Preparation for:
Drafting Merit Badge
Electricity Merit Badge
Engineering Merit Badge
Pioneering Merit Badge

Engineer

3 Den Meetings to complete

Takeaways

- A basic understanding of the engineering world.
- Learning about career choices in engineering.
- Awareness of the Engineering merit badge for Boy Scouts.

Do all of these:

1. Pick one type of engineer. With the help of the Internet, your local library, or a local engineer you may know or locate, discover and record in your book three things that describe what that engineer does. (Be sure to have your Webelos den leader, parent, or guardian's permission to use the Internet.) Share your findings with your Webelos den.

2. Learn to follow engineering design principles by doing the following:

    a. Examine a set of blueprints. Using these as a model, construct your own set of blueprints or plans to design a project.

    b. Using the blueprints or plans from your own design, construct your project. Your project may be something useful or something fun.

    c. Share your project with your Webelos den and your pack by displaying the project at a pack meeting.

3. Explore other fields of engineering and how they have helped form our past, present, and future.

4. Pick and do two projects using the engineering skills you have learned. Share your projects with your den, and also exhibit them at a pack meeting.

Requirement #1: Find out about an engineer, and

Requirement #3: Explore other fields of engineering

An engineer is a professional practitioner of engineering, concerned with applying scientific knowledge, mathematics and ingenuity to develop solutions for technical problems. Engineers design materials, structures, machines and systems while considering the limitations imposed by practicality, safety and cost. The word engineer is derived from the Latin root ingenium, meaning "cleverness".

The following is a comprehensive list of the major categories of engineering careers. You can just highlight this with your boys:

Chemical engineering

Chemical engineering comprises the application of physical and biological sciences to the process of converting raw materials or chemicals into more useful or valuable forms.

- Materials engineering - involves the properties of matter and its applications to engineering.
    - Ceramic engineering, the theory and processing of raw oxide material (e.g. alumina oxide), and advanced material that are polymorphic, polycrystalline, oxide, and non-oxide ceramics
    - Crystal engineering, the design and synthesis of molecular solid-state structures
- Process engineering - focuses on the design, operation, control, and optimization of chemical processes
    - Petroleum refinery engineering, the design of processes related to the manufacture of refined products
    - Plastics engineering, the design of the production process of plastics products
    - Paper engineering, the design of the production process of paper products
- Molecular engineering - focuses on the manufacturing of molecules.

Civil engineering

Civil engineering comprises the design, construction and maintenance of the physical and natural built environments.

- Geotechnical engineering - concerned with the behavior of geological materials at the site of a civil engineering project
    - Mining engineering, the exploration, extraction and processing of raw materials from the earth
    - Materials engineering - involves the properties of matter and its applications to engineering.
- Structural engineering - the engineering of structures that support or resist structural loads
    - Earthquake engineering, the behavior of structures subject to seismic loading
    - Wind engineering, the analysis of wind and its effects on the built environment
    - Architectural engineering, application of engineering principles to building design and construction
    - Ocean engineering, the design of offshore structures
- Transportation engineering - the use of engineering to ensure safe and efficient transportation of people and goods
    - Traffic engineering, a branch of transportation engineering focusing on the infrastructure necessary for transportation
    - Highway engineering
    - Railway systems engineering
- Environmental engineering - the application of engineering to the improvement and protection of the environment

    - Ecological engineering, the design, monitoring and construction of ecosystems
    - Fire protection engineering, the application of engineering to protect people and environments from fire and smoke
    - Sanitary engineering, the application of engineering methods to improve sanitation of human communities
    - Hydraulic engineering, the planning, development and maintenance of water resources and the application of hydrology
    - Municipal engineering, civil engineering applied to municipal issues such as water and waste management, transportation networks, subdivisions, communications, hydrology, hydraulics, etc.

Electrical engineering

Electrical engineering comprises the study and application of electricity, electronics and electromagnetism.

- Electronic engineering - the design of circuits that use the electromagnetic properties of electrical components such as resistors, capacitors, inductors, diodes and transistors to achieve a particular functionality.
    - Control engineering, focuses on the modeling of dynamic systems and the design of controllers using electrical circuits, digital signal processors and microcontrollers
    - Telecommunications engineering
- Computer engineering - the design and control of computing devices with the application of electrical systems
    - Software engineering, the development of instructions that control computing devices
- Power engineering - the generation, transmission and distribution of electricity, and the design of devices such as transformers, electric generators, electric motors, high voltage engineering and power electronics.
- Optical engineering - the design of instruments and systems that utilize the properties of electromagnetic radiation.

Mechanical engineering

Mechanical engineering comprises the design, analysis and usage of heat and mechanical power for the operation of machines and mechanical systems.

- Vehicle engineering - the design, manufacture and operation of the systems and equipment that propel and control vehicles
    - Automotive engineering, the design, manufacture and operation of motorcycles, automobiles, buses and trucks
    - Aerospace engineering, the design of aircraft, spacecraft and other air vehicles
    - Marine engineering, the design, construction, operation and support of marine vehicles
- Thermal engineering - concerns heating or cooling of processes, equipment, or enclosed environments
- Acoustical engineering - concerns the manipulation and control of vibration, especially vibration isolation and the reduction of unwanted sounds

Interdisciplinary and specialized fields

- Industrial engineering - the design and analysis of logistical and resource systems.
    - Manufacturing engineering, the ability to plan the practices of manufacturing, to research and develop the tool, processes, machines and equipment, and to integrate the facilities and systems for producing quality products with optimal expenditure.

    - Component engineering, the process of assuring the availability of suitable components required to manufacture a product.
    - Systems engineering, focuses on issues such as logistics, the coordination of different teams, automatic control of machinery for complex engineering projects
    - Construction engineering, the planning and management of construction projects
    - Safety engineering, assuring that a life-critical system behaves as needed even when pieces fail
- Applied engineering - the field concerned with the application of management, design, and technical skills for the design and integration of systems, the execution of new product designs, the improvement of manufacturing processes, and the management and direction of physical and/or technical functions of a firm or organization. Applied Engineering degreed programs typically include instruction in basic engineering principles, project management, industrial processes, production and operations management, systems integration and control, quality control, and statistics.
    - Automation/Control Systems/Mechatronics/Robotics
    - Computer-aided Drawing & Design (CADD)
    - Construction
    - Electronics
    - General
    - Graphics
    - Manufacturing
    - Nanotechnology
- Biological engineering - the application of engineering principles to the fields of biology and medicine.
    - Biomedical engineering, the application of engineering principles and techniques to the medical and biological sciences
    - Genetic engineering, the design and development of techniques to directly manipulate an organism's genes
    - Biochemical engineering, the design and construction of unit processes that involve biological organisms or molecules
    - Tissue engineering
    - Protein engineering, the development of useful or valuable proteins
- Mechatronics - a hybrid of mechanical and electrical engineering, intended to examine the design of automation systems.
    - Robotics
    - Instrumentation engineering
- Nuclear engineering - the application of nuclear processes to engineering
- Avionics - the design and programming of electronics and computer systems on board an aircraft or spacecraft
- Agricultural engineering - the application of engineering principles to agricultural fields such as farm power and machinery, biological material process, bioenergy, farm structures, and agricultural natural resources
    - Bioprocess engineering, the design and development of equipment and processes for the manufacturing of products from biological materials
    - Food engineering, concerns food processing, food machinery, packaging, ingredient manufacturing, instrumentation, and control.
    - Aquaculture engineering, the study of cultured aquatic species and the production systems used in their culture.
- Nanoengineering - the practice of engineering on the nanoscale
- Petroleum engineering - the application of engineering principles to drilling for and producing crude oil and natural gas
    - Reservoir engineering, the application of scientific principles to study the flow of fluids in underground reservoirs so as to obtain a high economic recovery.
    - Drilling engineering, the design and application of equipment and techniques to drill wells.
    - Production engineering, the design and application of equipment and techniques to bring well fluids to the surface and then separate out the various components.

Know Your Engineer

The Right "Man" for the Job!

Use a word from this list to fill in the best answer for each statement below.

Aeronautics	Agricultural	Chemical	Civil
Electrical	Industrial	Mechanical	

1. An engineer who designs plants to make water safe to drink - _____.
2. An engineer who designs machines in a factory - _____.
3. An engineer who tests new processes and checks old ones in a chemical plant - _____.
4. An engineer who plans new circuits and directs workers in an electrical plant - _____.
5. An engineer who designs and tests new space techniques - _____.
6. An engineer who designs and tests new techniques for new equipment for industry - _____.
7. An engineer who designs and tests equipment for farmers and ranchers - _____.

(Answers: 1-Civil 2-Mechanical 3-Chemical 4-Electrical 5-Aeronautics 6-Industrial 7-Agricultural)