**Aeroponics Water Pump Design Challenge**

**Overview:** *Write an overview of the project here:*
Even before the devastating earthquake in early 2010 conditions in Haiti were harsh, but now they are far worse. As the country struggles to recover, food insecurity, lack of access to clean water, and worsening acute and chronic malnutrition are major issues. Children are left at a significant disadvantage in terms of growth and development. Rated on the Human Development Index, Haiti has the poorest life expectancy, literacy, education, standards of living, and child welfare compared to other countries in the Americas.

Using aeroponics—the same technology NASA uses—Tower Garden grows plants with only water and nutrients rather than dirt. Research has found aeroponic systems grow plants three times faster and produce 30% greater yields on average. Having systems available like these can provide Haitians with healthy food that is available year round. These systems also allow people in areas where soil is poor or there is a lack of farming space, the ability to grow the food needed to maintain a healthy diet.

**Background Information:** *This should be what students have been learning about:*
There are an array of reasons to use hydroponics to grow fresh produce, from the health of our bodies to the health of the environment. Hydroponics eliminates soil and soil-borne pests and disease, so there is no need to use large amounts of pesticides. This, in turn, reduces soil erosion as well as air and water pollution. Pesticides from traditional soil-based agriculture run off into rivers and streams, harming fish populations. Reducing pollution is vital to protecting plants and animals indigenous to areas near farms.

Conservation and sustainability are a big part of hydroponic growing. Hydroponic nutrient solutions are recycled in recirculating systems, and can be reused in other garden areas such as potted plants or lawn areas. Reusing and recycling these products reduces the amount of waste that ends up in landfills.

Hydroponics gives hope for food production to areas of the world with poor or infertile soils. This gives populations of people in these areas access to healthy produce. The vegetables grown in these areas, and other places with hydroponic systems, are fresh, delicious and full of flavor- even more so than their soil counterparts. Hydroponics empowers communities that would otherwise not have access to fresh and delicious food.

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**Problem:** Many people in Haiti may not have access to electricity from an outlet to run a pump for an aeroponic water tower.

**Challenge:** Design and build a working water pump that can be powered without the use of an electrical outlet.

**Criteria/Constraints:** Using materials in the STEM lab or materials from home, make sure that your water pump -

- Can pump water up through a tube that is at least 6 feet long
- Is not powered by an electrical outlet
- Building materials available in Haiti or easily shipped to Haiti

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**Ask**: What is the problem I have been asked to solve, and what are my criteria and constraints? Restate in your own words:

**Research**: Think about your challenge. What have others done before? What designs currently exist, and how can they be modified to solve your problem?

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**Imagine**: What types of materials would be work best based on the challenge and the outlined constraints? Why have you selected those materials? How will you use the materials? Think of new ways to use them.

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**Plan**: Below please sketch and label two separate designs. Your sketches should be very detailed including any measurements and materials and amount of each material that will be needed to complete your design.

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**Create and Test:** Choose the best design from the 2 you created above. Make a shopping list of materials you will need (including amount of each material). Make notes about what happened during the build…what went right and why…what went wrong and how you fixed it.

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**Improve** - Reflect and Redesign: What did you change and why? How did your changes affect the outcome of your redesigned product?