Preliminary Report

1a)

Our kit reflects the concepts of buoyancy, density, pressure, Bernoulli's principle, friction, and forces such as weight. As the lego goes down the slide and into the water, the force that keeps the lego afloat over some period of time is the buoyancy force. We can compare the lego to a rock when referring to the buoyancy force. If we were to take a rock and drop it on the slide so it goes to the water, it would sink down faster than a lego. This is due to different densities. Density is the amount of matter present in an object. Through this, we can see that a lego and a rock have different densities referring to the buoyancy force the water exerts upwards on the objects. Bernoulli's principle also has a play in the engineering process implemented in this design. Bernoulli's equation allows us to go undercover and see how pressure, velocity, flow rate, and more are affected by different values! The weight of the lego is made up of the mass of the Lego and gravity from the earth, gravity determines how much you weigh. For example, how Astronauts on the moon are about to jump and bounce around easier than on earth because the moon has lower gravity. Pressure is the physical force exerted on an object. A way of measuring how much force is acting over an area. A strong push on a small area creates high pressure, while a weak push spread out over a large area creates only a little pressure. Friction is applied through the lego character making contact with the surface of the water and the slide itself. This interaction between the lego character and the slide is controlled by the flow rate of water interacting with the slide. The lower the flow rate, the more friction is going to be applied to the lego character.

1b)

For our kit, we are using cardboard, aluminum foil, a tub, a pump that can be easily reverse-engineered, water, a ball valve, and a lego object. The cardboard is used as a structure/base for the slide to make sure when water is on top of the slide the whole slide does not fall apart. This cardboard will be adjusted as well as the slide by the elementary school students to try and find a safe time for the lego to reach the bottom of the surface. This safe time will be calculated and measured by the engineering students before the day of the experiment. This will be the challenge that the education students will be experimenting with. The aluminum foil which is supposed to be placed on top of the cardboard is to prevent water damage on the base/cardboard pieces that we are using. This aluminum foil will be placed on the cardboard (slide) by the engineering students prior to the full assembly. The tub is just there to catch the

water so that we can recycle it back into the pump to keep the slide running. The pump can be used in two ways for this project kit. The first way is to demonstrate how a pump is used to move water from one place to another. The second way that we are using it is by having them put the pump back together since it is simple to take apart and rebuild the device. The water is how we run the actual slide and demonstrate the fluid mechanic process that is used within the design that we have planned. The lego object, or any lightweight object, is going to be used to show the water flow on the slide since the water is clear and we want to make the kit a little more fun for the kids.

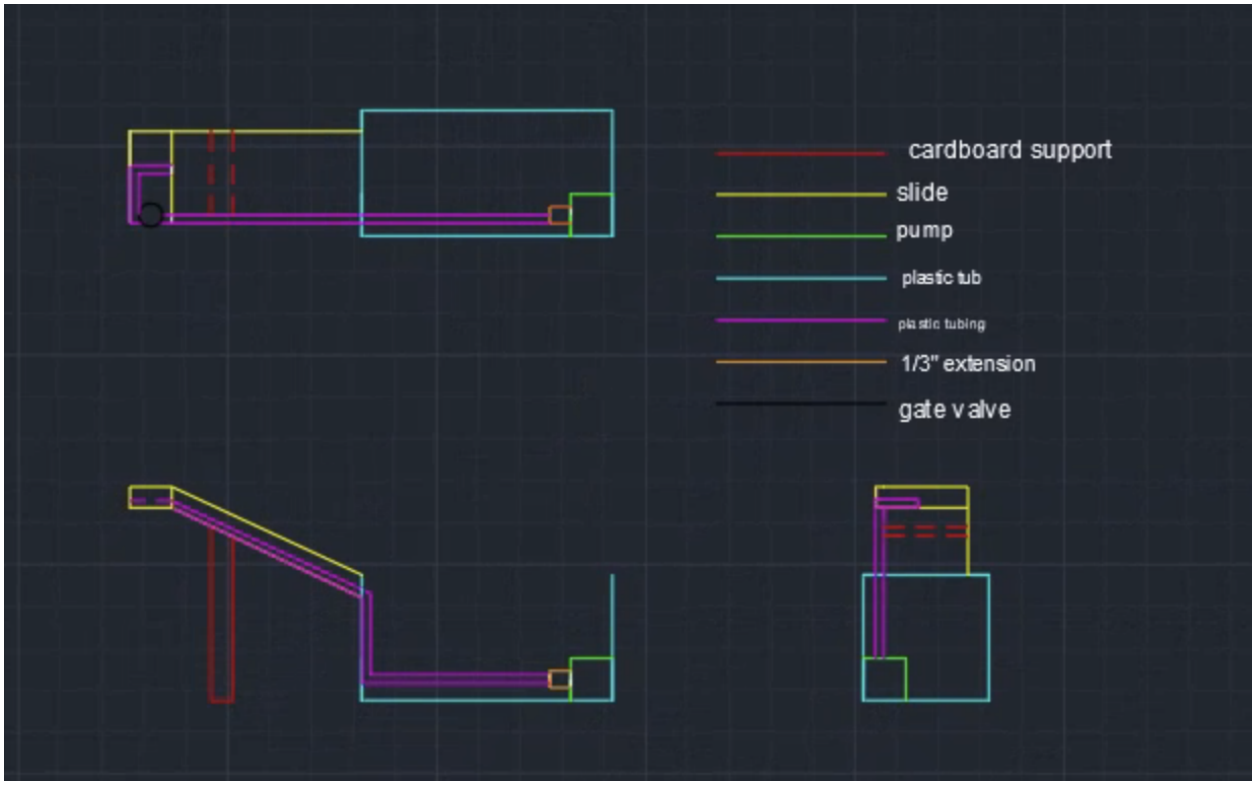
1c)

The kit is going to be used to teach the kids how a pump works and how to put one back together. Additionally, we can show the kids how the pump changes the flow rate of the water by speeding up and slowing down the motor in the middle of the pump. Additionally, the flow rate will be changed by the ball valve that is included. This kit can also be used to challenge the students by giving them an objective (like having the kids find a way to get the water to pump down the slide) and having them come up with their own design using the engineering design process that we teach them beforehand. We can also set up a race for the kids to see which slide can get the lego piece down the slide the fastest and the safest. The safety margin will be calculated by a set time or qualifying time for the students to achieve.

1d)

1. Obtain Materials.
2. Fill the plastic container with water.
3. Make slides designed by kids out of cardboard and aluminum foil.
4. Assemble and mount the slides to the plastic container.
5. Plug in and attach the pumps to the container and put the pump hose at the top of the slide, tape it to the top so it doesn't fall off. Also, place the ball valve on the tubing near the top of the slide.
6. Turn the pump on and make sure the water flows down back into the container.
7. Drop a lego man at the top of the slide, if he makes it to the container at the bottom the design succeeds, if not the slide has to be examined to see what needs to be fixed.

1e) CAD Drawing



1f) Final Budget

Item	Quantity	Link	Price
Pump	2	https://www.amazon.com/WELMIX-Aquarium-Submersible-Fountain-Hydroponics/dp/B09XMVGHKQ/ref=sr_1_3?crid=YLH5605VHGQG&keywords=welmix%2B80%2Bgph&qid=1677105169&sprefix=welmix%2B80%2Bgph%2Caps%2C88&sr=8-3&th=1	$20-28
Aluminum Foil	150 Sq Ft	https://www.amazon.com/365-Everyday-Value-Aluminum-Foil/	$8

		dp/B074H73HP2/ref=sr_1_6_f3_0o_fs?crid=961BU6RRV9MP&keywords=aluminum+foil&qid=1677106627&sprefix=aluminum+foil%2Caps%2C110&sr=8-6	
Cardboard		Provided by students	
Heavy Duty Bucket (testing bucket)	1	Provided by students	
Ball Valve	2	https://www.amazon.com/DERNORD-Valve-Stainless-Locking-Handles/dp/B07XFCXSWH/ref=sr_1_18_sspa?crid=8FFLFTH089JJ&keywords=1%2F4+in+aquarium+ball+valve&qid=1677606818&sprefix=1%2F4+in+aquarium+ball+valve%2Caps%2C86&sr=8-18-spons&psc=1&spLa=ZW5jcnlwdGVkUXVhbGlmaWVyPUEySVNCTUNCNENEUFdGJmVuY3J5cHRlZElkPUEwMDg0NTk5RUUzSjhBMEc1TTMxJmVuY3J5cHRlZEFkSWQ9QTA1MzYyODIzODJEMEtaTEkzUUomd2lkZ2V0TmFtZT1zcF9hdGZfbmV4dCZhY3Rpb249Y2xpY2tSZWRpcmVjdCZkb0	$23

		5vdExvZ0NsaWNrPXRydWU=	
Tape	1 Roll	Provided by students	
Lego Guy	2	Provided by students	
TOTAL			$59