

Alpha Phi Omega at WPI's

# MERIT BADGE UNIVERSITY

November 9th and December 7th



List of Classes and Prerequisites

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# Animation

## Before the First Day of MBU:

4. Animation in our world. Do the following:

- a. Tour an animation studio or a business where animation is used, either in person, via video, or via the Internet. Share what you have learned with your counselor.
- b. Discuss with your counselor how animation might be used in the future to make your life more enjoyable and productive.

## Before the Second Day of MBU:

None

# Art

## Before the First Day of MBU:

None

## Before the Second Day of MBU:

None

# Astronomy

## Before the First Day of MBU:

None

## Before the Second Day of MBU:

### 4. Do the following:

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

### 5. Do the following:

- 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. Using the internet (with your parent's permission) and other resources, 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.

### 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 position of the Moon, at the same hour and place, for four nights within a one-week period. Include landmarks on the horizon such as hills, trees, and buildings. Explain the changes you observe.

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 other 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 a log or notebook. Discuss with your counselor what you hope to observe prior to your observation session. 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, an asteroid, meteor, 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.

## Chemistry

Before the First Day of MBU:

Have Taken High School Chemistry or Biology

Before the Second Day of MBU:

None

# Citizenship in the Community

## Before the First Day of MBU:

4. Choose an issue that is important to the citizens of your community; then do the following:
  - a. Find out which branch of local government is responsible for this issue.
7. Do the following:
  - a. Identify three charitable organizations outside of Scouting that interest you and bring people in your community together to work for the good of your community.
  - b. Pick ONE of the organizations you chose for requirement 7a. Using a variety of resources (including newspapers, fliers and other literature, the Internet, volunteers, and employees of the organization), find out more about this organization.

## Before the Second Day of MBU:

3. Do the following:
  - a. Attend a meeting of your city, town, or county council or school board; OR attend a municipal, county, or state court session.
  - b. Choose one of the issues discussed at the meeting where a difference of opinions was expressed, and explain to your counselor why you agree with one opinion more than you do another one.
4. Choose an issue that is important to the citizens of your community; then do the following:
  - b. With your counselor's and a parent's approval, interview one person from the branch of government you identified in requirement 4a. Ask what is being done about this issue and how young people can help.
7. Do the following:
  - c. With your counselor's and your parent's approval, contact the organization you chose for requirement 7b, and find out what young people can do to help. While working on this merit badge, volunteer at least eight hours of your time for the organization. After your volunteer experience is over, discuss what you have learned with your counselor.



# Citizenship in the Nation

## Before the First Day of MBU:

3. Watch the national evening news five days in a row OR read the front page of a major daily newspaper five days in a row. Discuss the national issues you learned about with your counselor. Choose one of the issues and explain how it affects you and your family.

## Before the Second Day of MBU:

2. Do TWO of the following:

a. Visit a place that is listed as a National Historic Landmark or that is on the National Register of Historic Places. Tell your counselor what you learned about the landmark or site and what you found interesting about it.

b. Tour your state capitol building or the U.S. Capitol. Tell your counselor what you learned about the capitol, its function, and its history.

c. Tour a federal facility. Explain to your counselor what you saw there and what you learned about its function in the local community and how it serves this nation.

d. Choose a national monument that interests you. Using books, brochures, the Internet (with your parent's permission), and other resources, find out more about the monument. Tell your counselor what you learned and explain why the monument is important to this country's citizens.

6. With your counselor's approval, choose a speech of national historical importance. Find out about the author and tell your counselor about the person who gave the speech. Explain the importance of the speech at the time it was given and tell how it applies to American citizens today. Choose a sentence or two from the speech that has significant meaning to you, and tell your counselor why.

8. Name your two senators and a member of Congress from your congressional district. Write a letter about a national issue and send it to one of these elected officials, sharing your view with him or her. Show your letter to your counselor, along with any response you might receive.

# Citizenship in the World

## Before the First Day of MBU:

None

## Before the Second Day of MBU:

3. Do the following:

- a. Pick a current world event. In relation to this current event, discuss with your counselor how a country's national interest, history, and its relationship with other countries might affect areas such as its security, its economy, its values, and the health of its citizens.
- b. Select a foreign country and discuss with your counselor how its geography, natural resources, and climate influence its economy and its global partnerships with other countries.

7. Do TWO of the following (with your parent's permission) and share with your counselor what you have learned:

- a. Visit the website of the U.S. State Department. Learn more about an issue you find interesting that is discussed on this website.
- b. Visit the website of an international news organization or foreign government, OR examine a foreign newspaper available at your local library, bookstore, or newsstand. Find a news story about a human right realized in the United States that is not recognized in another country.
- c. Visit with a student or Scout from another country and discuss the typical values, holidays, ethnic foods, and traditions practiced or enjoyed there.
- d. Attend a world Scout jamboree.
- e. Participate in or attend an international event in your area, such as an ethnic festival, concert, or play.

# Digital technology

## Before the First Day of MBU:

Have an up-to-date Cyber Chip.

## Before the Second Day of MBU:

5. Do the following:

b. Using an Internet search engine (with your parent's permission), find ideas about how to conduct a troop court of honor or campfire program. Print out a copy of the ideas from at least three different websites. Share what you found with your counselor, and explain how you used the search engine to find this information.

c. Use a Web browser to connect to an HTTPS (secure) website (with your parent's permission). Explain to your counselor how to tell whether the site's security certificate can be trusted, and what it means to use this kind of connection.

# Electricity

## Before the First Day of MBU:

None

## Before the Second Day of MBU:

2. Complete an electrical home safety inspection of your home, using the checklist found in this pamphlet or one approved by your counselor. Discuss what you find with your counselor.

8. Make a floor plan wiring diagram of the lights, switches, and outlets for a room in your home. Show which fuse or circuit breaker protects each one.

# Electronics

Before the First Day of MBU:

None

Before the Second Day of MBU:

None

# Emergency Preparedness

## Before the First Day of MBU:

1. Earn the First Aid merit badge.
8. Do the following:
  - b. Prepare a personal emergency service pack for a mobilization call. Prepare a family emergency kit (suitcase or waterproof box) for use by your family in case an emergency evacuation is needed. Explain the needs and uses of the contents.

## Before the Second Day of MBU:

2. Do the following:
  - c. Meet with and teach your family how to get or build a kit, make a plan, and be informed for the situations on the chart you created for requirement 2b. Complete a family plan. Then meet with your counselor and report on your family meeting, discuss their responses, and share your family plan.
6. Do the following:
  - c. Find out who is your community's emergency management director and learn what this person does to prevent, protect, mitigate, respond to, and recover from emergency situations in your community. Discuss this information with your counselor, utilizing the information you learned from requirement 2b.
9. Do ONE of the following:
  - a. Using a safety checklist approved by your counselor, inspect your home for potential hazards. Explain the hazards you find and how they can be corrected.
  - b. Review or develop a plan of escape for your family in case of fire in your home.
  - c. Develop an accident prevention program for five family activities outside the home (such as taking a picnic or seeing a movie) that includes an analysis of possible hazards, a proposed plan to correct those hazards, and the reasons for the corrections you propose.

# Energy

## Before the First Day of MBU:

1. Do the following:

- a. With your parent's permission, use the internet to find a blog, podcast, website, or an article on the use or conservation of energy. Discuss with your counselor what details in the article were interesting to you, the questions it raises, and what ideas it addresses that you do not understand.

## Before the Second Day of MBU:

4. Conduct an energy audit of your home. Keep a 14-day log that records what you and your family did to reduce energy use. Include the following in your report and, after the 14-day period, discuss what you have learned with your counselor.

- a. List the types of energy used in your home such as electricity, wood, oil, liquid petroleum, and natural gas, and tell how each is delivered and measured, and the current cost; OR record the transportation fuel used, miles driven, miles per gallon, and trips using your family car or another vehicle.

- b. Describe ways you and your family can use energy resources more wisely. In preparing your discussion, consider the energy required for the things you do and use on a daily basis (cooking, showering, using lights, driving, watching TV, using the computer). Explain what is meant by sustainable energy sources. Explain how you can change your energy use through reuse and recycling.

6. Prepare pie charts showing the following information and explain to your counselor the important ideas each chart reveals. Tell where you got your information. Explain how cost affects the use of a nonrenewable energy resource and makes alternatives practical.

- a. The energy resources that supply the United States with most of its energy.
- b. The share of energy resources used by the United States that comes from other countries.
- c. The proportion of energy resources used by homes, businesses, industry, and transportation.
- d. The fuels used to generate America's electricity.
- e. The world's known and estimated primary energy resource reserves.

1. Do the following:

b. After you have completed requirements 2 through 8, revisit your source for requirement 1a. Explain to your counselor what you have learned in completing the requirements that helps you better understand the article.

## Engineering

Before the First Day of MBU:

None

Before the Second Day of MBU:

4. Visit with an engineer (who may be your counselor or parent) and do the following:

- a. Discuss the work this engineer does and the tools the engineer uses.
- b. Discuss with the engineer a current project and the engineer's particular role in it.
- c. Find out how the engineer's work is done and how results are achieved.
- d. Ask to see the reports that the engineer writes concerning the project.
- e. Discuss with your counselor what you learned about engineering from this visit.

9. Find out about three career opportunities in engineering. Pick one and research the education, training, and experience required for this profession. Discuss this with your counselor and explain why this profession might interest you.

# Environmental Science

Before the First Day of MBU:

None

Before the Second Day of MBU:

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



# Fire Safety

## Before the First Day of MBU:

None

## Before the Second Day of MBU:

6. Conduct a home safety survey with the help of an adult. Then do the following:

- a. Draw a home fire-escape plan, create a home fire-drill schedule, and conduct a home fire drill.
- b. Test a smoke alarm and demonstrate regular maintenance of a smoke alarm.
- c. Explain what to do when you smell gas and when you smell smoke.
- d. Explain how you would report a fire alarm.
- e. Explain what fire safety equipment can be found in public buildings.
- f. Explain who should use fire extinguishers and when these devices can be used.
- g. Explain how to extinguish a grease pan fire.
- h. Explain what fire safety precautions you should take when you are in a public building.

12. Determine if smoke detectors are required in all dwellings within your municipality. If so, explain which specific types are required. Tell your counselor what type of smoke detectors your house has or needs.

# First Aid

## Before the First Day of MBU:

1. Satisfy your counselor that you have current knowledge of all first-aid requirements for Tenderfoot, Second Class and First Class ranks.

## Before the Second Day of MBU:

5. Prepare a first-aid kit for your home. Display and discuss its contents with your counselor

# Geology

## Before the First Day of MBU:

None

## Before the Second Day of MBU:

4. Do ONE of the following:
  - a. With your parent's and counselor's approval, visit with a geologist, land-use planner, or civil engineer. Discuss this professional's work and the tools required in this line of work. Learn about a project that this person is now working on, and ask to see reports and maps created for this project. Discuss with your counselor what you have learned.
  - b. Find out about three career opportunities available in geology. 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.

# Inventing

## Before the First Day of MBU:

2. Do ONE of the following:

- a. Identify and interview with a buddy (and with your parent's permission and merit badge counselor's approval) an individual in your community who has invented a useful item. Report what you learned to your counselor.
- b. Read about three inventors. Select the one you find most interesting and tell your counselor what you learned.

## Before the Second Day of MBU:

7. Build a working prototype of the item you invented for requirement 6. Test and evaluate the invention. Among the aspects to consider in your evaluation are cost, usefulness, marketability, appearance, and function. Describe how your original vision and expectations for your invention are similar or dissimilar to the prototype you built. Have your counselor evaluate and critique your prototype. (Before you begin building the prototype, you must have your counselor's approval, based on the design and building plans you have already shared.)

8. Do ONE of the following:

- a. Participate with a club or team (robotics team, science club, or engineering club) that builds a useful item. Share your experience with your counselor.
- b. Visit a museum or exhibit dedicated to an inventor or invention, and create a presentation of your visit to share with a group such as your troop or patrol.

# Music

## Before the First Day of MBU:

3. Do TWO of the following:

- a. Attend a live performance or listen to three hours of recordings from any two of the following musical styles: blues, jazz, classical, country, bluegrass, ethnic, gospel, musical theater, opera. Describe the sound of the music and the instruments used. Identify the composers or songwriters, the performers, and the titles of the pieces you heard. If it was a live performance, describe the setting and the reaction of the audience. Discuss your thoughts about the music.
- b. Interview an adult member of your family about music. Find out what the most popular music was when he or she was your age. Find out what his or her favorite music is now, and listen to three of your relative's favorite tunes with him or her. How do those favorites sound to you? Had you ever heard any of them? Play three of your favorite songs for your relative, and explain why you like these songs. Ask what he or she thinks of your favorite music.
- c. Serve for six months as a member of a school band, choir, or other organized musical group, or perform as a soloist in public six times.
- d. List five people who are important in the history of American music and explain to your counselor why they continue to be influential. Include at least one composer, one performer, one innovator, and one person born more than 100 years ago.

## Before the Second Day of MBU:

None

## Programming

### Before the First Day of MBU:

Have prior programming experience. Have an up-to-date Cyber Chip.

### Before the Second Day of MBU:

None

## Robotics

### Before the First Day of MBU:

None

### Before the Second Day of MBU:

None

# Space Exploration

## Before the First Day of MBU:

None

## Before the Second Day of MBU:

2. Design a collector's card, with a picture on the front and information on the back, about your favorite space pioneer. Share your card and discuss four other space pioneers with your counselor.

7. Design an inhabited base located within our solar system, such as Titan, asteroids, or other locations that humans might want to explore in person. Make drawings or a model of your base. In your design, consider and plan for the following:

- a. Source of energy
- b. How it will be constructed
- c. Life-support system
- d. Purpose and function

# STEM NOVA: Splash

## Before the First Day of MBU:

1. Choose A or B or C and complete ALL the requirements.
  - A. Watch about three hours total of science-related shows or documentaries that discuss water as it relates to the hydrologic cycle, primary sources, primary users (including wildlife, health, sources of pollution, waste treatment, and related sciences and technologies.) Then do the following:
    - a. Make a list of at least five questions or ideas from the show(s) you watched.
  - B. Read (about three hours total) about water as it relates to the hydrologic cycle, primary sources, primary users, health, sources of pollution, waste treatment, and related sciences and technologies.

Then do the following:

- a. Make a list of at least five questions or ideas from each article.
- C. Do a combination of reading and watching (about three hours total). Then do the following:
  - a. Make a list of at least five questions or ideas from each article or show.

## Before the Second Day of MBU:

- C. Use the internet (with your parent's or guardian's permission) to determine the annual water use for your state in gallons and acre-feet.
  - a. What are the main sources (provide percentages)?
  - b. Who are the main users (provide percentages)?
  - c. What are the trends in total and per capita water use over time?
  - d. Discuss what you learned with your counselor.

Helpful Link:

USGS Water Use in the United States

<https://water.usgs.gov/watuse/>

- D. Household water use. Create a list all of the ways that water is used around your home in a 24-hour period, including the bathroom, kitchen, and any appliances. Don't forget outdoor water uses such as pools, hot tubs, sprinkler systems, landscape and gardens, pets and/or livestock, and cleaning efforts such as washing cars, boats, pets, etc.
- a. Estimate how much water is used for each function over a specific time period. Add your estimates to come up with an estimate of total water usage by your family for one month or one year.
  - b. Compare your estimate with the actual total found on your home water bill, and account for any large differences. (Hint: ask your parent or guardian to help you locate that information on the monthly water bill or well meter.)

Note: If you live in a multi-family housing unit and do not have an individual water bill, you may be able to obtain the information from your unit's management. If not, measure your water usage for at least two tasks (for example, by leaving the drain closed when you take a shower, then measuring the amount of water that collected in the tub during your shower), and use that data to revise your estimates.

- a. How does your local usage compared to the average use per capita in your state? The United States Geological Survey ([usgs.org](http://usgs.org)) is a good source for data on average water usage.
- b. Identify several ways to reduce your water consumption, and practice them for one month. Estimate how much clean water you have saved.
- c. Discuss your work and what you learned with your counselor.



# STEM NOVA: Woosh!

## Before the First Day of MBU:

1.
  - a. Watch about three hours total of engineering-related shows or documentaries that involve motion or motion-inspired technology. Then do the following:
    - i. Make a list of at least two questions or ideas from what you watched.
    - ii. Discuss two of the questions or ideas with your counselor.
  - b. Read (about three hours total) about motion or motion-inspired technology. Then do the following:
    - i. Make a list of at least two questions or ideas from what you read.
    - ii. Discuss two of the questions or ideas with your counselor.
  - c. Do a combination of reading and watching (about three hours total). Then do the following:
    - i. Make a list of at least two questions or ideas from what you read and watched.
    - ii. Discuss two of the questions or ideas with your counselor.
- Examples of shows include—but are not limited to—those found on PBS ("NOVA"), Discovery Channel, Science Channel, National Geographic Channel, TED Talks (online videos), and the History Channel. You may choose to watch a live performance or movie at a planetarium or science museum instead of watching a media production. You may watch online productions with your counselor's approval and under your parent's supervision. One example is the NOVA Lever an Obelisk page on ancient Egypt and the use of levers, available at [www.pbs.org/wgbh/nova/egypt/raising/lever.html](http://www.pbs.org/wgbh/nova/egypt/raising/lever.html) .
- Examples of magazines include—but are not limited to—Odyssey, Popular Mechanics, Popular Science, Science Illustrated, Discover, Air & Space, Popular Astronomy, Astronomy, Science News, Sky & Telescope, Natural History, Robot, Servo, Nuts and Volts, and Scientific American.

## Before the Second Day of MBU:

4. Choose A or B and complete ALL the requirements.

- a. Visit an amusement park. Then discuss the following with your counselor:
  - i. The simple machines present in at least two of the rides
  - ii. The forces involved in the motion of any two rides
- b. Visit a playground. Then discuss the following with your counselor:
  - i. The simple machines present in the playground equipment
  - ii. The forces involved in the motion of any two playground fixtures

# STEM NOVA: Let It Grow

## Before the First Day of MBU:

1. Choose A or B or C and complete ALL the requirements.
  - a. Watch three hours total of shows or documentaries related to agriculture or farming. Then do the following:
    - i. Make a list of at least five questions or ideas from the show(s) you watched.
  - b. Read (about three hours total) about anything related to agriculture or farming. Then do the following:
    - i. Make a list of at least five questions or ideas from each article.
  - c. Do a combination of reading and watching (about three hours total). Then do the following:
    - i. Make a list of at least five questions or ideas from each article or show.

## Before the Second Day of MBU:

4. Visit a farm, botanical garden, grocery store, or any other location where farm produce can be found. If a visit is not possible, you can do a virtual tour online with your parent's permission and counselor's approval.
  - a. During your visit, talk with someone in charge about how the plants are grown or animals are raised, and how the food is processed.