Fall 13 - Homework Assignment #1 – Due: Wed., 4 May

* List five everyday examples of the application of fluid mechanics. Please provide comprehensive details of how fluid mechanics is involved and list appropriate references.
  1. **Water Tower**
     1. The purpose of a water tower is to provide water pressure to maintain the safe supply of water to an entire town or one building. The water tanks are usually placed at very high elevations because that will provide the most pressure. This is because Concepts from fluid statics state that the pressure is directly proportional to change in height, so an increase in elevation means an increase in pressure.

<http://www.howstuffworks.com/water.htm>

<http://www.princeton.edu/~achaney/tmve/wiki100k/docs/Water_tower.html>

<http://www.tutorvista.com/physics/pascal-s-law-for-kids>

* 1. **Dishwasher**
     1. Dish washers have valves in them that bring up the water from the ground into the machine. The design of these valves relies on knowing a number known as the Reynolds number. The manufacturers must use this number in order to use the right diameter for the valves based on the density and velocity of the water.

<http://home.howstuffworks.com/dishwasher1.htm>

* 1. **Hydraulic machines**
     1. A basic hydraulic machine consists of a cylindrical piston with a fluid inside of it, typically oil. The fundamentals of what hydraulic machines are used for is something known as “hydraulic multiplication”. In terms of the piston machine, hydraulic multiplication involves changing the size of the pistons so that the applying a force to one piston will cause a greater force to the other piston. This happens because of Pascal’s principal, which states that “Pressure is transmitted undiminished in an enclosed static fluid”. Since the fluid inside a hydraulic machine is at rest, this means that the pressure inside the machine can be assumed to be constant. So applying a force to a larger piston will produce a larger force on a smaller piston ~~This is due to Pascal’s principal, which states that “Pressure is transmitted undiminished in an enclosed static fluid.” This allows us to apply “hydraulic multiplication” to the machine and this is the fundamentals of what hydraulic machines are used for~~. In terms of the cylindrical piston machine, hydraulic multiplication involves changing the size of the pistons so that applying a force to one piston will cause a greater force to the other piston.

<http://science.howstuffworks.com/transport/engines-equipment/hydraulic.htm>

<http://hyperphysics.phy-astr.gsu.edu/hbase/pasc.html>

* 1. **Submarine**
     1. Submarines use laws from fluid statics in everyday operation. As the submarine transitions from going below sea level to the surface or vice versa, it experiences a lot of pressure and forces on its exterior walls. One of the most important forces that a submarine encounters is the buoyant force. This force prevents the submarine from sinking all the way down to the ocean floor. A submarine has two tanks that control its elevation underwater: ballast tanks and trim tanks. To make the submarine rise up to the surface, the tanks are filled with air and to make the surface dive underwater, the tanks are filled with water.

<http://science.howstuffworks.com/transport/engines-equipment/submarine1.htm>

* 1. **Aircraft-** 
     1. The fluid mechanics topic of fluid flow is applied to aircrafts, in particular turbulent flow known as turbulence. This happens because the airflow over the wing does not have constant density parameters and thus does not produce steady flow. Another fluid mechanics topic that is also used is The Bernouli’s principle because it explains how an airplane jet flies. The faster moving air moving air above the jet wing to creates low pressure below the wing, creating a lift force and causing it to fly.

<http://science.howstuffworks.com/transport/flight/modern/airplanes2.htm>

<http://www.howstuffworks.com/hidden-threat-in-the-skies-info2.htm>

* Solve the problems below that relate to the conversion of units from one system to another. Please show details of your work.

1.20, 1.21, and 1.22

**Problem 1.20:**

Part a:

Part b:

Part c:

Part d:

Part e:

**Problem 1.21:**

Part a:

Part b:

Part c:

Part d:

Part e:

**Problem 1.22:**

Part a:

Part b:

Part c:

Part d:

Part e: