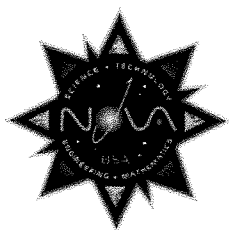




Unit Leader's Guide

STEM in a BOX Cub Scout NOVA Award Program



Michigan Crossroads Council, BSA
STEM Programs
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STEM Program Guide

Introduction

The Boy Scouts of America launched the Nova awards program in an effort to incorporate learning about Science, Technology, Engineering and Math (STEM). The national BSA website details the goals and aims of the program and a link is provided at the end of the document.

The program is open to Cub Scouts, Boy Scouts and Venturing and the activities and requirements are age appropriate and designed to stimulate interest in STEM.

Why STEM

In today's world, the ability to understand the concepts around STEM has proven essential to developing strong career paths. The Boy Scouts of America is in the business of developing youth and STEM provides a supplement to the traditional Scouting program and complements the outdoor activities and a Scout's journey to Eagle.

Secondly, many aspects of our lives involve STEM whether we know it or not. From simple calculations about how early we should leave for an appointment to calculating the amount of paint we need to buy to cover a child's bedroom are all STEM-related activities. By bringing STEM activities into the Scouting program we can enhance the Scouting experience and cultivate the natural curiosity of youth.

Finally, various Scout Activities from building a Pinewood Derby car to archery to cooking to fire building involves a STEM concept. STEM is literally all around us and we make use of it every day. What better way to complement the traditional Scouting program than to add an element that explains the physics behind archery in addition to teaching the skill.

What Is a STEM Award

There are two types of STEM awards: Nova and Supernova awards. The Nova awards incorporate various STEM-related activities, e.g., reading, viewing, experimenting, and outings along with earning STEM related adventure loops, pins or merit badges. The Supernova awards are more rigorous and build upon the Nova awards.

STEM Program Guide

Nova Awards

To earn a Nova award a Cub Scout, Boy Scout or Venturer can earn traditional belt loop/pin or merit badge in conjunction with satisfying other specific requirements for the individual Nova award.

Nova awards are guided by a Nova awards counselor. The counselors need to have an interest in helping with the STEM program and a general familiarity with STEM, but in no way needs to be a scientist, technologist, engineer or mathematician. A counselor is any registered adult age 21 or older (unless he/she is working with his/her own child).

The STEM initiative is meant to be “fun” and cultivate a desire to explore additional STEM concepts and ideas much like the traditional Scouting program asks youth to seek a broader outdoor experience.

Nova awards are work done at a unit level and the barrier to entry for each unit is low. A willingness to try is all that is required of the adult leader to help a Scout move forward with an award.

Since STEM stands for science, technology, engineering and mathematics, there is a Nova award for each category at each level of Scouting. They are listed as follows:

CUB SCOUT NOVA

- 1-2-3 Go! [Tracking Form](#)
- Science Everywhere [Tracking Form](#)
- Swing! [Tracking Form](#)
- Tech Talk – [Tracking Form](#)

BOY SCOUT NOVA

- Designed to Crunch [Tracking Form](#)
- Shoot! [Tracking Form](#)
- Start Your Engines [Tracking Form](#)
- Whoosh! [Tracking Form](#)

VENTURING NOVA

- Hang On! [Tracking Form](#)
- Launch! [Tracking Form](#)
- Numbers Don't Lie [Tracking Form](#)
- Power Up [Tracking Form](#)

STEM Program Guide

Supernova Awards

These awards are a higher level award requiring more rigor to complete. They are built, however, on the foundation of the Nova awards. Thus the youth would complete a number of Nova awards as pre-work to beginning the Supernova project.

Supernova awards mentors must be 21 or older, be subject matter experts in a STEM (science, technology, engineering, mathematics) field and be a registered and approved member of Michigan Crossroads Council.

For the Supernova awards, the youth will work with a Supernova mentor who is a registered member and approved by the Michigan Crossroad Council's Advancement Committee.

Keys to a Successful STEM Program

The STEM program complements the traditional Scout program and provides another avenue for exploration, leadership development and fun. For many youth, the allure of science and technology is overwhelming and used properly the STEM program can be a powerful recruiting tool.

First, make it fun. The STEM program is not designed to supplement traditional schooling, but rather to spark the imagination and natural curiosity of youth.

Second, incorporate it into your traditional program. It is simple to add a STEM element to Scouting activities which complements the "what" of the activity with the "how and why" it works. For example, the Pinewood Derby event at the Cub Scout level is all about science and engineering.

Start with a group session to introduce the topic to your pack, troop or crew. The project should have a physical element.

Most important is to review the information in websites of both the BSA and the Michigan Crossroads Council. Everything a unit needs to start a STEM initiative is located on the website including the Nova awards guidebooks or you can purchase the guidebooks at your local Scout shop.

Please note: Nova Award Books for Cub Scouts are available, as of June 2015, for the NEW Cub Scout Program. Check the printing date on your books and ONLY use the June 2015 books if you are starting your Nova Awards after 6/1/2015. Your local Scout Shop will have only these books on hand now.

STEM Program Guide

How to Start

Up until now, we've talked about what the program is about. Now, we discuss how to practically launch the program in your unit. The following is a practical step-by-step guide to getting the program up and running.

Step 1: Contact your District STEM Chair and include STEM in your program planning.

This individual is charged by his/her district with helping to roll the STEM program out to each unit. They will be active at roundtable around STEM topics and will be willing to discuss with your unit leadership about the STEM program.

The District STEM Chair can make a presentation to your unit leadership and/or unit membership. Leverage this resource.

Part of the discussion will center on how to incorporate STEM into your program planning and recruiting efforts.

Step 2: Recruit Nova awards counselors.

The Nova awards counselor is a unit appointed position, and can be any registered adult age 21 or older (unless he/she is working with his/her own child). To be effective the single most important aspect for the counselor is a willingness to help. While an interest in and a familiarity with STEM concepts is helpful, it is not in the least bit required. In fact, any adult leader can administer the Nova awards program.

The above notwithstanding, each and every unit probably has a number of individuals who have STEM careers and would be more than willing to be subject matter experts (SME's) for your unit. Use the resource survey (see Resources section) to identify the candidates.

Additional resources can be found at roundtable and on the Michigan Crossroads Council website.

Step 3: Schedule a group STEM activity.

In your unit, designate a pack meeting, troop meeting or crew meeting to launch and explain the STEM program to the youth. This is not just a lecture, but a practical and hands on approach where you will get started on a Nova award as a group.

Select a single Nova award for your unit and work with your District STEM Chair to help launch. Have a Nova awards counselor introduce the award at a group meeting and be available to guide participants through the award. Start by doing part of the award during a unit function. The activities should include a practical exercise—watching a video or conducting individual experiments.

STEM Program Guide

Sample activities include:

- Show a video that applies to an award.
- Do a STEM-related demonstration.
- Go on a STEM-related field trip.

Examples can be found at: <http://mindtrekkers.mtu.edu>

Step 4: Call for Supernova awards mentors (optional).

This step is needed if a member in your unit wants to pursue the Supernova award. The Supernova awards mentor is similar to a merit badge counselor, in that they must be a registered leader and have domain expertise. In simple terms, they must have STEM credentials. They will need to fill out an [application](#) and be approved by the Michigan Crossroad Council's Advancement Committee as a Supernova mentor.

STEM Program Guide

Resources

The following are links to assets and websites that can aid in your STEM journey:

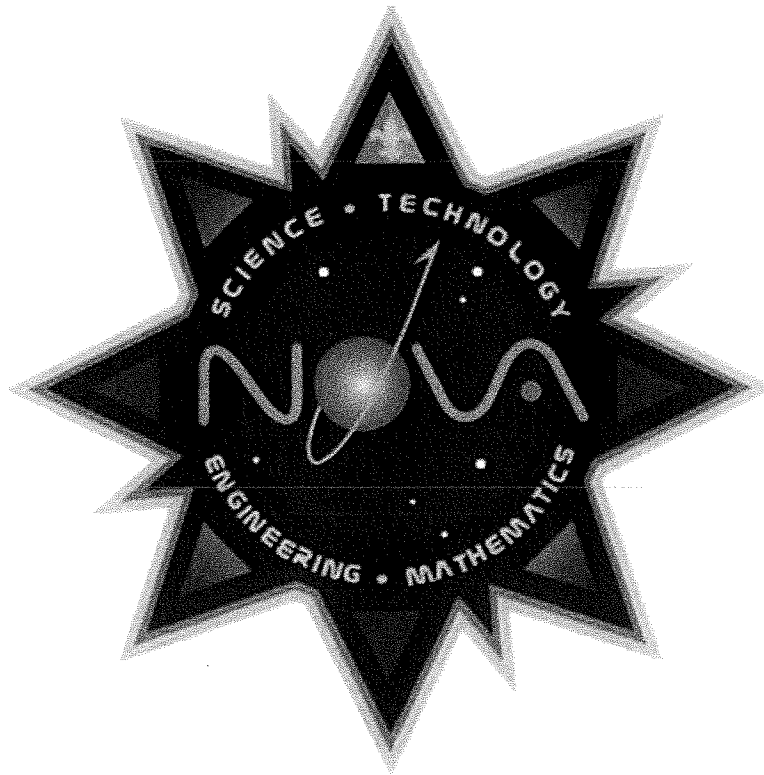
The national BSA website (<http://www.scouting.org/stem/Awards/AboutNova.aspx>) begins detailing the goals and aims of the program.

Check out the Michigan Crossroads Council calendar, and search on STEM to find events, activities, camps, and Nova Award specific events in our Council: <http://www.michiganscouting.org/Calendar>

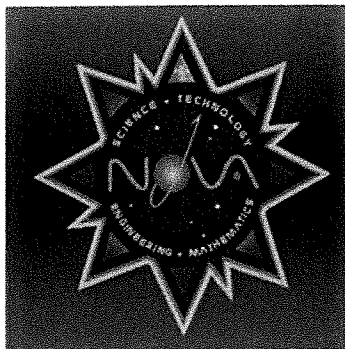
CUB SCOUT NOVA

STEM in a Box

Tech Talk Kit



BOY SCOUTS OF AMERICA®
MICHIGAN CROSSROADS COUNCIL



How to use this guide

The STEM in a Box program is designed to give Scout leaders an easy, user-friendly way to present concepts to their Scouts. Each kit contains everything you need to complete the requirements for that module. Where possible, we have provided you with background information to help with the idea. Experiments were designed to make the learning fun and interactive for your Scouts.

This instruction key provides visuals to help you know what each lesson entails. For example, when you see the yellow star, you know that this information will be a discussion point you can use with your Scouts to explore a topic further.

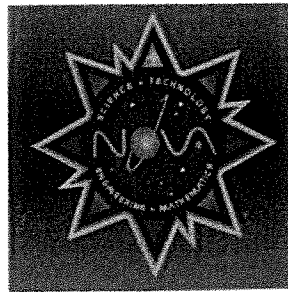
<u>Instruction Key</u>	
Discussion Point	★
Background Information	➡
Hands On Experiment	∞

Be sure to look through the STEM in a Box kit before you use it for the first time. There may be some information that will be helpful to read before you have a room full of Scouts ready to start their STEM adventures.

Please be sure to note any supplies that need to be replenished on the supply list enclosed, before you return the STEM kit to the Field Service Center. If an item breaks, please let us know right away.

Most importantly, have FUN with your Scouts! You are doing important work, inspiring and engaging future engineers, doctors, chemists, rocket scientists, electricians and more. Thank you for what you do!

STEM in a Box



TECH TALK

Introduction

The Tech Talk Module is designed to help Cub Scouts explore how technology affects their daily lives. The materials in this box provide the resources to complete the award.

- Background information about rocketry and the scientific method
- Award Tracking Forms
- Cub Scout Nova Awards Guidebook

Directions

Review the Tech Talk requirements (p. 17-21) and the counselor instruction (p. 47 & 58) in the Cub Scout Nova Awards Guidebook.

The following information is designed to assist you with how to present the materials in this box.

Requirement (1.)

Look up the definition of the word technology and discuss the meaning with your counselor.



What is technology?

Technology is a body of knowledge used to create tools, develop skills, and extract or collect materials. It is also the application of science (the combination of the scientific method and material) to meet an objective or solve a problem.

See the following experiment entitled, "What is Technology? Discussion Ideas" to help facilitate a group discussion with Scouts and get them thinking about technology. Also, use the enclosed photos and Evolution Diagrams to show how technology has evolved.



STEM-in-a-Box Experiment



What is Technology? Discussion Ideas

This lesson helps you engage Scouts in the general topic of technology. It involves discussion and a short scenario to allow Scouts to develop a sense of what technology is and to dispel the notion that technology relates mostly to computers.

Activity: *Technology—What's It All About?*

You can engage the group as a whole in discussion as directed. Alternatively, you can divide the group into three to five Scouts each. Ask each group to consider the questions you ask, and then have each group provide its responses. It is also possible to have groups consider only a limited number of the questions and then handle the remainder with the whole group. If you choose either of the last two approaches, you should limit the time allotted for groups to consider each question to several minutes.

1. Begin by asking the group, "How do you define technology?"

Accept all answers and write Scout responses on the board. Do not attempt to have Scouts refine their definitions of technology at this point. They will revisit their definitions and refine them in Step 5. Scouts, like older individuals, may harbor the preconception that technology relates mostly to computers. Through advertisements and media articles, they are familiar with the terms *information technology* and *computer technology*.

Counselor note: Asking this question requires Scouts to call on their prior knowledge, and it engages their thinking. At this point, do not critique Scout responses. Appropriate counselor comments are short and positive, such as "good" and "what else?" Other appropriate counselor responses include, "Why do you believe that?" or "How do you know that?" Questions such as these allow the counselor to assess Scouts' current knowledge about the subject and to adjust lessons accordingly. They also provide a springboard to "Let's find out" or "Let's investigate." In general, it is time to move forward when the counselor sees that thinking has been engaged.

2. Ask Scouts, "In general, what does technology do for us?"

This question may help Scouts understand that technology helps us solve problems, makes our lives easier, and extends our abilities to do things. Technology is used to develop skills or tools, both in our daily lives and in our occupations.

**3. Focus discussion on technologies that are relevant to each Scout's life.
Ask Scouts to look around the room. What technologies do they see? How do these technologies solve problems and make their lives easier?**



Accept all responses and write them on the board. Scouts may mention any number of items. Some may be school-related, such as binders, backpacks, pens, pencils, paper, and paper clips. Other items may be more personal, such as water bottles, personal stereos, and hair clips. Scouts may neglect items such as shoelaces, zippers, buttons, fabric, eyeglasses or contact lenses, makeup, and bandages. Discussion should reinforce the notion that humans develop technology with a specific objective in mind. A related concept is that a given task requires the right tool or tools.

4. **Pick a technology that Scouts have mentioned. Ask them what types of knowledge were required to develop that technology.**

Scouts may not realize that technologies are generally developed by applying knowledge from multiple disciplines. For example, producing today's audio devices, such as a portable CD player, requires knowledge obtained from engineering, physics, mathematics, chemistry, and computer science.

5. **On the basis of previous discussions, ask Scouts to rethink and refine their definition of technology (from Step 1).**

Scouts should mention that technology is a way of solving problems through the application of knowledge from multiple disciplines.

1. **Tell Scouts to imagine that they live in the Stone Age. Their only garment has been ripped and requires mending. How would they do it?**

Scouts first should recognize that the ripped garment is a problem requiring a solution. They should consider what technologies they have available. The Stone Age was a period early in the development of human cultures when tools were made of stone and bone. Clothing consisted of animal skins or fabrics woven from threads derived from plant fibers. Bones and sharp reeds were used to make needles.

7. **Ask Scouts how their approach to mending the garment would change as time advanced from the Stone Age to the present. What new knowledge would allow the development of new technology?**

Scout responses will vary, and some Scouts may want to jump directly from the Stone Age to the modern sewing machine. Slow them down and have them consider incremental changes in knowledge and technologies. They may cite the use of metals to fashion repair tools, like knives and finer needles. New knowledge of metals and chemistry would help here. Later advances in engineering and mechanics would lead to the development of human-run machines for assisting with repairs. Eventually, advances in physics (electricity) and engineering led to the invention of modern sewing machines. Similarly, advances in agriculture, chemistry, and engineering produced better fabrics and threads. Scouts should derive an understanding that technology advances through interactions among multiple disciplines. While a problem may remain basically the same over time (for instance, the need to make or repair clothing), advances in technology change how the problem is solved.



Requirement (2. A & B)



Discuss EACH of the following with your counselor:

A. How technology is used in EACH of the following fields:

Communication (6, 17)

Business (26, 27, 34, 47, evolution of Apple)

Construction (11, 13, 21, 28, 29, 31, 32, 37, 38)

Sports (8, 25, 30)

Entertainment (33, 35)



Refer to the photos provided, which show both the old and new versions of technology and equipment used in these fields.

B. Tell why technology is important.

This is an easy discussion, because technology is so prevalent in our modern world. Ask Scouts to think about what improvements have been made from the beginning to now in each of the above fields (ex. Phones: the old bag phone compared to the tiny cell phones of today.) Use the enclosed photos to show both old and modern technology for each of the above fields, and also use the Evolution Diagrams to show how technology has evolved.

Requirement (3.A)

Watch an episode or episodes (about one hour total) of a show about anything related to science. Then do the following:

- 1. Make a list of at least two questions or ideas from what you have watched.*
- 2. Discuss two of the questions or ideas with your counselor.*



Suggested videos:

National Geographic for Kids

<http://video.nationalgeographic.com/video/kids/>

Mythbusters clips and short episodes

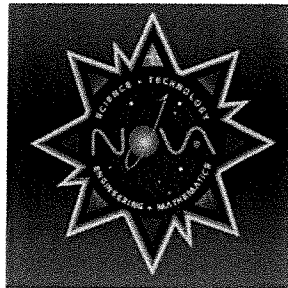
<http://www.discovery.com/tv-shows/mythbusters>

Excellent documentary about lunar astronauts: James May Goes to the Moon

http://www.streetfire.net/video/james-may-goes-to-the-moon-full-episode_695845.htm



TECHNOLOGY DISCUSSIONS



TECH TALK

Requirement (5. A & B)



What technology is used in your belt loop or pin?

- A. *Discuss with your counselor how you think this technology:*
 - a. *Was invented*
 - b. *Could be made better*

Refer to the photos provided, which show both the old and new versions of technology and equipment used in those pursuits.

- B. *Discuss your ideas about technology with your counselor.*

Requirement (6. A & B)

Visit a place where technology is being designed, used or explained, such as one of the following: an amusement park, a police or fire station, a radio or television station, a newspaper office, a factory or store or any other location where technology is being designed, used or explained.

- A. *During your visit, talk to someone in charge about the following:*
 - 1. *The technologies used where you are visiting.*
 - 2. *Why the organization is using these technologies.*
- B. *Discuss with your counselor the technology that is designed, used or explained at the place you visited.*

Requirement (7.)

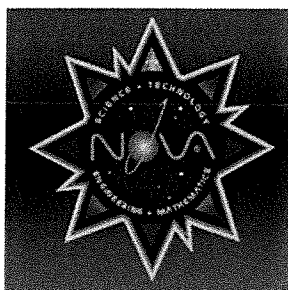


Discuss with your counselor how technology affects your daily life.

Again, you may refer to the photos provided, which show both the old and new versions of technology and equipment used in life.



MODERN FABRIC WATER RESISTANCE EXPERIMENT



TECH TALK



Modern Fabric Water Resistance Experiment

See the following experiment entitled, "Modern Fabric Water Resistance Experiment" to help Scouts test the technology used to treat fabrics so they are more water resistant. It's a scientific application for something they probably take for granted every day!



STEM-in-a-Box Experiment



Modern Fabric Water Resistance Experiment

This science experiment allows you to compare the water resistant properties of different types of fabrics. The tests were done using fabrics made of cotton, wool and polyester. Tests were also done with and without applying Scotch Guard coating.

Hypothesis

Our first hypothesis is that amongst the fabric types, polyester will be the most water resistant. Our second hypothesis is that all fabrics demonstrate better water resistance after a layer of Scotch Guard is applied.

Fabric types and water resistance

Fabrics are materials that are used to make clothing, cushion covers, curtains and tablecloths, and many other things. Many types of fabric are available on the market, and they are made from many different types of materials, textures and colors. The fabrics can be made from natural or synthetic materials. In the old days, fabrics were only available made from natural materials.

Cotton is the most common type of fabric used for making clothing. It is durable, cheap and easy to clean but tends to shrink at high temperatures. Wool is made from animal hair that is knitted very tightly and is suitable for winter use because it is very effective in keeping us warm during winter, while absorbing moisture and resisting static. Synthetic fabrics like polyester or nylon are cheaper, stretchable and easier to clean.

Waterproof fabrics prevent water droplets from being absorbed but allow water vapor to pass through them. They are made by closely knitting the fibers or providing them with a coating of waterproof material.

Scientific Terms

Fabrics, synthetic, water resistance

Materials

- 2 pieces of cotton cloth, 2"W x 4"H
- 2 pieces of polyester cloth, 2"W x 4"H
- 1 measuring cup or beaker
- 1 container (cup) for holding water
- 1 ruler
- 1 digital scale for weighing small objects
- large paperclips (4)
- Small clear cups (4)
- 1 permanent marker
- timer
- access to tap water



Procedure

2. For this experiment, the independent variable is the use of Scotch Guard and the type of fabric tested – cotton and polyester. The dependent variable is the amount of water absorbed by the fabric. This is determined by measuring the weight of the fabric before and after wetting the fabric. The constants (control variables) are the size of the fabric and the amount of water dispensed.
3. The cloth should be cut into the same size and their weight checked on the digital scale. Two pieces of fabric of the same type should have the same weight. If not, trim the edges of the heavier piece very slightly and re-weigh to see if they are now of the same weight. Repeat the process until they are. The measured weight is recorded in the table given below.
4. One piece of cloth from each type of fabric is treated with Scotch Guard, following the manufacturer's instructions. Reweigh the fabric to see if the Scotch Guard added additional weight (it shouldn't). You can mark the treated fabric with an "S" so you know which has been treated.
5. Add the same amount of water to each cup, 250ml is a good amount, depending on the size of your container. The water should be lukewarm. Mark the level of water with a marker on the outside of your container. Measure and record the height of the water in your cup.
6. Attach each piece of fabric with a paperclip to the side of a Dixie cup so that the fabric is just touching the liquid.
7. Set the timer for 10 minutes. Then, when the time has elapsed, check your fabric swatches.

Observations

- Are the fabric swatches getting wet? Is one type wetter than another?
- Weigh each fabric sample and record the results. It can be said that the heavier fabrics took on more water than the lighter ones.
- Measure the amount of liquid in your cups. Did the level change?

Conclusion

Based on both the level of water left in your cups and the weight of the fabric after 10 minutes elapsed, which type of fabric resisted water? Did adding the Scotch Guard affect the results?

Waterproof fabrics can be made from natural or synthetic materials. Their ability to resist water droplets makes them suitable for use in manufacturing raincoats, tents and swimming attire. They are normally given a coating of waterproofing chemicals like PVC, rubber or wax.

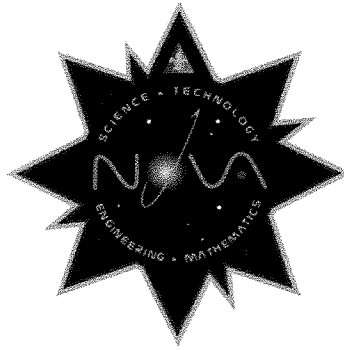
Also consider

This experiment can also be repeated using different types of fabrics besides the ones that we tested.

Try to repeat the science project experiment by immersing the fabric in water and comparing the time taken for them to dry.



Stem-in-a-Box



Tech Talk NOVA Box Content List

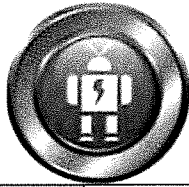
➤ Bound Manual

Fabric Water Resistance Experiment

- Swatches of fabric (cotton, wool, polyester) – To replace, buy remnants from Fabric or Hobby Stores
- Digital Scale (1)
- Clear Cups (3) – To replace, can be purchased at any discount store
- Timer (May use smart phone or watch for best accuracy)
- Large Paper Clips or Bulldog Clips (3) – Must be vinyl coated to resist rust
- Can of Scotch Guard Fabric Protector

NOTE: Items in RED will need to be resupplied as needed. Box should be stocked for 20 Scouts.

Scout: _____



Tech Talk

This module is designed to help you explore how technology affects your life each day.

Date			
1. Choose A or B or C and complete ALL the requirements.			
A. Watch an episode or episodes (about one hour total) of a show about anything related to technology. Then do the following:			
(1) Make a list of at least two questions or ideas from what you watched.			
(2) Discuss two of the questions or ideas with your counselor.			
B. Read (about one hour total) about anything related to technology. Then do the following:			
(1) Make a list of at least two questions or ideas from what you read.			
(2) Discuss two of the questions or ideas with your counselor.			
C. Do a combination of reading and watching (about one hour total) about anything related to technology. Then do the following:			
(1) Make a list of at least two questions or ideas from what you read and watched.			
(2) Discuss two of the questions or ideas with your counselor.			
Date		Completed A, B or C	
2. Complete ONE ADVENTURE from the following list. (Choose one that you have not already earned.) Wolf: Finding Your Way; Motor Away. Bear: Make It Move; A World of Sound. Webelos: Build It; Fix It; Movie Making			
Date		Adventure	
3. Explore EACH of the following:			
A. Look up a definition of the word <i>technology</i> and discuss the meaning with your Counselor.			
B Find out how technology is used in EACH of the following fields: 1) Communication. 2) Business.			
3) Construction. 4) Sports. 5) Entertainment.			
C.. Discuss your findings with your counselor.			
6. Visit a place where technology is being designed, used, or explained, such as one of the following: an amusement park, a police or fire station, a radio or television station, a newspaper office, a factory or store, or any other location where technology is being designed, used, or explained.			
A. During your visit, talk to someone in charge about the following:			
(1) The technologies used where you are visiting			
(2) Why the organization is using these technologies			
B. Discuss with your counselor the technology that is designed, used, or explained at the place you visited.			
Date			
7. Discuss with your counselor how technology affects your everyday life.			
Date			

