MERIT BADGE SERIES



ENGINEERING



STEM-Based

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ENGINEERING



"Enhancing our youths' competitive edge through merit badges"

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Requirements

1. Select a manufactured item in your home (such as a toy or an appliance) and, under adult supervision and with the approval of your counselor, investigate how and why it works as it does. Find out what sort of engineering activities were needed to create it. Discuss with your counselor what you learned and how you got the information.
2. Select an engineering achievement that has had a major impact on society. Using resources such as the Internet (with your parent's permission), books, and magazines, find out about the engineers who made this engineering feat possible, the special obstacles they had to overcome, and how this achievement has influenced the world today. Tell your counselor what you learned.
3. Explain the work of six types of engineers. Pick two of the six and explain how their work is related.
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.

5. Do ONE of the following:

   a. Use the systems engineering approach to make step-by-step plans for your next campout. List alternative ideas for such items as program schedule, campsites, transportation, and costs. Tell why you made the choices you did and what improvements were made.

   b. Make an original design for a piece of patrol equipment. Use the systems engineering approach to help you decide how it should work and look. Draw plans for it. Show the plans to your counselor, explain why you designed it the way you did, and explain how you would make it.

6. Do TWO of the following:

   a. *Transforming motion.* Using common materials or a construction set, make a simple model that will demonstrate motion. Explain how the model uses basic mechanical elements like levers and inclined planes to demonstrate motion. Describe an example where this mechanism is used in a real product.



   b. *Using electricity.* Make a list of 10 electrical appliances in your home. Find out approximately how much electricity each uses in one month. Learn how to find out the amount and cost of electricity used in your home during periods of light and heavy use. List five ways to conserve electricity.

   c. *Understanding electronics.* Using an electronic device such as a mobile telephone or portable digital media player, find out how sound travels from one location to another. Explain how the device was designed for ease of use, function, and durability.

   d. *Using materials.* Do experiments to show the differences in strength and heat conductivity in wood, metal, and plastic. Discuss with your counselor what you have learned.



e. *Converting energy.* Do an experiment to show how mechanical, heat, chemical, solar, and/or electrical energy may be converted from one or more types of energy to another. Explain your results. Describe to your counselor what energy is and how energy is converted and used in your surroundings.

f. *Moving people.* Find out the different ways people in your community get to work. Make a study of traffic flow (number of vehicles and relative speed) in both heavy and light traffic periods. Discuss with your counselor what might be improved to make it easier for people in your community to get where they need to go.



g. *Building an engineering project.* Enter a project in a science or engineering fair or similar competition. (This requirement may be met by participation on an engineering competition project team.) Discuss with your counselor what your project demonstrates, the kinds of questions visitors to the fair asked, and how well you were able to answer their questions.

7. Explain what it means to be a registered Professional Engineer (P.E.). Name the types of engineering work for which registration is most important.

8. Study the Engineer's Code of Ethics. Explain how it is like the Scout Oath and Scout Law.

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.

Engineering Resources

Scouting Literature

Architecture, Automotive Maintenance, Chemistry, Composite Materials, Digital Technology, Drafting, Electricity, Electronics, Energy, Inventing, Model Design and Building, Nuclear Science, Programming, Robotics, Space Exploration, Surveying, and *Welding* merit badge pamphlets

For more information about or to order Scouting-related resources, see http://www.scoutstuff.org (with your parent's permission).

Books

Anderson, Margaret Jean. *Isaac Newton: The Greatest Scientist of All Time.* Enslow, 2001.

Baine, Celeste. *Is There an Engineer Inside You? A Comprehensive Guide to Career Decisions in Engineering,* 3rd ed. Professional Publications, 2004.

Berlow, Lawrence H. *Reference Guide to Famous Engineering Landmarks of the World: Bridges, Tunnels, Dams, Roads, and Other Structures.* Oryx, 1998.

Brown, Henry T. *507 Mechanical Movements: Mechanisms and Devices.* Dover Publications, 2005.

Dupre, Judith. *Bridges: A History of the World's Most Famous and Important Spans.* Black Dog & Leventhal, 1997.

———. *Skyscrapers: A History of the World's Most Extraordinary Buildings*. Black Dog & Leventhal, 2013.

Freedman, Russell. *The Wright Brothers: How They Invented the Airplane.* Holiday House, 1994.

Garner, Geraldine O. *Careers in Engineering,* 2nd ed. McGraw-Hill, 2002.

Green, Constance McLaughlin. *Eli Whitney and the Birth of American Technology*. Addison Wesley Longman, 1997.

Hickam Jr., Homer H. *Rocket Boys (October Sky)*. Delacorte, 1998.

Kent, Steven. *The Ultimate History of Video Games: From Pong to Pokemon.* Prima Lifestyles, 2001.

Kuprenas, John, and Matthew Frederick. *101 Things I Learned in Engineering School.* Grand Central Publishing, 2013.

Middleton, William. *Landmarks on the Iron Road: Two Centuries of North American Railroad Engineering (Railroads Past and Present).* Indiana University Press, 1999.

Molotch, Harvey. *Where Stuff Comes From: How Toasters, Toilets, Cars, Computers, and Many Other Things Come to Be as They Are.* Routledge, 2005

Pletsch, William. *Integrated Circuits: Making the Miracle Chip.* Pletsch & Associates, 2000.

Reid, T.R. *The Chip.* Random House, 2001.

Roberts, Dustyn. *Making Things Move: DIY Mechanisms for Inventors, Hobbyists, and Artists.* McGraw-Hill, 2010.

Organizations and Websites

American Indian Science and Engineering Society
2305 Renard SE, Suite 200
Albuquerque, NM 87106
Telephone: 505-765-1052
Website: http://aises.org

American Institute of Chemical Engineers
120 Wall St., 23rd floor
New York, NY 10005-4020
Toll-free telephone: 800-242-4363
Website: http://www.aiche.org

American Society of Civil Engineers
1801 Alexander Bell Drive
Reston, VA 20191-4400
Toll-free telephone: 800-548-2723
Website: http://www.asce.org

ASME International (American Society of Mechanical Engineers)
2 Park Ave.
New York, NY 10016-5990
Toll-free telephone: 800-843-2763
Website: http://www.asme.org

Institute of Electrical and Electronics Engineers
3 Park Ave., 17th Floor
New York, NY 10016-5997
Telephone: 212-419-7900
Website: http://www.ieee.org

Jet Propulsion Laboratory
4800 Oak Grove Drive
Pasadena, CA 91109
Telephone: 818-354-4321
Website: http://www.jpl.nasa.gov

Kennedy Space Center
Toll-free Telephone: 866-737-5235
Website:
https://www.kennedyspacecenter.com

National Action Council for Minorities in Engineering
440 Hamilton Ave., Suite 302
White Plains, NY 10601-1813
Telephone: 914-539-4010
Website: http://www.nacme.org

National Aeronautics and Space Administration
NASA Headquarters
Washington, DC 20546-0001
Telephone: 202-358-0001
Website: http://www.nasa.gov

National Society of Black Engineers
205 Daingerfield Road
Alexandria, VA 22314
Telephone: 703-549-2207
Website: http://www.nsbe.org

National Society of Professional Engineers
1420 King St.
Alexandria, VA 22314-2794
Toll-free Telephone: 888-285-6773
Website: http://www.nspe.org

Smithsonian National Air and Space Museum
Sixth and Independence Avenue, SW
Washington, DC 20560
Telephone: 202-633-2214
Website: http://www.nasm.si.edu

Society of Hispanic Professional Engineers
Telephone: 323-725-3970
Website: http://www.shpe.org

Society of Manufacturing Engineers
1 SME Drive
P.O. Box 930
Dearborn, MI 48128
Toll-free telephone: 800-733-4763
Website: http://sme.org

Society of Petroleum Engineers
Toll-free telephone: 800-456-6863
Website: http://www.spe.org

Technology Student Association
Toll-free telephone: 888-860-9010
Website: http://www.tsaweb.org

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