Engineering Merit Badge

Boy Scouts of America Information Packet

Walter P. Chrysler Museum
Auburn Hills, Michigan

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Boy Scout
Engineering Merit Badge

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.

   Information on the Pre-Visit Information Sheet

2. Select an engineering achievement that has had a major impact on society. Use the resources available to you to research it. Tell your counselor about the engineer(s) who made it possible, the special obstacles they had to overcome, and how this achievement has influenced the world today.

   Tour Guide will cover at the museum

3. Explain the work of six types of engineers. Pick two of the six and explain how their work is related to the automotive field.

   Information on the Pre-Visit Information Sheet

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

   Tour Guide is a present or retired Engineer. This information will be covered at the museum.

   - Discuss the work the engineer did and the tools the engineer used.
   - Discuss with the engineer a current/past project and the engineer's particular role in it.

- Find out how the engineer's work is done and how results are achieved.

- Ask to see the reports that the engineer writes concerning a project.

- Discuss with your counselor what you learned about engineering from this visit.

5. Do one of the following:

   The Scout will need to do this after the visit to the museum.

   - Use the engineering-systems approach to make a step-by-step plan for your next camp out. 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.

   - Make an original design for a piece of patrol equipment. Use the engineering-system 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 the following:

   This activity will need to be done after visiting the museum.

   - Transforming motion. Using common materials or a construction set, make a simple model that will demonstrate transforming motion. How does this make use of basic mechanical concepts like levers and inclined planes? Describe an example where this mechanism is used in a real product.

This activity will need to be done after visiting the museum.

- 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.

7. Find out what high school courses you need to take to be admitted to an engineering program in a college/university. Find out what other Subjects would be helpful in preparing for an engineering career.

   Information on the Pre-Visit Information Sheet

8. Explain what it means for an engineer to be a registered Professional Engineer (P.E.). In what types of engineering work is registration most important?

   Information on the Pre-Visit Information Sheet the boys may talk with the guide while they are in their group to complete this requirement.

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

   Information on the Pre-Visit Information Sheet the boys may talk with the guide while they are in their group to complete this requirement.

Engineer's Activities

- Design
- Application of Theory
- Manufacturing
- Laboratory Testing
- Simulation
- Computer Aided Design (CAD, CATIA)
- Prototyping
- Aerodynamic Testing
- Computational Fluid Dynamics
- Materials Engineering
- Fuel Technologies
- Interior Design
- Ergonomics
- Exterior Design
- Electronics
- Friction
- NVH (Noise, Vibration, Harshness)
- BSR (Buzz, Squeak, Rattle)

List of Engineering disciplines that are involved in developing an automobile:

- Mechanical: These engineers learn how to use shafts and bearings, pulleys, gears, and mechanisms (collections of levers) to make things move around same forth or in special patterns, at specified speeds. They understand how hard you can push on a part before it will bend or break and how to design the shape of a part so that the lightest possible part will support the most force possible.

- Ceramic: These engineers will develop processes that convert clay and nonmetallic minerals into ceramic products such as dishes, protective tiles for the space shuttle and solar panels. Clay models are also used in automobile testing and design.
- Computer: This sector of engineering for the automobile appeared in the early 1980s.

- Electrical: Developing from early inventions by Thomas Edison and George Westinghouse, electricity moved quickly from just lighting our homes to powering automobiles.

- Industrial: These engineers are concerned with how manufacturing plants are organized: what machinery there is, how materials and the things being produced flow through the factory, and how people are organized to make the factory as effective as it can be. They often are involved in managing warehouse operations such as tracking inventory, routing conveyors, and overseeing materials handling.

- Materials: These engineers work with all kinds of materials, natural and synthetic, to create new materials that meet specific needs for strength, flexibility, durability, and resistance to corrosion.

- Manufacturing: Mass producing large quantities of products requires special knowledge of high-speed machinery (including automated machines and robots), to make sure the parts and finished products really are identical.

- Software: Software engineers learn or create different programming languages to perform different kinds of tasks. The computer chips that are used in automobiles have been programmed to control function of mechanical and electronic functions. Computer chips regulate fuel injection and automatic transmissions.

- Systems Engineering: Power plants require the expertise of many kinds of engineers, systems engineers figure out how all the many parts of a complex system work together.

- All types of engineering job functions are involved in creating a car. (This could be related to Computer Design Station)

History of the Automobile:

- The first type of mechanical and personal transportation was the bicycle. Compared to bicycles, automobiles improved personal transportation

because they carry more people at one time, travel faster and further on fuel and shield occupants from nature's elements. Cars originally used the same basic manufacturing structure as bicycles-chains, bearings, pneumatic wheels, metal frames---coupled with carriage body techniques.

- During the 1880s, thousands of Americans began using the 4-cycle gasoline engine perfected by Nicklaus Otto in the 1870s to power machinery. Bicycle mechanics like the Wright brothers became familiar with them because they used them to power metalworking machinery. Once Gottlieb Daimler invented a lightweight relatively high-speed engine, it was the ideal power plant for a self-propelled vehicle. Electric cars were heavy and slow because of the weight of the batteries. They also could not travel far from a recharging source. Steam cars took time to start and had to carry copious quantities of water as well as fuel. Once the successes of Gottlieb Daimler and Karl Benz with self propelled vehicles were reported to Americans, anyone having experience with gasoline engines or bicycle manufacture tried to duplicate it. The U.S., with a prosperous population and vast spaces, was the ideal market for automobiles. The drawbacks of the gasoline-powered vehicles were obviously subject to refinement. Chrysler Corporation would play a major role in the refinement.

- Walter P. Chrysler was the only mass transport (railroad) figure to rise to a leading position in the auto industry. He instinctively understood the appeal of what the automobile offered. Chrysler was experienced in managing a large organization due to his railroad background. He was also experienced at controlling costs in manufacturing. Trained originally as a practical machinist and via correspondence school as an engineer, he was not a tinkerer, inventor, investor, or a small businessman as many other auto pioneers were. He was a man with an appreciation of the automobile; an understanding of what professional engineers could do, and had experience in manufacturing complex machinery efficiently and profitably, while employing large workforces. Because of Chrysler's approach, Chrysler Corporation became a leading manufacturer very quickly, and long after creating a new automotive enterprise was thought possible. It happened because of a combination of superior engineering and efficient manufacturing practice----excellent products at good prices----and excellent sales and marketing techniques. Chrysler Corporation, as a result, played a leading role in refining the automobile into the comfortable, efficient, comparatively inexpensive,

safe, and reliable machine it is, and the dominant form of transport in the western world.

High School Courses:

Entering freshmen planning to major in engineering or computer science should take at least four years of high school mathematics courses (maintaining a 3.00 or B average) as well as courses in chemistry and physics and have a solid background in English composition. Drafting and machine shop courses are useful, but not necessary. Normally, a 3.00 (B average) is required for admission to a School of Engineering and Computer Science.

College Courses:

Calculus
Chemical Principles
Computer Problem Solving in Engineering & Science
Dynamics & Vibrations
Engineering Probability & Statistics
Introduction to Differential Equations
Introduction to Digital Logic & Microprocessors
Introduction to Electrical Circuits
Introduction to Engineering
Introduction to Fluid & Thermal Energy Transport
Introduction to Linear Algebra
Introductory Physics
Lumped Parameter Linear Systems
Mechanics of Materials
Multivariable Calculus
Professional Engineering
Properties of Materials
Statics & Dynamics
Thermodynamics

Professional Registration:

Qualified engineers may become licensed to practice engineering in their state. This is not always required, but for some governmental work and to

review and approve design it may be needed. The applicant must complete the following:

- Earn a four-year engineering degree in a program approved by the state engineering licensure board.

- Complete four years of qualifying engineering work experience.

- Pass the Fundamentals of engineering exam also called Engineer-in-Training exam.

- Pass the Principle and Practice of engineering (P.E.) exam.

Engineers uphold and advance the integrity, honor and dignity of their profession by:

- Using their knowledge and skill for the enhancement of human welfare.

- Being honest and impartial, and faithfully serving the public, their employers, and clients.

- Striving to increase the competence and prestige of the engineering profession.