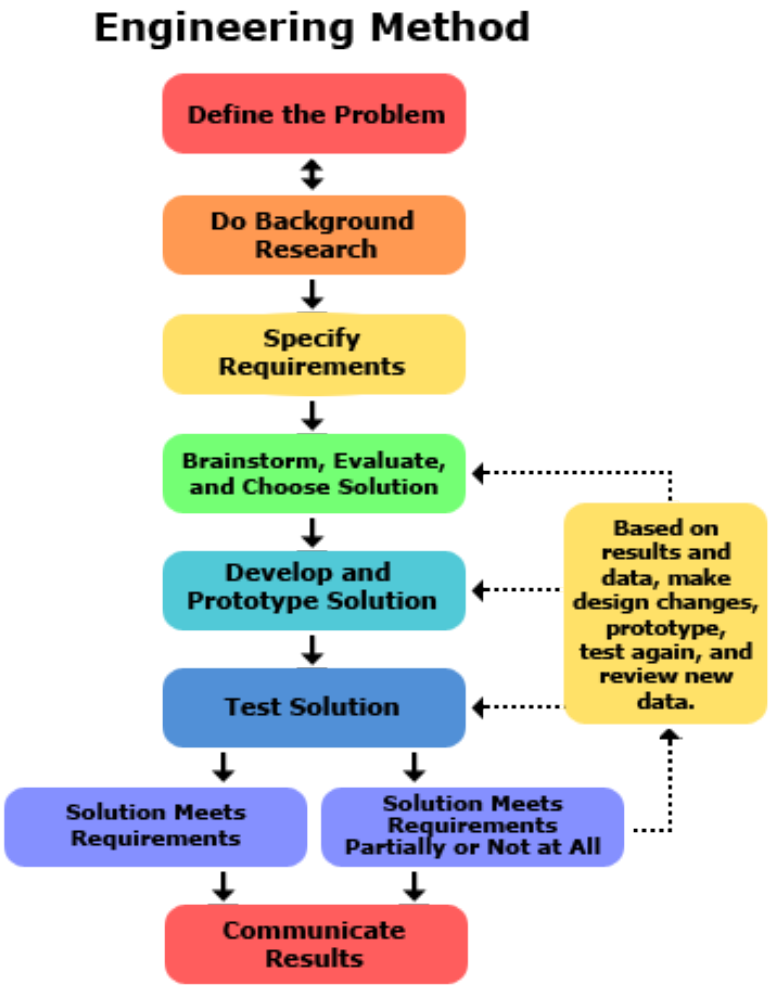
The Engineering Process

If you decide to do an engineering project, the process is very similar to the scientific method, except that engineers identify a problem and then try to solve that problem. It can be hard to figure out if you should be using the scientific method or the engineering process/method. One thing to keep in mind is that if you want to invent and new product, computer program, experience, or environment, then you should definitely be using the engineering method. If you just want to build something for fun, then build it and use the Scientific Method to test a question and hypothesis. For example, if you want to build a remote control car, do it, and then ask it if can go faster through an obstacle course you designed than a car you bought. You must test and measure something whether it is a science or engineering project.

A key aspect of the engineering method is that your process must be iterative – this means you must start with one solution to your problem and improve upon it at least twice. This means you will have at least 3 solutions or prototypes, with the later versions building and improving upon earlier versions.



First, define the problem, or identify the specific need, which is a lot like asking a question. What problem are you trying to solve? You may want to make something easier, faster, stronger, lighter, or more durable. You may also want to improve the world for other organisms you interact with, such as plants and animals.
*****Who needs what because why?**

Next do background research, just like with the scientific method. For engineering, you should research who the users are and what products and solutions already exist. You may also need to do some background research into different types of materials and different building techniques.

Next, specify the requirements: your design requirements, or constraints, state the important characteristics that your solution needs to succeed, while still being reasonable to construct. **Considerations for constraints include available materials, cost, size, and your own ability to create something (you will think about some of this after you brainstorm).**
*You will also need to set the criteria that you will use to determine if your design is successful or not. These criteria will end up being the things that you collect data for so you need to make sure that they are things that can be measured. One way to identify the design requirements for your solution is to analyze a similar, exis.ng product, no.ng each of its key features.

Next, brainstorm, evaluate, and choose a solution.

After brainstorming, evaluating, and choosing your best solution, you develop a plan and build a prototype of your solution and test it. *A prototype is an operating version of a solution. Keep a list of materials that you need as you draw your plans. This will help to ensure that you have everything you need. Prepare a schematic and step-by-step instructions explaining how to create your prototypes. Make sure that someone else will be able to follow your instructions. Write out a clear set of operating instructions.

Record as much data as you can rela.ng to the success criteria that you identified earlier. Use that data to determine how successful your design is.

A key part of the engineering process is iteration – designing, making, and testing new prototypes until you have found your best working solution. The design process involves multiple iterations and redesigns of your final solution. *You will likely test your solution, find new problems, make changes, and test new solutions before settling on a final design. Use those data to determine how successful your design is.
***Remember that it's alright if it doesn't work perfectly the first time! The Engineering Design Process is a cycle that you get to repeat as many times as you need to in order to solve the problem!!!

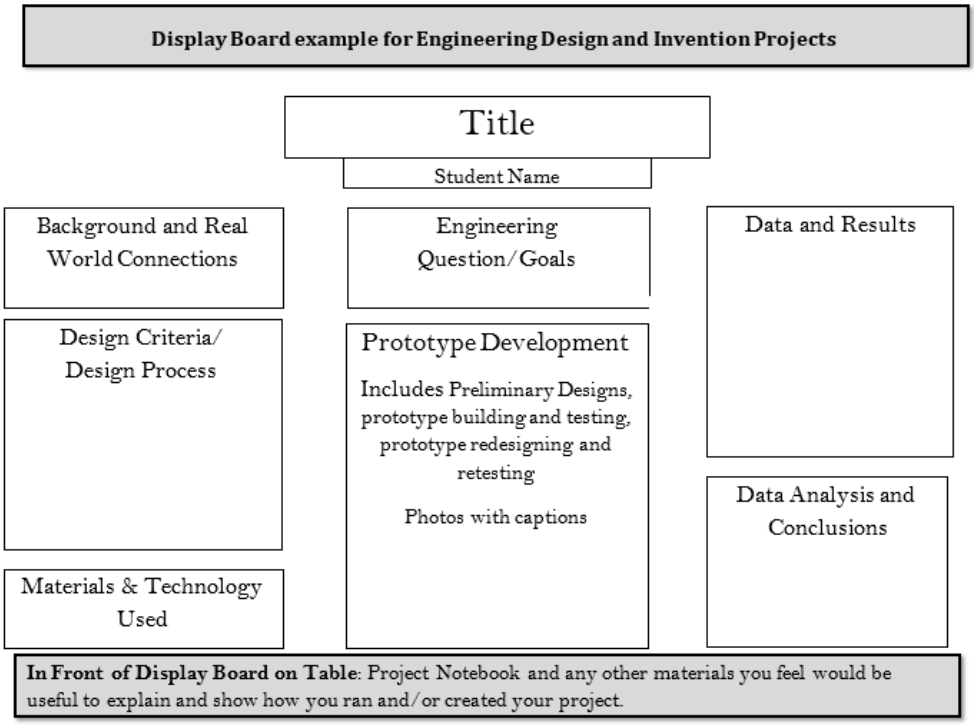
Finally, as with the scientific method, you clearly communicate your results. **Poster and oral presentation to judges:** You need to prepare a display board to communicate your work to others. Organize your information so that your audience can quickly follow your experiment by reading from top to

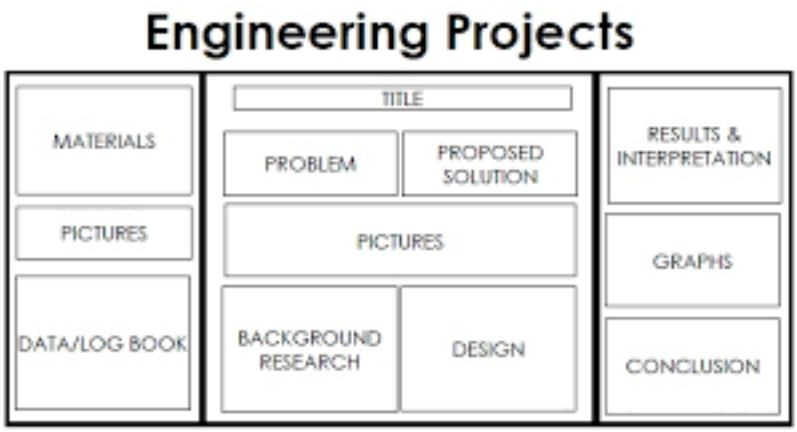
bottom, then left to right. Include each step of your project: Abstract, question, hypothesis, variables, background research, and so on. Check out http://www.sciencebuddies.org/science-fair-projects/project_display_board.shtml#samples for more ideas. There are also some sample displays in the library.

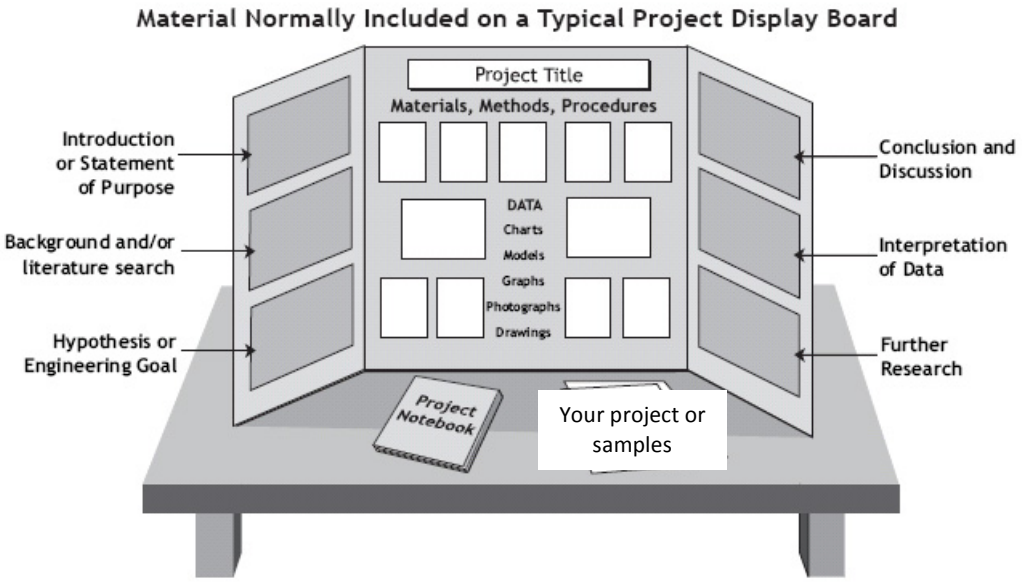
The title should be big and easily read from across the room. Choose one that accurately describes your work, but also grabs peoples' attention.

Use a font size of at least 16 points for the text on your display board, so that it is easy to read from a few feet away. It's OK to use slightly smaller fonts for captions on picture and tables.

Remember: A picture speaks a thousand words! Use photos or draw diagrams to present non-numerical data, to propose models that explain your results, or just to show your experimental setup. Here are some examples of ways to set up your display board:







- Prepare to present to the judges for approximately 5 minutes
- Be ready to answer questions
- Know your project and show your enthusiasm
- Look the judge in the eye and speak clearly
- Use props to demonstrate your experiment, if possible
- Reference results, tables and graphs
- Don't just read from the poster
- Practice your presentation in front of someone before the fair