Activity 3: Rainwater Collection System
Engineering Design Challenge

When engineers create a new design, one of their first tasks is to understand the restrictions that are imposed by the nature of the product and its purpose. For example, when they design a building, it might be necessary for it to withstand certain conditions, such as 100 mph winds. It may also need to shelter people from specific weather conditions, for example, it might be required that the building be able to maintain an indoor temperature of 70 degrees F when it is 0 degrees F outside. Specifications and restrictions are known as design constraints.

Engineering Design Problem:
Your instructor will give you a cardboard box that represents a house. You must put a roof over the house that will protect it from rain. In addition, you should collect as much rainwater from the roof as possible.

Optimize your design within the following design constraints:

1. Water from a watering can will be used to simulate rainwater striking the roof. (If it is raining outside, you may do the experiment in the rain.)

2. You must collect the rainwater runoff in a measuring cup placed at least 5 inches from the house.

3. You may use materials provided by your instructor, including tape, cardboard, aluminum foil and wax paper. You may also ask to use some extra types of materials.

4. Testing will be outside.

5. You must work within the amount of time allotted by your instructor.

Be sure to spend time planning with your partner before you begin building.
Activity 4: Building a Water Filter
Engineering Design Challenge

In the last activity, you collected rainwater. Now you must design a way to filter the water so that it will flow smoothly through the plumbing system in your home. Be sure to spend time planning with your partner before you begin.

**Design Problem:** You must create a filter that can be used to remove dirt and other particles from a dirty water sample. The water should be made as clean as possible after it has gone through the filter. In addition, the water needs to move through the filter as quickly as possible.

Optimize your design within the following design constraints:

1. The structure of your filter will be a plastic soda bottle with 2-3" cut off the bottom. The bottle will be turned upside down and water will flow in the top and out through the smaller end (see diagram below).
2. Put larger gravel and rocks at the bottom to hold the components of your filter in the bottle.
3. You will use the materials provided by your instructor, which may include, dirt, gravel, sand and/or limestone. You will decide how to arrange these materials in the filter.
4. To test your filter, dirty water will be poured through it.

![Diagram of water filter](image)