



## **The Scientific Method (or the Engineering Design Process)**

Note: this is for the Innovation type of project

### ***Step 1: Define the Problem***

Look around you. Look outside. Take a walk and observe the environment. What do you wonder about? Are there any problems in the world you want to fix? This is the perfect opportunity to find your own answers. Once you have figured out your problem, conduct research to form the idea for your invention. Brainstorm some possibilities and narrow it down to one specific problem that will provide the basis for the invention you wish to create.

Stuck inside the house? Visit our cyber Greenhouse and explore the nature of our world as it changes alongside human action and other natural occurrences.

(provide link to our web layout of the different environmental categories)

An example of a problem could be “Energy creates lots of pollution. Could this be solved by using energy from the sun?”

### ***Step 2: Specify Requirements***

Now that you know what you want your invention to do, specify exactly what it is required to do from what you know and have researched about so far! You can state what is required by using the old-age traditional scientific statement: “If \_\_\_\_\_ then \_\_\_\_\_.” Be sure to include why you think this will happen; be specific.

For example “If there was a type of panel that could absorb and capture energy from sunlight then we could use that panel to convert the sunlight to usable energy.”

### ***Step 3: Brainstorm Solutions***

So now you know what you require your invention to do, you just need to figure out how to get it to do it. The best way to do that is more research. A lot of the time, if you look into inventions that are similar in some way to your own invention you can get ideas on what types of materials could work and how to connect different materials.

If we use the example above, the solar panel, then we know that metal and pavement get hot when we touch it, but there is no known way to convert that heat to energy. There is also something called interconnected silicone cells that can absorb the heat energy.

#### ***Step 4: Choose the Best Solution***

So you've got a few ideas down, and now is the time to pick one. While it is possible to create more than one invention, that would require a lot of design work and building. Your best bet is to look at all of your possibilities you found while brainstorming and pick the best one.

For the solar panel example, you already know that using metal or pavement would be pointless. However, there is no evidence proving that silicone cells would not work. Out of those three options, it would be the best one to pick.

#### ***Step 5: Do Development Work and Get Materials***

You have your idea for your invention, now it's time to figure out how to make it work. You should draw out your plans prior to building. Make sure your drawing is done to scale, and write the measurements on it. Make sure you draw and label every angle of the invention. You will not be happy if you need to do something multiple times when actually building your invention because you slacked off on your drawing. Once you figure out what you will need and how much of it is required, you should begin to get the materials that will be required when you build. Your parents can help with this part if you give them a list of supplies.

For the solar panel, you would want to draw the size of the panel, let's say a 10cm by 10cm square, as well as any wires that may be required, and write down the materials you are using on the side. For more complex projects multiple views will be required. After that, you would want to buy the silicone cells required for the experiment.

#### ***Step 6: Build a Prototype***

This is the part of the process where you get to build your invention. Make sure you have your drawings and materials beside you, and be sure to refer to them often. If you need to use heavy machinery or tools that you are not comfortable with, ask a parent or a friend for help. Remember, safety first. Once you finish this, you will have a prototype to go along with your drawing.

If I need a square of interlocking silicone cells to create my panel, then I will cut my square to the shape indicated in my drawing, 10cm by 10cm, and then I will connect any wires where they should be located based on my drawing. Once I'm done, I will have a prototype of the invention I drew in the development stage.

#### ***Step 7: Test and Redesign***

You have finally arrived at the end of your project! Well, maybe. Now it is time to test the prototype that you created. If everything went well, it will work exactly as you imagined it. If not, don't worry, that does not mean that you will lose at the science fair. If this is the case, you need

to take notes. Record what went wrong, why it went wrong, and how you would redesign your project to fix it. Maybe next year you will have the new and improved model!

Lets say I built a successful solar panel. I'm done! Now you should try to think of uses for your invention or ways to improve it further. Now lets say I did not build a successful solar panel. Why didn't it work? What could I change to make it work? These are the kind of questions you want to be able to answer for a judge at a science fair. Who knows, maybe you still have enough time to rebuild?

Interpret and organize the results from your invention in graphs and charts so that it is easily comprehensible. Present the information on a display board (<http://www.nsis.ca/display-tips>). Prepare a presentation for the audience and judges. You've just made an invention that could change the world we live in; blow the audience away with your creativity and knowledge! It is your time to share your hard work and present yourself as a new, young Scientist! Be enthusiastic, professional, and above of all, have fun!