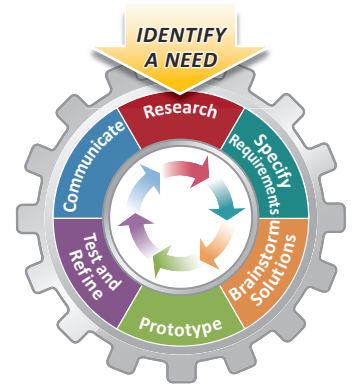


Engineering Design Log

Why Keep an Engineering Design Log?

People who are trying to meet a need or solve a problem often follow an approach called the engineering cycle. The engineering cycle divides the design process into a series of stages that can be repeated as needed. Engineers often use a design log to keep track of their work. As you develop your own designs, keep a log to describe your ideas, gather information, ask questions, sketch plans, record results, and share findings. Your log should include the following stages:



1. Identify a Need

What problem are you trying to solve? What process are you trying to improve?

2. Research

Part of research is identifying what you know about a topic or closely related topics that may help you to design your solution. Then you may think about any additional information you need to gather and where you can find that information. What do you know about this topic? What additional information do you need?

3. Specify Requirements

The requirements of a design process include criteria, constraints, and trade-offs. Criteria are the standards a product or process must meet in order to be successful. Constraints are rules that limit the design of your product and include cost, availability of materials, and time. A trade-off is a compromise that exchanges one idea with another that may not be as good but still achieves the design requirements. For this design challenge, what are the design criteria and constraints? Can you identify any trade-offs at this stage? (Trade-offs often become more apparent during subsequent stages of the design process.)

4. Brainstorm Solutions

Describe the different ways you could solve the problem. Which solution should you explore first? Can you make a plan or blueprint of your solution?

5. Prototype

Now that you have chosen a solution, build your prototype. At this stage, you may need to gather some materials and/or tools. Did you learn something new as you constructed your prototype?

6. Test and Refine

How will you test your design and what data will you record? Once you have your prototype and other materials set up and you are ready to record your observations, conduct your tests. Construct a data table to record and analyze your data. Considering the results of your tests, what improvements should you make to your design?

7. Communicate

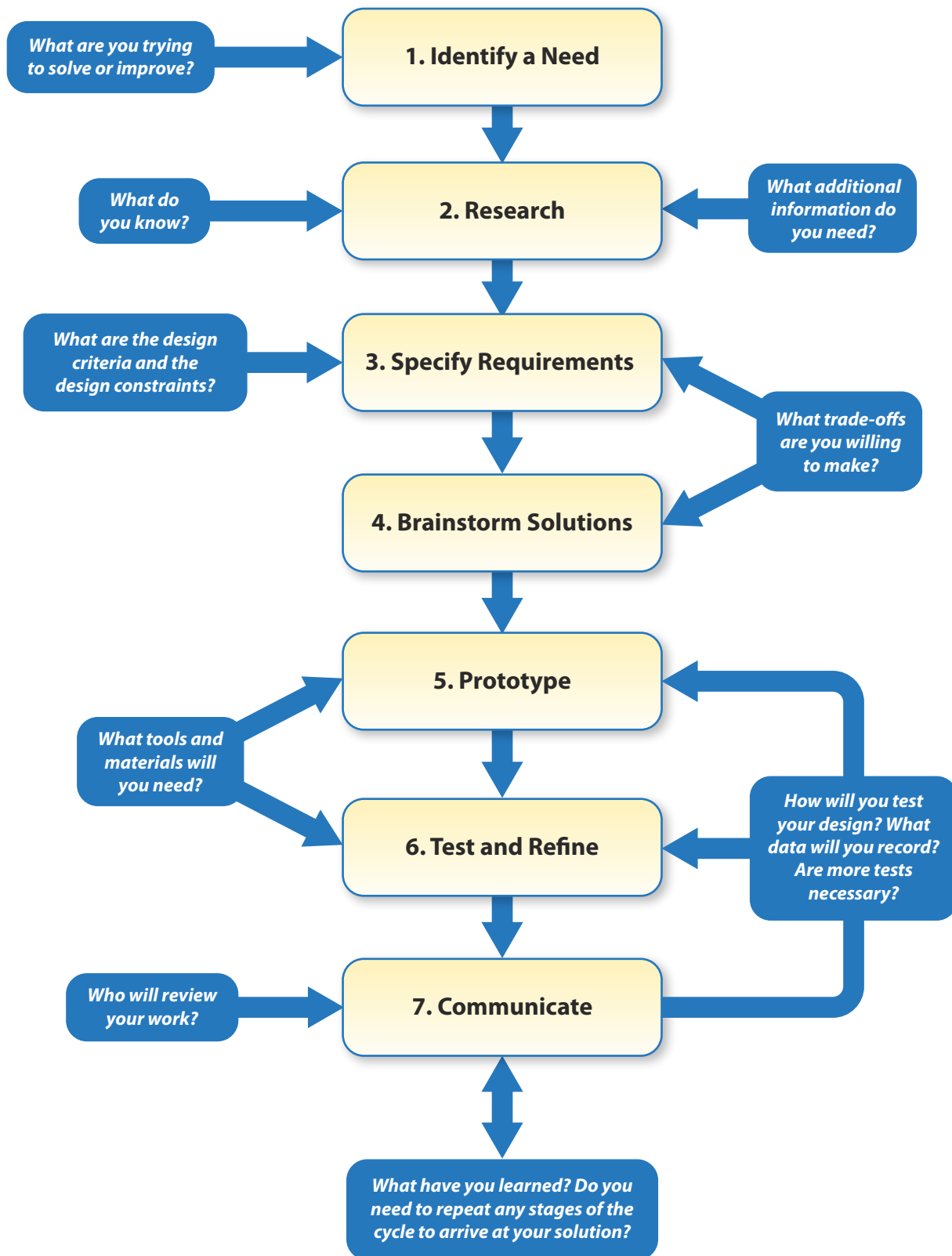
Scientists and engineers share their ideas within communities so that others may benefit from their work and review their conclusions. How will you share your design with others? What suggestions do others have for your design?

8. Reflect and Revise

The design process does not have to end when the results are communicated. What new information could you find that would help your design? Is there another type of test you could perform on your design, or an idea you weren't able to investigate in the first round of the process? Review your notes and reflect on these questions.

Engineering Design Log

The engineering cycle can also be thought of as a series of decisions.
This diagram shows where these decisions are often made.



Engineering Design Log Sample Grading Rubric

Stages of the Engineering Cycle	Exceeds expectations	Meets expectations	Does not meet expectations
Research and Specify Requirements	<ul style="list-style-type: none"> • Problem statement identifies needs • Statement of design requirements includes at least 3 constraints and at least 3 criteria 	<ul style="list-style-type: none"> • Problem statement identifies needs • Statement of design requirements includes some constraints and criteria 	<ul style="list-style-type: none"> • The problem statement is incomplete or the statement of design requirements does not include criteria and/or constraints
Brainstorm and Prototype	<ul style="list-style-type: none"> • Includes a diagram or plan of the prototype that indicates each of the design elements and their purpose or function 	<ul style="list-style-type: none"> • Includes design elements indicated by a diagram or plan 	<ul style="list-style-type: none"> • Does not include design elements indicated by a diagram or plan
Test and Refine	<ul style="list-style-type: none"> • The data table indicates which design was tested (ex. "1, 2, etc.") and the performance of each prototype • The data table lists trade-offs in each design • Accompanying the data table are diagrams of each design. Each diagram labels refinements made on the previous design. 	<ul style="list-style-type: none"> • The data table indicates which design was tested (ex. "1, 2, etc.") and the performance of each prototype • The data table lists trade-offs in each prototype 	<ul style="list-style-type: none"> • The data table does not indicate which design was tested or the performance of that design • The data table does not list the trade-offs in each prototype • OR, a data table is not included

Safety Skills

Follow these basic safety guidelines:

- 1. Prepare** for each investigation. Read the investigation sheets carefully. Take special note of safety instructions.
- 2. Listen** to your teacher's instructions before, during, and after the investigation. Take notes to help you remember what your teacher has said.
- 3. Get ready to work.** Roll long sleeves above the wrist. Tie back long hair. Remove dangling jewelry and any loose, bulky outer layers of clothing. Wear shoes that cover your toes.
- 4. Gather** protective clothing (goggles, apron, gloves) at the beginning of the investigation.
- 5. Emphasize teamwork.** Help each other. Watch out for one another's safety.
- 6. Clean up** spills immediately. Clean up all materials and supplies after an investigation.

Know what to do when...

7. working with heat.

- a. Always handle hot items with a hot pad. Never use your bare hands.
- b. Move carefully when you are near hot items. Sudden movements could cause burns if you touch or spill something hot.
- c. Inform others if they are near hot items or liquids.

8. working with electricity.

- a. Always keep electric cords away from water.
- b. Extension cords must not be placed where they may cause someone to trip or fall.
- c. If an electrical appliance isn't working, feels hot, or smells hot, tell a teacher right away.

9. disposing of materials and supplies.

- a. Generally, liquid household chemicals can be poured into a sink. Completely wash the chemical down the drain with plenty of water.
- b. Generally, solid household chemicals can be placed in a trash can.
- c. Any liquids or solids that should not be poured down the sink or placed in the trash have special disposal guidelines. Follow your teacher's instructions.
- d. If glass breaks, do not use your bare hands to pick up the pieces. Use a dustpan and a brush to clean up. "Sharps" trash (trash that has pieces of glass) should be well labeled. The best way to throw away broken glass is to seal it in a labeled cardboard box.

10. you are concerned about your safety or the safety of others.

- a. Talk to your teacher immediately. Here are some examples:
 - You smell chemical or gas fumes. This might indicate a chemical or gas leak.
 - You smell something burning.
 - You injure yourself or see someone else who is injured.
 - You are having trouble using your equipment.
 - You do not understand the instructions for the investigation.
- b. Listen carefully to your teacher's instructions.
- c. Follow your teacher's instructions exactly.

Safety in the science lab is everyone's responsibility!