Water Wheel Design Challenge

The Challenge

In this design challenge, you will use your knowledge of energy transfers and transformations to design the most efficient water wheel as you can! Your team will have the following materials:

- one 2-L plastic bottle
- tape
- scissors
- 1.2 meters of string
- paperclip
- 50-80 gram weight (2 large washers)
- rubber band
- a variety of blade/paddle making materials: index cards, Styrofoam meat trays, plastic and paper cups, waxed cardboard from milk or juice cartons

The following will remain constant:

- the diameter of the water wheels (2-L plastic bottle)
- the volume of water poured over the water wheels (1 gallon)
- the rate of water being poured (use of a funnel and the same person pouring)
- the height from which the water will be poured (15 cm / 6 inches above the water wheel's hub)
- the mass of the weights that the water wheel will lift

Define Efficiency

Describe how your class will determine the most efficient water wheel. Include in the description tools needed to gather efficiency data:

The most efficient water wheel is one that…..

Research and Planning

Use the available web and print resources to consider:

- *How do water wheels work? What parts do they have?*
- *What do the paddles or blades of water wheels have to do?*
- *What features make efficient water wheels?*
- *How can my team use the available materials in the best possible way?*

Designing and Building of Water Wheel

Use your scientists' notebook to keep research, ideas, plans, and update progress. Keep entries dated and include labeled diagrams.

Testing the Water Wheel

Develop a data table to record team and class data. A sample data table is provided below:

[sample]

Student Team	Trial 1 time	Trial 2 time	Trial 3 time	Observations

Redesign, rebuild, and retest.

Use your scientists' notebook to keep research, ideas, plans, and update progress. Keep entries dated and include labeled diagrams.

Designing and Building of Water Wheel

Analyze the efficiency of water wheel. Use both words and sketches to describe what aspects of their first model worked well and which aspects could be improved.

In your notebook, include the revisions to your design.

Reflection Questions

Reflect and write about your water wheel experiences in your notebooks. Include the following:

- *Describe energy transfers and/or transformation that are "intended" in your model water wheel.*
- *Describe energy transfers and/or transformations that are "unintended" in your model water wheel.*
- *Use an example of an energy transfer or transformation in your water wheel to explain that energy cannot be created or destroyed.*
- *These parts of our model worked well ….*
- *If I could redesign the blades of our model again I would… because…*
- *How do you think that water could be used to generate electricity for a community?*
- *What else besides blade design would need to be considered before building water wheels or water turbines in a community?*
- *If you were asked to build a turbine that utilized the energy from wind, how would the turbine blades be similar to and different from the turbine blades you constructed for water?*