

MET 330

8th Project Assignment: Preliminary Report

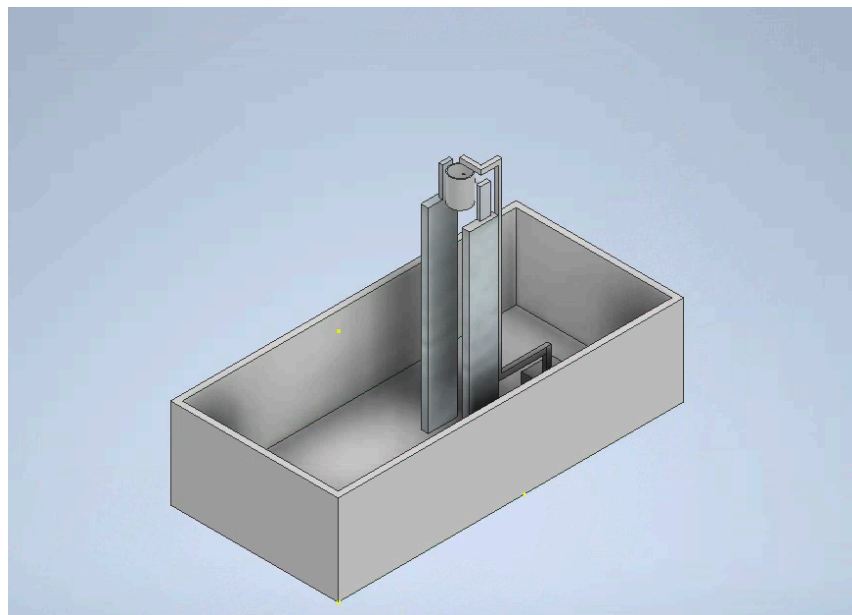
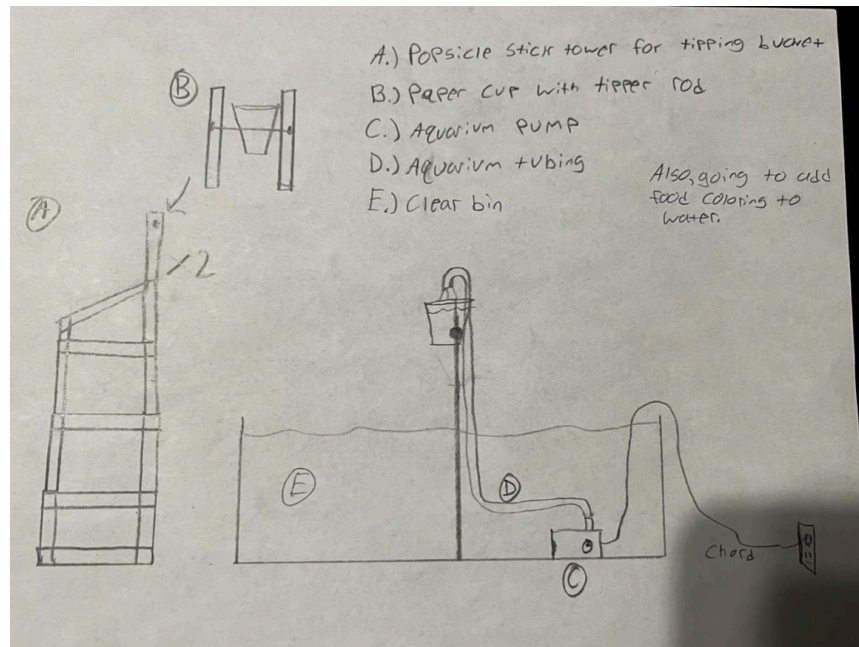
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The Bernoulli Brothers' Design

## Design and Drawings

This design is an open surface clear container filled with water and food coloring. When the pump is put into the water it will suck the water up into the aquarium tubing showing the flow of the food coloring water. It will then fill up a paper cup that will eventually dump onto a ramp made with popsicle sticks. The design of this water park tipping bucket will demonstrate the flow of fluids, the flow rate of the pump since the pump allows us to turn the flow rate down.



## Fluid Mechanics Concepts

### 1. Fluid Flow

- a. Imagine you have a toy car. You push it, and it moves along the floor. Fluid flow is like that but with water. In your project, the water with color moves from the big container, through a tube, into a cup, and then slides down a ramp. It's like the water is going on a fun ride through your water park!

### 2. Flow Rate

- a. Flow rate is how fast the water moves. Using the pump in your project, you can make the water go faster or slower, just like when you control how fast you pour a jug of juice into a glass. If you turn the pump up, the water rushes out quickly; if you turn it down, it dribbles out slowly.

### 3. Gravity

- a. Gravity is what makes things fall to the ground when you drop them. In your water park, gravity helps the water travel down the ramp.

### 4. Bernoulli's Principle

- a. This one's a bit like magic. Imagine when you blow over the top of a paper and it lifts up. That's because the air moving over the paper is moving fast and creates less pressure. In your water park, when the water moves fast through the tubes or down the ramp, it's kind of doing the same thing. But instead of lifting paper, it just flows smoothly.

### 5. Laminar vs. Turbulent Flow

- a. Think of laminar flow as when you line up your toy cars and push them so they all move smoothly in a straight line. That's like water moving nice and smoothly.

Turbulent flow is when everything gets mixed up and chaotic, like if those cars crashed into each other and went all over the place. Depending on how fast the pump makes the water move, you might see the water moving smoothly or getting all swirly.

## 6. Viscosity and Reynolds Number



- a. Viscosity is a fancy word for how thick or thin a liquid is. Water is thin and runs quickly, but honey is thick and moves slowly. In your water park, you're mostly dealing with water, so it's like having a thin liquid that moves easily. The Reynolds Number is a bit like a secret code that tells us if the water will move nice and smooth or all mixed up, but you don't need to worry about that. Just think about how some things run fast (like water) and some things run slow (like honey).

### **Process Simplified**

First, we have a clear bin that we're going to fill with water; think of this as our mini ocean. We then have a special gadget called a pump, which can suck water up and move it where we want it to go. We connect this pump to a long, bendy straw, but we actually call it tubing because it's what we use to guide the water on its adventure.

We'll use the pump to send the water on a trip through the tubing, all the way up into a paper cup. We'll place the cup so that when it gets full, it tips over and sends the water sliding down a ramp we've built out of jumbo popsicle sticks, just like a water slide at a water park. The whole design shows how we can move water around and make it do fun tricks using just a few simple things like a pump, some tubing, a clear bin, paper cups, and popsicle sticks.

## Materials and Parts

Image	Name	Cost
	90 GPH Mini Submersible Pump, Small Fountain Pump (5W 350L/H)	\$9
	EZ-FLO 1/2 Inch ID (5/8 Inch OD) PVC Clear Vinyl Tubing, 10 Foot Length	\$6.88
	Clear Storage bin	\$8.99
	4oz paper cups	\$10
	Jumbo Popsicle sticks	\$6.29

Pump	\$9		
Tubing	\$6.88		
Clear Bin	\$8.99		
paper cups	\$10		
popsicle sticks	\$6.29		
			<b>Cost</b>
			<b>\$41.16</b>

