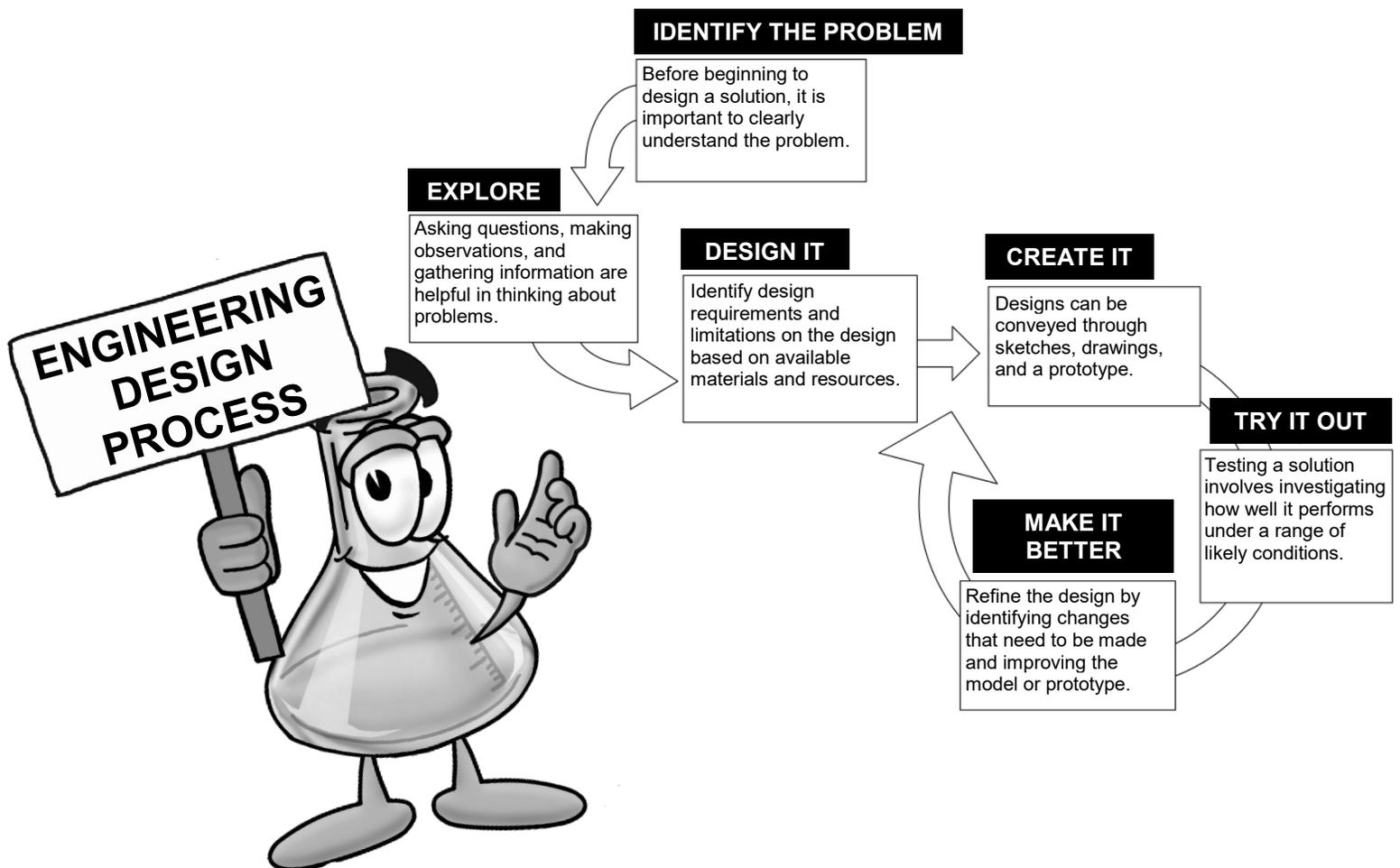




SCIENCE ON-THE-GO

ENGINEERING DESIGN PROCESS

Anything that is built must first be engineered or designed and manufactured according to an engineering practice. The field of engineering is divided into branches such as civil, electrical, mechanical, and chemical engineering. An **ENGINEER** is a person who designs and builds complex products, machines, systems, or structures. The **ENGINEERING DESIGN PROCESS** is a series of steps engineers use to guide them as they solve problems.



DEFINING AND DELIMITING ENGINEERING PROBLEMS

A situation people want to change or create can be approached as a problem to be solved through the engineering design process. Asking questions, making observations, and gathering information are helpful in thinking about problems. Before beginning to design a solution, it is important to clearly understand the problem.

Engineers must contend with a variety of limitations, or **CONSTRAINTS**, when

they engage in a design solution. Constraints may be physical, economic, legal, political, social, ethical, aesthetic, or related to time and place. In terms of quantitative measurements, constraints may include limits on cost, size, weight, or performance.

The success of a design is determined by considering the desired features of a solution. **CRITERIA** is the requirements a design needs to do in order to be successful. Criteria address what job the design solution will perform and how, its durability, and its cost.

Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account.

DEVELOPING POSSIBLE SOLUTIONS

Designs can be conveyed through sketches, drawings, or physical models. A **PROTOTYPE** is a physical model of a design solution, which is helpful in testing product ideas or the properties of different materials. These representations are useful in communicating ideas for a problem's solutions to other people.

Research on a problem should be carried out before beginning to design a solution. Testing a solution involves investigating how well it performs under a range of likely conditions.

At whatever stage, communicating with peers about proposed solutions is an important part of the engineering design process. Shared ideas can lead to improved designs. Tests are often designed to identify failure points or difficulties, which suggest the elements of the design need to be improved.

OPTIMIZING THE DESIGN SOLUTION

Because there is always more than one possible solution to a problem, it is useful to compare and test designs. Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints.

