

Rain Water Collection

Topic Area(s)	Cost	Time	Grade Level	Supplies
<ul style="list-style-type: none"> • Environmental engineering • Life science 	\$10	60 minutes	6-7	<ul style="list-style-type: none"> • Cups • Cardboard or cardstock • Tape • Craft sticks • Plates • Straws • Plastic wrap • Aluminum foil • Kiddy pool • Watering can • Measuring cup or graduated cylinder

Curriculum Links

Current curriculum

- Grade 6 Processes of Science:
 - Manipulate and control a number of variables in an experiment
 - Apply solutions to a technical problem (e.g., malfunctioning electrical circuit)
- Grade 7 Processes of Science:
 - Test a hypothesis by planning and conducting an experiment that controls for two or more variables
 - Create models that help to explain scientific concepts and hypotheses
- Grade 7 Life Science – Ecosystems:
 - Assess survival needs and interactions between organisms and the environment
 - Assess the requirements for sustaining healthy local ecosystems
 - Evaluate human impacts on local ecosystems
- Grade 7 Social Studies – Economy and Technology: assess ways technological innovations enabled ancient people to adapt to and modify their environments, satisfy their needs, increase exploration and trade, develop their cultures.
- Grade 7 Social Studies – Human and Physical Environment:
 - Assess how physical environments affected ancient civilizations
 - Identify the impact of human activity on physical environments in ancient civilizations

New curriculum (based on latest online version – August 2015):

- Grade 6 Science Curricular Competencies related to the experimental method, including data collection, analysis and evaluation
- Grade 7 Science Big Ideas:
 - Earth and its climate have changed over geological time
- Grade 7 Science Content:
 - Survival needs and interactions between organisms and the environment
 - Evidence of climate change over geological time and the recent impacts of humans
- Grade 7 Science Curricular Competencies related to the experimental method, including data collection, analysis and evaluation

Materials (for class of 30)

- Cups
- Cardboard or cardstock
- Tape
- Craft sticks
- Plates
- Straws
- Plastic wrap
- Aluminum foil
- 1x kiddy pool or outdoor area where water can be spilled
- 1x watering can
 - Ensure the watering can has a rain/sprinkle spout
- 1x measuring cup or graduated cylinder
- 1x Rubbermaid bin or small table to support the rain water collection system

**Background Information****Water**

Water is very important to people; it is the reason we are able to keep living! People need water not only for drinking but for transportation, production of good and services, cleaning and plant and animal growth for food. Many of these purposes can use any type of water (fresh or salty) but drinking water must be **fresh water**, which means that there is no salt content. Our bodies cannot digest **salt water** correctly.

There is a problem, however, between the ratio of salt water and fresh water on this earth. About 70% of the earth is covered in water. Of that, about 97.5% is ocean water and other salty water. That means, only 2.5% of the water on earth is good for us to drink! Of that, 1.75% is

locked up in the glaciers and the polar ice caps. This means that really and truly, there is only 0.75% water on the earth that we can consume right now. That is not a lot of water when you think of how much water is on this earth! This means we need to find ways to conserve the drinking water we have find ways to get more drinking water! We are also very lucky in Canada because our **Great Lakes** make up 21% of the world's fresh water supply.

Rain Water Collection

Using rain as drinking water has been happening for thousands of years. The Egyptians, ancient Palestine's, Greeks and Romans figured out very quickly that safe drinking water only came from deep wells or from the sky. Is this still a safe thing to do? Well, back 4000 years ago when Egyptians and other ancient communities drank **rain water**, there was significantly less pollution in the air. When water is evaporated from the earth's surface, it can pick up harmful **pollutants**. So although rain water will have no salt content (since salt does not evaporate with water), there is a chance that there will be other **contaminants**. With increasing pollution in our current times, there is an increased risk of health issues with rain water.

Procedure

- 1) Explain components of rain water collection system to students: roof, trough and storage tank.
- 2) Provide the students with a list of potential design materials for their water collection system and set up the design materials at a design "shop" for them to choose from.
 - a. Extension: Give your students a budget and provide a list of prices of the design materials.
- 3) In small groups, have the students use the building materials to build a water collection system.
- 4) For testing, place their collection system in the middle of the kiddie pool and pour a full water can (the same amount of water for each team) over the system.
 - a. Make sure to move the watering can around so it pours over the entire surface of the kiddie pool. The reason for this is because a bigger roof would then catch more of the watering can's water.
- 5) Pour the water collected in the storage container into the measuring cup to record the amount collected.

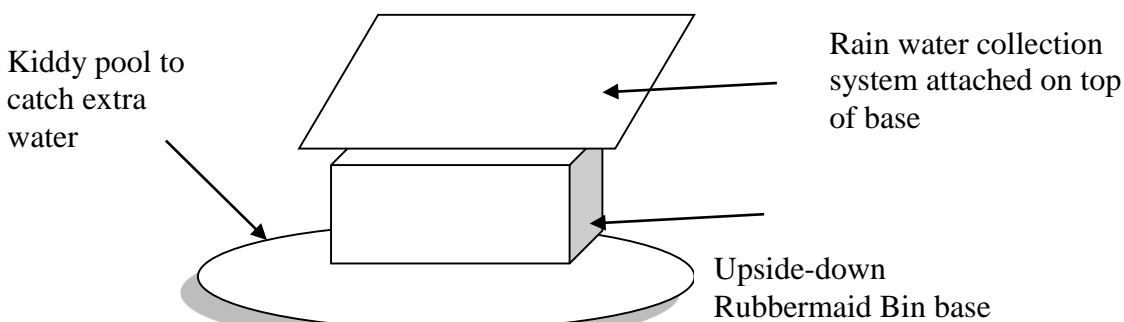


Figure 1: Rain water collection testing setup

Extensions:

- Give your students a budget and provide a list of prices of the design materials. In real life, engineers have to work with a limited budget.
- Incorporate water filters into the water collection system:
<http://legacy.ewb.ca/en/whatwedo/canada/projects/hso/teachers/w4w/workshop.htm>
↓
- Have your students measure variables (roof surface area, water collected, etc.), enter into a table or graph and interpret.
- Go find a rain water collection system at your school garden, local community gardens or build your own: <http://www.instructables.com/id/How-to-build-a-rain-water-collector/>

Example Designs:

The picture above and on the left uses a cooler for the base. It has Styrofoam plates for the roof which are placed in an “open-flower” style to catch the rain. A cardboard tube acts as the trough and a party cup is the storage container.

The picture above and on the right also uses a cooler for the base. It has a cardboard roof that is slanted. The cardboard roof is covered in aluminum foil so that the cardboard does not get destroyed from the water. The roof is on a slant so that it also acts as the trough. The storage container is also a plastic cup but this time it is attached by wooden skewers so that it stays in place and does not fall over during testing.

Connecting Engineering to Your Classroom

Water Treatment Plants

Today a common system to provide clean drinking water to homes is a **Water Treatment Plant**. Engineers work to design, build and maintain water treatment plants. In a community, water is collected from a fresh water source (for example the Capilano Reservoir) and it goes through the water treatment process. This means that the water is first filtered for large sized contaminants (plastic, diapers, etc), then filtered for smaller contaminants (soil, sand, etc) and then chemicals are added to rid the water of any unhealthy bacteria or germs. Once the water is cleaned, it is transported to individual homes in the community via pipes. Some homes have underground tanks of water to store their water supply. Once a home has dirtied the water from using it, the water is sent back to the water treatment plant to get cleaned again and get reused.

Although Water Treatment Plants are a good idea because they keep water clean for us and reuse the water, we still have a small amount of fresh water on this earth. Canadians are lucky to be so close to a large amount of fresh water but what about other places on earth that do not have this luxury? Engineers work to design solutions to gather as much fresh water as possible! Engineers also work to develop more effective ways of treating water to remove contaminants as well as to improve safety and treatment of mines and factories to prevent waste from being dumped into lakes and streams to begin with.

Metro Vancouver offers field trips of our local watersheds and water treatment facilities:
<http://www.metrovancouver.org/events/school-programs/K-12-field-trips/Pages/default.aspx>
for more information.