



Environmental Science

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 2016 • This workbook was updated in March 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. Make a timeline of the history of environmental science in America.

1500s	
1600s	
1700s	
1800s	
1900s	

2000s

[illegible]

Identify the contribution made by the Boy Scouts of America to environmental science. Include dates, names of people or organizations, and important events.

[illegible]

2. Define the following terms: population, community, ecosystem, biosphere, symbiosis, niche, habitat, conservation, threatened species, endangered species, extinction, pollution prevention, brownfield, ozone, watershed, airshed, nonpoint source, hybrid vehicle, fuel cell.

Population:

[illegible]

Community:

[illegible]

Ecosystem:

[illegible]

Biosphere:

1. 姓名: 张三 2. 性别: 男 3. 年龄: 25 4. 职业: 程序员 5. 籍贯: 广东 6. 学历: 本科 7. 婚姻状况: 未婚 8. 兴趣爱好: 阅读, 运动 9. 教育经历: 2010-2014 年就读于某某大学计算机专业 10. 工作经历: 2014-2018 年就职于某某公司担任软件开发工程师 11. 自我评价: 性格开朗, 责任心强, 具备良好的团队合作精神和沟通能力	1. 姓名: 李四 2. 性别: 女 3. 年龄: 30 4. 职业: 教师 5. 籍贯: 湖南 6. 学历: 硕士 7. 婚姻状况: 已婚 8. 兴趣爱好: 音乐, 旅游 9. 教育经历: 2008-2012 年就读于某某大学教育学专业 10. 工作经历: 2012-2017 年就职于某某小学担任语文老师 11. 自我评价: 为人师表, 爱岗敬业, 具有扎实的专业知识和丰富的教学经验
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Symbiosis:

Niche:

Habitat:

Conservation:

Threatened species:

Endangered species:

Extinction

Pollution prevention:

Brownfield:

Ozone:

Watershed:

Airshed:

Nonpoint source:

Hybrid vehicle:

Fuel cell:

3. Do ONE activity in EACH of the following categories (using the activities in this pamphlet as the bases for planning and carrying out your projects):

a. Ecology

- ☐ 1. Conduct and experiment to find out how living things respond to changes in their environments. Discuss your observations with your counselor.
- ☐ 2. Conduct an experiment illustrating the greenhouse effect. Keep a journal of your data and observations. Discuss your conclusions with your counselor.
- ☐ 3. Discuss what is an ecosystem. Tell how it is maintained in nature and how it survives.

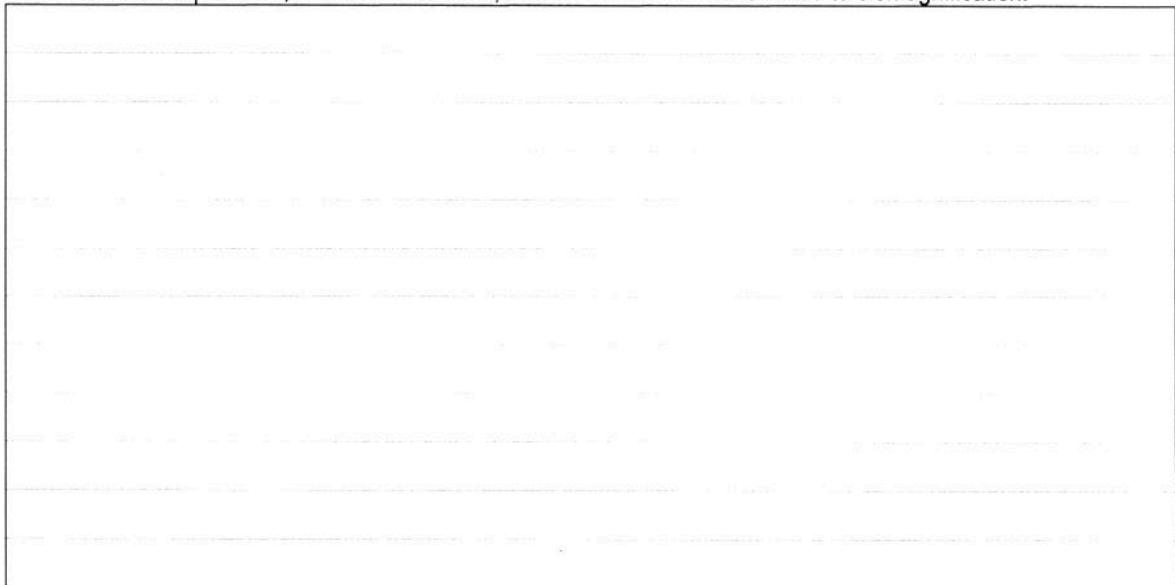
b. Air Pollution

- ☐ 1. Perform an experiment to test for particulates that contribute to air pollution. Discuss your findings with your counselor.
- ☐ 2. Record the trips taken, mileage, and fuel consumption of a family car for seven days, and calculate how many miles per gallon the car gets. Determine whether any trips could have been combined ("chained") rather than taken out and back. Using the idea of trip chaining, determine how many miles and gallons of gas could have been saved in those seven days.
- ☐ 3. Explain what is acid rain. In your explanation, tell how it affects plants and the environment and the steps society can take to help reduce its effects.



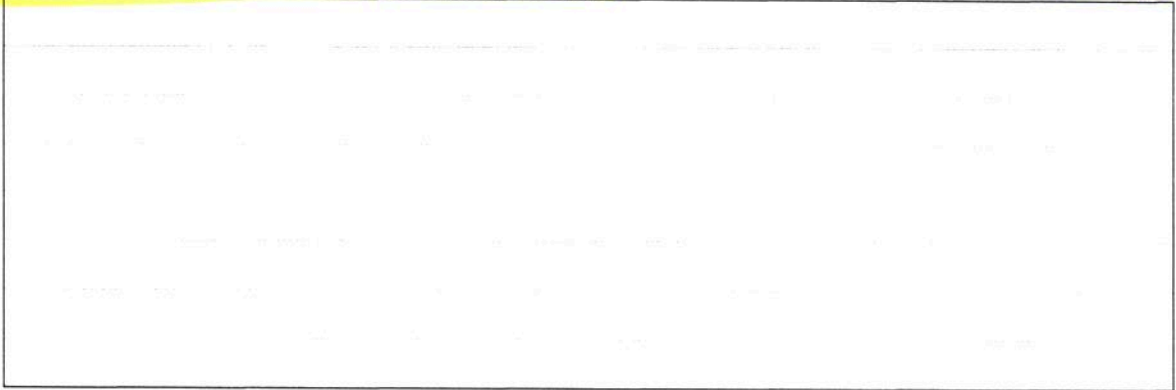
c. Water Pollution

- ☐ 1. Conduct an experiment to show how living things react to thermal pollution. Discuss your observations with your counselor.
- ☐ 2. Conduct an experiment to identify the methods that could be used to mediate (reduce) the effects of an oil spill on waterfowl. Discuss your results with your counselor.
- ☐ 3. Describe the impact of a waterborne pollutant on an aquatic community. Write a 100-word report on how that pollutant affected aquatic life, what the effect was, and whether the effect is linked to biomagnification.



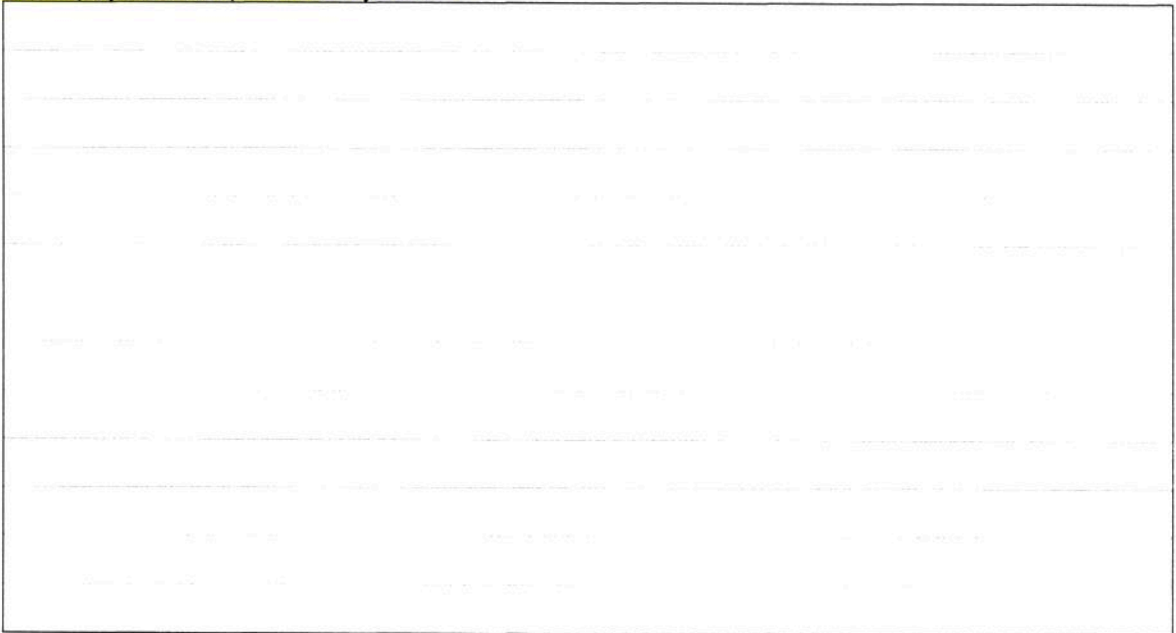
d. Land Pollution

- ☐ 1. Conduct an experiment to illustrate soil erosion by water. Take photographs or make a drawing of the soil before and after your experiment, and make a poster showing your results. Present your poster to your patrol or troop. (Per National, "troop" means "unit".)
- ☐ 2. Perform an experiment to determine the effect of an oil spill on land. Discuss your conclusions with your counselor.
- ☐ 3. Photograph an area affected by erosion. Share your photographs with your counselor and discuss why the area has eroded and what might be done to help alleviate the erosion.



e. Endangered Species

- ☐ 1. Do research on one endangered species found in your state. Find out what its natural habitat is, why it is endangered, what is being done to preserve it, and how many individual organisms are left in the wild. Prepare a 100-word report about the organism, including a drawing. Present your report to your patrol or troop.
- ☐ 2. Do research on one species that was endangered, or threatened, but which has now recovered. Find out how the organism recovered, and what its new status is. Write a 100-word report on the species and discuss it with your counselor.
- ☐ 3. With your parent's and counselor's approval, work with a natural resource professional to identify two projects that have been approved to improve the habitat for a threatened or endangered species in your area. Visit the site of one of these projects and report on what you saw.



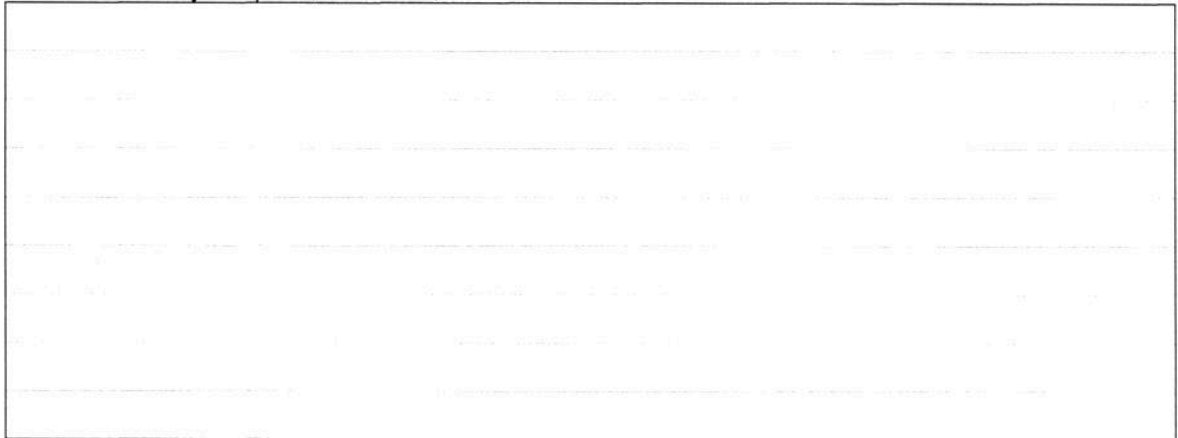
f. Pollution Prevention, Resource Recovery, and Conservation

- ☐ 1. Look around your home and determine 10 ways your family can help reduce pollution. Practice at least two of these methods for seven days and discuss with your counselor what you have learned.
- ☐ 2. Determine 10 ways to conserve resources or use resources more efficiently in your home, at school, or at camp. Practice at least two of these methods for seven days and discuss with your counselor what you have learned.
- ☐ 3. Perform an experiment on packaging materials to find out which ones are biodegradable. Discuss your conclusions with your counselor.



g. Pollination

- ☐ 1. Using photographs or illustrations, point out the differences between a drone and a worker bee. Discuss the stages of bee development (eggs, larvae, pupae). Explain the pollination process, and what propolis is and how it is used by honey bees. Tell how bees make honey and beeswax, and how both are harvested. Explain the part played in the life of the hive by the queen, the drones, and the workers.



- ☐ 2. Present to your counselor a one-page report on how and why honey bees are used in pollinating food crops. In your report, discuss the problems faced by the bee population today, and the impact to humanity if there were no pollinators. Share your report with your troop or patrol, your class at school, or another group approved by your counselor.
- ☐ 3. Hive a swarm OR divide at least one colony of honey bees. Explain how a hive is constructed

4. Choose two outdoor study areas that are very different from one another (e.g., hilltop vs. bottom of a hill; field vs. forest; swamp vs. dry land). For BOTH study areas, do ONE of the following:
 - a. Mark off a plot of 4 square yards in each study area, and count the number of species found there. Estimate how much space is occupied by each plant species and the type and number of non-plant species you find.

Study Plot Location 1: _____ Number of Species: _____

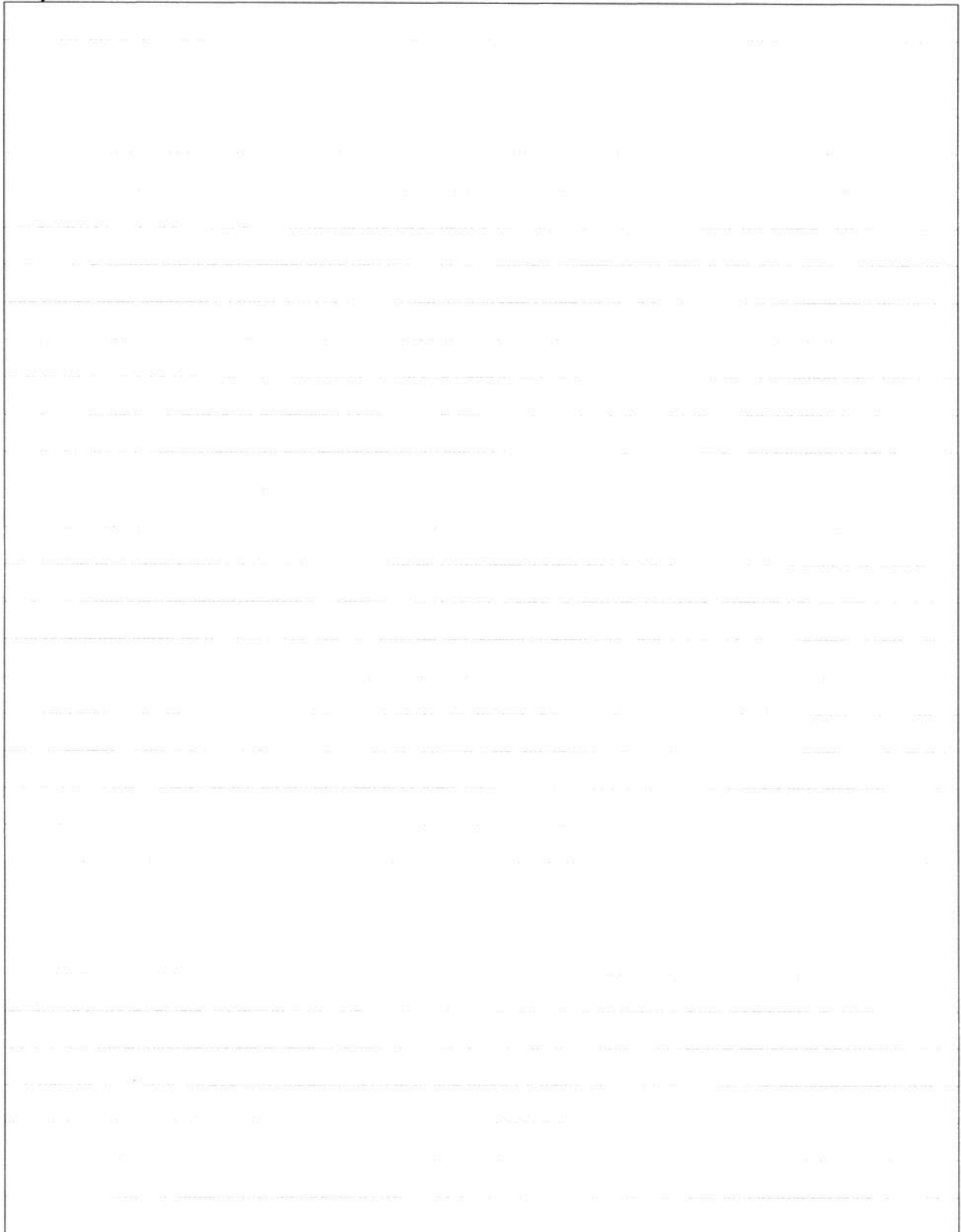
[illegible][illegible]

Study Plot Location 2: _____ Number of Species: _____

Plant Species	Space each occupies

Non-Plant Species	Number found

Write a report that adequately discusses the biodiversity and population density of these study areas. Discuss your report with your counselor.



- b. Make at least three visits to each of the two study areas (for a total of six visits), staying for at least 20 minutes each time, to observe the living and nonliving parts of the ecosystem. Space each visit far enough apart that there are readily apparent differences in the observations. Keep a journal that includes the differences you observe

Study Area 1:

Visit 1 Date: _____ **Time Started:** _____ **Time Ended:** _____

Observations of living parts:

[illegible]

Observations of nonliving parts:

1. The first part of the document is a letter from the President of the United States to the Congress, dated January 1, 1861. It is a formal address, and it is the first of its kind since the signing of the Constitution. The President, James Buchanan, is addressing the Congress, and he is doing so in a very formal and dignified manner. He is discussing the state of the Union, and he is discussing the issues that are facing the country at that time. He is also discussing the role of the President, and he is discussing the responsibilities of the Congress. The letter is a very important document, and it is a very interesting one to read. It gives us a glimpse into the mind of the President, and it gives us a glimpse into the state of the country at that time. It is a document that is worth reading, and it is a document that is worth studying.

Differences noted:

Technical drawing of a mechanical part, likely a piston or cylinder head, showing various dimensions and features. The drawing includes a top view, a side view, and a cross-section view. Dimensions are given in inches and centimeters. Key features include a central bore, a skirt, and a flange. The drawing is labeled with '1', '2', '3', '4', '5', '6', '7', '8', '9', '10', '11', '12', '13', '14', '15', '16', '17', '18', '19', '20', '21', '22', '23', '24', '25', '26', '27', '28', '29', '30', '31', '32', '33', '34', '35', '36', '37', '38', '39', '40', '41', '42', '43', '44', '45', '46', '47', '48', '49', '50', '51', '52', '53', '54', '55', '56', '57', '58', '59', '60', '61', '62', '63', '64', '65', '66', '67', '68', '69', '70', '71', '72', '73', '74', '75', '76', '77', '78', '79', '80', '81', '82', '83', '84', '85', '86', '87', '88', '89', '90', '91', '92', '93', '94', '95', '96', '97', '98', '99', '100'.

Visit 2 Date: _____ **Time Started:** _____ **Time Ended** _____

Observations of living parts:

Observations of nonliving parts:

[illegible]

Differences noted:

1. The first part of the document is a header section containing the following information:

- Page number: 1
- Date: 10/10/10
- Time: 10:10
- Location: 10:10
- Subject: 10:10

2. The second part of the document is a body section containing the following information:

- Section 1: 10:10
- Section 2: 10:10
- Section 3: 10:10
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- Section 8: 10:10
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- Section 100: 10:10

3. The third part of the document is a footer section containing the following information:

- Page number: 1
- Date: 10/10/10
- Time: 10:10
- Location: 10:10
- Subject: 10:10

Visit 3 Date: _____ **Time Started:** _____ **Time Ended** _____

Observations of living parts:

[illegible]

Observations of nonliving parts:

1. NAME OF THE VESSEL USSC 1000 NO. OF CREW 10
 2. NAME OF THE CAPTAIN JOHN J. HARRIS
 3. NAME OF THE COMMANDER JOHN J. HARRIS
 4. NAME OF THE FIRST OFFICER JOHN J. HARRIS
 5. NAME OF THE SECOND OFFICER JOHN J. HARRIS
 6. NAME OF THE THIRD OFFICER JOHN J. HARRIS
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 106. NAME OF THE HUNDRED-THIRD OFFICER JOHN J. HARRIS
 107. NAME OF THE HUNDRED-FOURTH OFFICER JOHN J. HARRIS
 108. NAME OF THE H

Differences noted:

Study Area 2:
Visit 1 Date: _____ **Time Started:** _____ **Time Ended:** _____
Observations of living parts:

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
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Observations of nonliving parts:

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Differences noted:

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
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Visit 2 Date: _____ Time Started: _____ Time Ended _____

Observations of living parts:

Observations of nonliving parts:

[illegible]

Differences noted:

1. The first part of the document is a title page. It contains the title "THE HISTORY OF THE UNITED STATES OF AMERICA" and the author "BY JAMES MADISON". It also includes the date "1791" and the publisher "NEW YORK: PRINTED BY J. B. ALLEN, 1791".

2. The second part of the document is a preface. It begins with the words "I have the honor to acknowledge the receipt of your letter of the 10th inst. and in reply to inform you that the same has been forwarded to the proper authorities for their consideration."

3. The third part of the document is the main body of the text. It is divided into several sections, each dealing with a different aspect of the history of the United States. The sections are:

- The first section deals with the early history of the United States, from the time of the first settlers to the time of the American Revolution.
- The second section deals with the American Revolution, from the time of the first battles to the time of the signing of the Declaration of Independence.
- The third section deals with the early years of the new nation, from the time of the signing of the Constitution to the time of the death of George Washington.
- The fourth section deals with the years of the French Revolution and the Napoleonic Wars, from the time of the signing of the Treaty of Amiens to the time of the signing of the Treaty of Paris.
- The fifth section deals with the years of the War of 1812, from the time of the declaration of war to the time of the signing of the Treaty of Ghent.
- The sixth section deals with the years of the Mexican War, from the time of the declaration of war to the time of the signing of the Treaty of Guadalupe Hidalgo.
- The seventh section deals with the years of the Civil War, from the time of the declaration of war to the time of the signing of the Emancipation Proclamation.
- The eighth section deals with the years of Reconstruction, from the time of the signing of the Reconstruction Act to the time of the signing of the Reconstruction Act of 1867.
- The ninth section deals with the years of the Gilded Age, from the time of the signing of the Sherman Antitrust Act to the time of the signing of the Sherman Antitrust Act of 1890.
- The tenth section deals with the years of the Progressive Era, from the time of the signing of the Sherman Antitrust Act to the time of the signing of the Sherman Antitrust Act of 1890.
- The eleventh section deals with the years of the First World War, from the time of the declaration of war to the time of the signing of the Treaty of Versailles.
- The twelfth section deals with the years of the Second World War, from the time of the declaration of war to the time of the signing of the Treaty of San Francisco.
- The thirteenth section deals with the years of the Cold War, from the time of the signing of the North Atlantic Treaty to the time of the signing of the SALT II Treaty.
- The fourteenth section deals with the years of the Vietnam War, from the time of the declaration of war to the time of the signing of the Paris Peace Accords.
- The fifteenth section deals with the years of the Watergate scandal, from the time of the declaration of war to the time of the signing of the Watergate Act.
- The sixteenth section deals with the years of the Iran-Iraq War, from the time of the declaration of war to the time of the signing of the UN Security Council Resolution 598.
- The seventeenth section deals with the years of the Gulf War, from the time of the declaration of war to the time of the signing of the UN Security Council Resolution 688.
- The eighteenth section deals with the years of the Kosovo War, from the time of the declaration of war to the time of the signing of the UN Security Council Resolution 1244.
- The nineteenth section deals with the years of the Afghanistan War, from the time of the declaration of war to the time of the signing of the UN Security Council Resolution 1368.
- The twentieth section deals with the years of the Iraq War, from the time of the declaration of war to the time of the signing of the UN Security Council Resolution 1483.

4. The fourth part of the document is a conclusion. It begins with the words "I have the honor to acknowledge the receipt of your letter of the 10th inst. and in reply to inform you that the same has been forwarded to the proper authorities for their consideration."

5. The fifth part of the document is a list of references. It contains a list of books and articles that were used in the writing of the document.

6. The sixth part of the document is a list of footnotes. It contains a list of footnotes that were used in the writing of the document.

7. The seventh part of the document is a list of appendices. It contains a list of appendices that were used in the writing of the document.

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Visit 3 Date: _____ Time Started: _____ Time Ended: _____

Observations of living parts:

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Observations of nonliving parts:

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Differences noted:

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Then, write a short report that adequately addresses your observations, including how the differences of the study areas might relate to the differences noted, and discuss this with your counselor.



5. Using the construction project provided or a plan you create on your own, identify the items that would need to be included in an environmental impact statement for the project planned.



6. Find out about three career opportunities in environmental science.

- 1.
- 2.
- 3.

Pick one and explain how to prepare for such a career.

Discuss with your counselor what education and training are required, and explain why this profession might interest you.

Education

Training

Why this profession might interest you.

Requirement resources can be found here:

http://www.meritbadge.org/wiki/index.php/Environmental_Science#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.