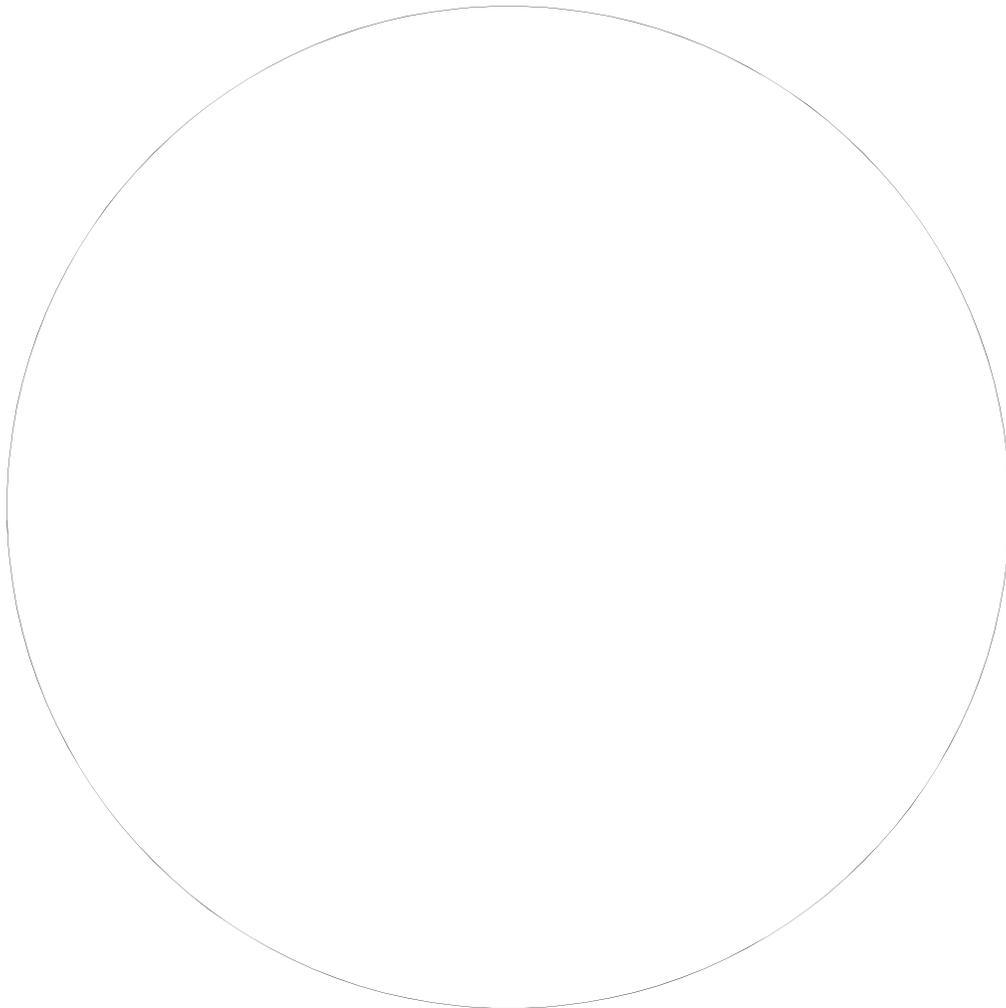
Date: __/__/__ Time: ____	Date: __/__/__ Time: ____	
<p>● North Star</p>		
West	North	East
<p><u>Suggested procedure:</u> <i>Choose a clear night when you will have time and the ability to make observations some hours apart. Looking north, draw the position of the Big Dipper with relation to the North Star. Note the time next to it. Several hours later (six hours are best but at least four hours and preferably more than five hours) draw the position of the big dipper with relation of the North Star and note the time next to it. (Be sure to clearly identify which diagram represents which observation)</i></p>		

c. Describe the motion of the planets across the sky.

d. Observe a planet and describe what you saw.

6. Do the following:

a. Sketch the face of the Moon and indicate at least five seas and five craters. Label these landmarks.



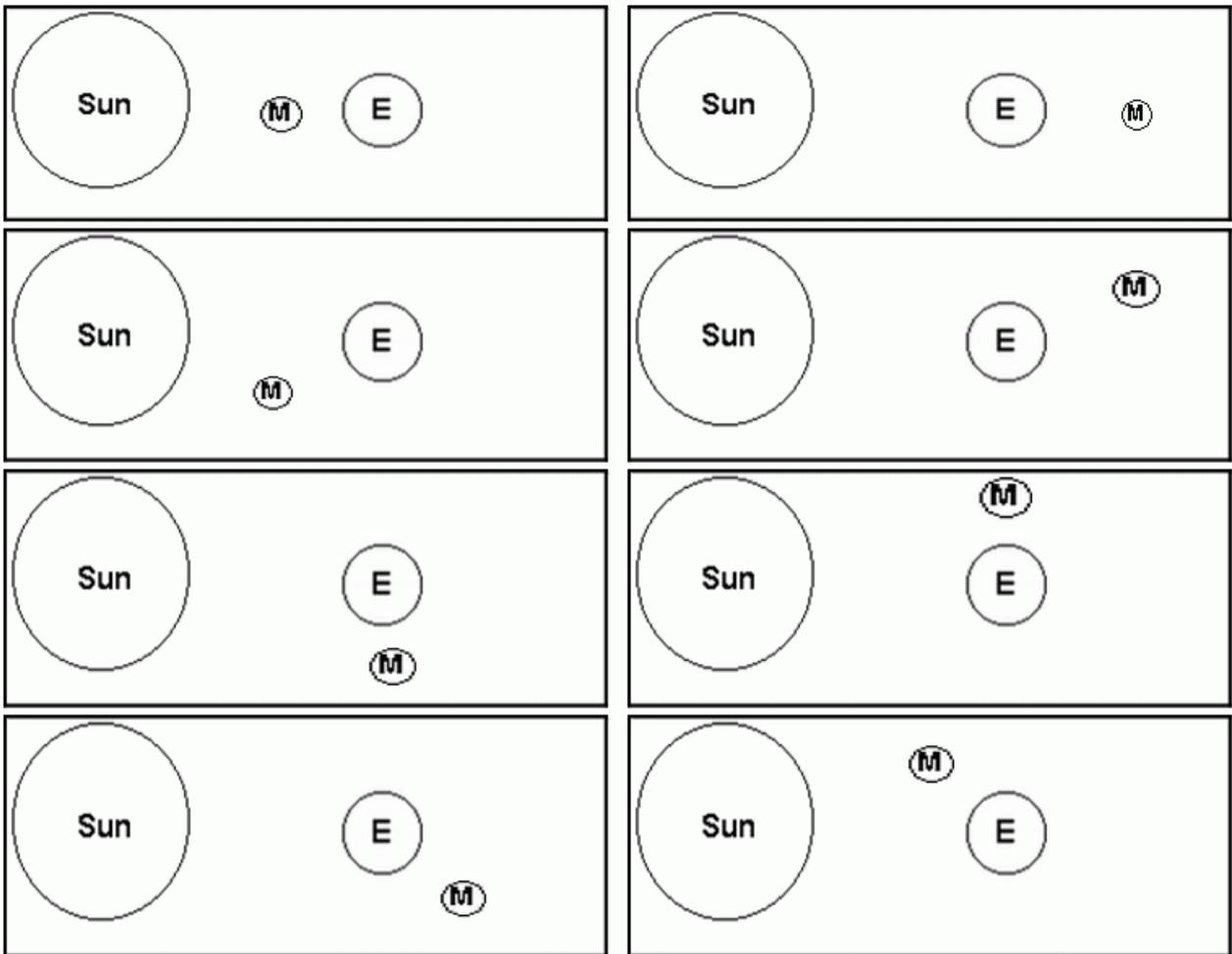
- b. Sketch the phase and the daily position of the Moon, at the same hour and place, for four days in a row. Include landmarks on the horizon such as hills, trees, and buildings.

Date: __/__/__ Time: ____	Date: __/__/__ Time: ____	
Date: __/__/__ Time: ____	Date: __/__/__ Time: ____	
East	South	West
<p><u>Suggested procedure:</u> <i>First check to see whether it is a morning or evening moon and chose a time to view the moon. Avoid an observation period when there will be a new moon. Choose a time and place you are going to be able to observe the moon each day. On the first day, sketch the relative position of the moon across the southern horizon noting its height and shape (phase). Draw some landmarks on the sketch as points of reference. On the same drawing, repeat this at the same time each day for the next three days, showing the height and shape of the moon for each observation. <u>Note the date and time of your observation next to each sketch of the moon.</u> If the sky is overcast and the moon is not visible, either extend the observations until you can make four of them, and/or using the other observations, estimate where the moon would have been and what shape it would have been on the overcast day(s) and indicate that what is an estimate due to overcast sky.</i></p>		

Explain the changes you observe.

c. List the factors that keep the Moon in orbit around 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.



Editor's Note: These diagrams can be used to show the relative positions of the Sun, Earth, and Moon during the new, first-quarter, full, and last-quarter phases of the Moon as well as during the Waxing Gibbous, Waning Gibbous, Waxing Crescent, and Waning Crescent phases of the Moon (which is not required for the merit badge). Two of the diagrams can be used to show the positions both for a phase of the Moon and during an eclipse.

7. Do the following:

- a. Describe the composition of the Sun, its relationship to other stars, and some effects of its radiation on Earth's weather and communications.

Composition:

Relationship to other stars:

Effects on Earth's weather:

Effects on communications.

- b. Define sunspots and describe some of the effects they may have on solar radiation.

Definition:

Effects:

- c. Identify at least one red star, one blue star, and one yellow star (other than the Sun).

Red star:

Blue star:

Yellow star:

Explain the meaning of these colors.

8. 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.

9. Find out about three career opportunities in astronomy.

1.	
2.	
3.	

Pick one and find out the education, training, and experience required for this profession _____

Discuss this with your counselor, and explain why this profession might interest you.

Requirement resources can be found here:
http://www.meritbadge.org/wiki/index.php/Astronomy#Requirement_resources

Important excerpts from the Guide To Advancement - 2015, No. 33088 (SKU-620573)

[1.0.0.0] — Introduction

The current edition of the *Guide to Advancement* is the official source for administering advancement in all Boy Scouts of America programs: Cub Scouting, Boy Scouting, Varsity Scouting, Venturing, and Sea Scouts. It replaces any previous BSA advancement manuals and previous editions of the *Guide to Advancement*.

[Page 2, and 5.0.1.4] — Policy on Unauthorized Changes to Advancement Program

No council, committee, district, unit, or individual has the authority to add to, or subtract from, advancement requirements. There are limited exceptions relating only to youth members with special needs. For details see section 10, "Advancement for Members With Special Needs".

[Page 2] — The "Guide to Safe Scouting" Applies

Policies and procedures outlined in the *Guide to Safe Scouting*, No. 34416, apply to all BSA activities, including those related to advancement and Eagle Scout service projects.

[7.0.3.1] — The Buddy System and Certifying Completion

A youth member must not meet one-on-one with an adult. Sessions with counselors must take place where others can view the interaction, or the Scout must have a buddy: a friend, parent, guardian, brother, sister, or other relative—or better yet, another Scout working on the same badge—along with him attending the session. If merit badge counseling or instruction includes any Web-based interaction, it must be conducted in accordance with the BSA Social Media Guidelines (<http://www.scouting.org/Marketing/Resources/SocialMedia>). For example, always copy one or more authorized adults on email messages between counselors and Scouts.

When the Scout meets with the counselor, he should bring any required projects. If these cannot be transported, he should present evidence, such as photographs or adult verification. His unit leader, for example, might state that a satisfactory bridge or tower has been built for the Pioneering merit badge, or that meals were prepared for Cooking. If there are questions that requirements were met, a counselor may confirm with adults involved. Once satisfied, the counselor signs the blue card using the date upon which the Scout completed the requirements, or in the case of partials, initials the individual requirements passed.

Note that from time to time, it may be appropriate for a requirement that has been met for one badge to also count for another. See "Fulfilling More Than One Requirement With a Single Activity," 4.2.3.6.

[7.0.3.2] — Group Instruction

It is acceptable—and sometimes desirable—for merit badges to be taught in group settings. This often occurs at camp and merit badge midways, fairs, clinics, or similar events. Interactive group discussions can support learning. The method can also be attractive to "guest experts" assisting registered and approved counselors. Slide shows, skits, demonstrations, panels, and various other techniques can also be employed, but as any teacher can attest, not everyone will learn all the material.

There must be attention to each individual's projects and his fulfillment of *all* requirements. We must know that every Scout—actually and *personally*—completed them. If, for example, a requirement uses words like "show," "demonstrate," or "discuss," then every Scout must do that. It is unacceptable to award badges on the basis of sitting in classrooms *watching* demonstrations, or remaining silent during discussions.

It is sometimes reported that Scouts who have received merit badges through group instructional settings have not fulfilled all the requirements. To offer a quality merit badge program, council and district advancement committees should ensure the following are in place for all group instructional events.

- A culture is established for merit badge group instructional events that partial completions are acceptable expected results.
- A guide or information sheet is distributed in advance of events that promotes the acceptability of partials, explains how merit badges can be finished after events, lists merit badge prerequisites, and provides other helpful information that will establish realistic expectations for the number of merit badges that can be earned at an event.
- Merit badge counselors are known to be registered and approved.
- Any guest experts or guest speakers, or others assisting who are not registered and approved as merit badge counselors, do not accept the responsibilities of, or behave as, merit badge counselors, either at a group instructional event or at any other time. Their service is temporary, not ongoing.
- Counselors agree to sign off only requirements that Scouts have actually and personally completed.
- Counselors agree not to assume prerequisites have been completed without some level of evidence that the work has been done. Pictures and letters from other merit badge counselors or unit leaders are the best form of prerequisite documentation when the actual work done cannot be brought to the camp or site of the merit badge event.
- There is a mechanism for unit leaders or others to report concerns to a council advancement committee on summer camp merit badge programs, group instructional events, and any other merit badge counseling issues—especially in instances where it is believed BSA procedures are not followed. See "Reporting Merit Badge Counseling Concerns," 11.1.0.0.
- There must be attention to each individual's projects and his fulfillment of all requirements. We must know that every Scout—actually and personally—completed them.

It is permissible for guest speakers, guest experts, or others who are not merit badge counselors to assist in the counseling process. Those providing such assistance must be under the direction of a registered and approved counselor who is readily available onsite, and provides personal supervision to assure all applicable BSA policies and procedures—including those related to BSA Youth Protection—are in place and followed.

[7.0.3.3] — Partial Completions

A Scout need not pass all the requirements of one merit badge with the same counselor. It may be that due to timing or location issues, etc., he must meet with a different counselor to finish the badge. The Application for Merit Badge has a place to record what has been finished—a "partial." In the center section on the reverse of the blue card, the counselor initials for each requirement passed. In the case of a partial completion, the counselor does not retain his or her portion of the card. A subsequent counselor may choose not to accept partial work, but this should be rare. A Scout, if he believes he is being treated unfairly, may work with his unit leader to find another counselor. An example for the use of a signed partial would be to take it to camp as proof of prerequisites. Partial completions have no expiration except the Scout's 18th birthday. Units, districts, or councils shall not establish other expiration dates for partial merit badges.

[7.0.4.8] — Unofficial Worksheets and Learning Aids

Worksheets and other materials that may be of assistance in earning merit badges are available from a variety of places including unofficial sources on the Internet and even troop libraries. Use of these aids is permissible as long as the materials can be correlated with the current requirements that Scouts must fulfill. Completing "worksheets" may suffice where a requirement calls for something in writing, but this would not work for a requirement where the Scout must discuss, tell, show, or demonstrate, etc. Note that Scouts shall not be required to use these learning aids in order to complete a merit badge.