

Engineering



All around us are technological breakthroughs that have made our lives more exciting and our world smaller each day. By the touch of a button, we can communicate instantaneously with someone on the other side of the globe. By understanding physics, we have created methods of transportation that move us thousands of miles in hours. Our lives depend on televisions, telephones, cars, bridges, bone implants, crop rotation techniques, chemical reactions, oil refineries, and manufacturing plants. Engineers use math and science as tools to bring these things to our lives.

Do you enjoy math and science classes in school? Women are currently highly underrepresented in the field of engineering. To be a successful engineer, all it takes is creativity, enthusiasm, and a curiosity about what you can bring to the future. Discover that you have what it takes.

Complete the two starred activities and six others of your choice.

- *1.** Make a list of at least 10 things in your house or school that didn't exist 10 years ago. Have your friends do the same and compare your lists. How has the advancement of technology affected your life? Write to at least three computer, communications, automotive, or other technologically based corporations asking for brochures about their latest exciting products. Find out how new engineering advances have decreased the price and improved performance of at least one of the following: computers, biological implants, automobiles, or communications systems. Discuss with others how you think your life will change in the next 10 years and how technology will contribute to those changes.
- 2.** By reading magazine or newspaper articles or by talking to someone from another country, find out what technologies exist in other places of the world. (For example: How does the phone system work in Europe? What sorts of public transportation exist in Japan?)
- 3.** Lead a workshop for younger Girl Scouts in which you, either separately or together, design a high-tech house of the future. Some creative ways you could present ideas to each other include writing stories, drawing pictures, or acting out scenarios about the people who will live in this house.
- 4.** Find the names of at least 10 women engineers, past or present, and read about their accomplishments. You could do this by reading engineering journals, professional membership directories, *Who's Who in Science and Engineering*, or the magazine *The Woman Engineer* or by contacting the Society of Women Engineers through a local college or university.
- 5.** Try to talk with or meet a female engineer. If you don't know of one, call a company or university, explain your project, and ask for the name of a female engineer or engineering professor. Ask her why she decided to study engineering, if she enjoys it, and if she's ever experienced discrimination in her field because she's a woman. If possible, spend part of a day with her to discover more about what she does.
- 6.** Design the layout of a factory that will manufacture a consumer product of your choosing. Don't forget to include space for receiving raw materials, machinery for making and packing the product, space for storing product that has yet to be sent out, and a system for delivering loads of your final product to the customer.

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Think about how each area of the factory affects the others. If the packing line breaks down, where will the finished product go while it waits to be packed? Will the production line have to be shut down as well? Will there then be a shortage of final packages in the warehouse when truckers come, expecting their loads on time?

Think about all the planning that goes into predicting what demand there will be for your product. If you have too much sitting in the warehouse, you have spent too much money on product that isn't being bought. If you don't have enough to supply the customers, they will take their business to another company.

If possible, tour a factory that makes consumer products. Ask how some of the above questions are resolved and what other types of problems occur in the daily management of a plant.

- 7.** Visit your town or city's department of public works. Find out what a city engineer does. Who is responsible for planning and designing the construction of new roads and traffic lights and when is it decided that these new roads or traffic lights are needed? Who approves building permits and what criteria do they use to accept or deny proposals? Where does sewage go? How are public transportation schedules designed? How do electricity and telephone lines reach your house? Is the environment taken into consideration when all of these questions are answered?
- 8.** Learn how to operate a home computer. Find out what a spreadsheet program does and use one to calculate a monthly budget or your grade point average at school. If you don't have access to a spreadsheet program, do these calculations by hand and imagine how much faster and easier it would be to use a computer to do the calculations all at once.

Find out what sort of programs engineering professionals use to make their jobs easier. These might include math programs, graphing programs, or CAD programs. You might do this by visiting a software store, talking with an engineer, or reading computer magazines.

OR

Find out about the Internet and the World Wide Web. What is a "home page" on the Web? How many places in the world can you contact with your computer? Explore the World Wide Web and find an article you find amusing or interesting to share with your friends. If you already have experience "scanning the Web," try your hand at designing a home page for your Girl Scout troop (you can get ideas by looking at other peoples' home pages.)

- 9.** Learn the definitions of the terms *capacitor*, *resistor*, *transistor*, *chip*, *voltage*, *amp*, *diode*, and *LED*. Learn how to operate a voltmeter or ammeter. After unplugging it, open a radio and look at the components inside. Visit a store such as Radio Shack; ask a salesperson to show you the electronic components section. How many different sizes of capacitors and resistors do you see? Ask what the various chips on the shelf do. Using a kit or an introductory electronics booklet, build a simple circuit, such as a transistor radio.
- 10.** What is the difference between a sprocket and a gear? A socket wrench and a pipe wrench? Find out what it really means to have a 10-speed bicycle. What physically happens to your bicycle when you switch gears? Why and how does that affect the ease or difficulty of your pedaling? Learn how to properly care for your bicycle — checking air in the tires, oiling the gears, etc. Learn how to replace a brake pad or chain on your bike.

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- 11.** Enter your school's science fair in the engineering category.
- 12.** Learn how to safely operate at least three power tools.
- 13.** Spend a day volunteering your services as a builder. You might contact an organization such as Habitat for Humanity and build or repair houses. Your group might design and build a footbridge on a trail in your area or a storage shed for your local Girl Scout camp. The possibilities are unlimited.
- 14.** Build a simple solar hot water heater by placing a tube or container of water on roof tiles (find these at any home improvement store) and covering both the water and the tiles with a clear material that can withstand weather, such as fiberglass. You might also add some sort of insulation ("bubble wrap" works well) underneath the cover and above the container of water. Build at least three different configurations using different materials (perhaps roof tiles of different colors or different types of insulation). Place all your heaters, along with a container of water and nothing else, outside. Measure the temperature of the water in each unit every day at the same time for a month. What materials work best for keeping the water warm? Did any of your configurations consistently keep water at a significantly higher temperature than the water with no tiles or insulation? What are the advantages and disadvantages of using solar energy as opposed to gas or electricity for heating water?
- 15.** Technology has affect all aspects of our lives, including the arts. Do at least one of the following activities (see "Science-Related Activities" in *Safety-Wise* for safety guidelines):
 - Find out how sound and lighting engineers contribute to theatrical productions. Contact a theater, ask how the sound effects and set lighting are designed, and, if possible, sit with an engineer during a production.
 - How has engineering contributed to music? Find out about computer MIDI programs that enable composers to use computers and synthesizers to notate music as they play it with an instrument and then have a computer play their compositions back for them. If possible, visit a piano store that has an acoustic piano that can similarly record performances and then play them back via computer disk. Or, visit a music store that sells electronic instruments and synthesizers. How authentic do the instrument imitations sound?
 - Find out how the advent of new computer technologies has affected computer graphics and animation. Read or talk with someone about how pictures can be scanned into a computer and altered or how animated for the movies is generated. Visit a computer store and ask for a demonstrations of animation with CD-ROM technology.
- *16.** Find out the statistics on how many women study engineering (hint: they're low!). Lead a discussion with your group or parents about why you think this is.

Ask permission to conduct a survey at your school. Ask both boys and girls what they like or dislike about science and math. Be sure to find out what science and math classes they've taken. Ask what they think an engineer does and whether they would study engineering in college. If not, why not? Add anything else you want to your survey and give it to at least 100 people around your age. (If your school isn't that big, survey as many people as you can. Be sure to answer the questions yourself!) Are there any differences in answers between girls and boys?

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Speak to counselors, write to engineering colleges, or speaking with engineering students to find out what studying engineering in college is like. Present your findings and survey results in an oral presentation to your fellow students, on a bulletin board at your school, or as a pamphlet that others can read. Has any of your research affected your opinion of engineering one way or another?



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