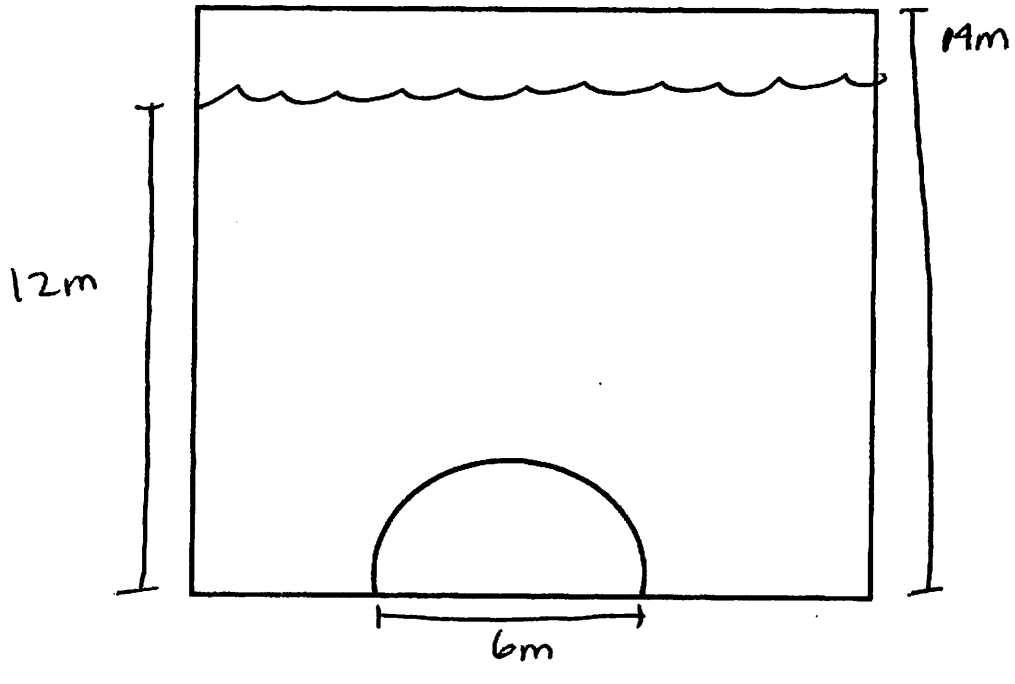
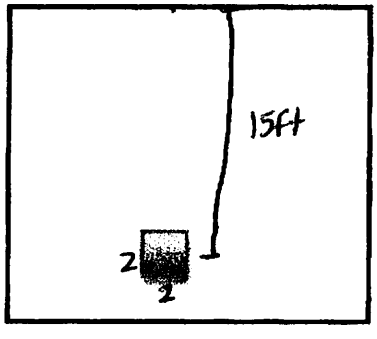
Contract #1:
We have been asked to help regulate the water levels at a local river by installing a dam. They are building a vertical dam and a gate at the base of the dam. The dam and gate are pictured below. The diameter of the base of the half circle gate is 6 m. The proposed dam height is 14 m from river base. The water level will be 12 meters on the dam.

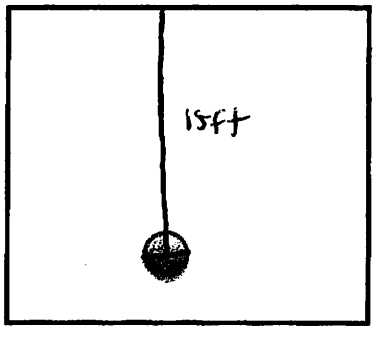
1. Determine the hydrostatic force on the gate.
2. The gate at the base of the dam should open and release water when the hydrostatic force/pressure reaches 4.25×10^5 N. How high will the water level be when the gate opens?



Contract #2: The US Navy is testing new windows for their submarines. They are considering various materials that can handle various lbs/sq. ft. The vertical sides of two submarines are submerged under water. There is a window on each submarine and the centers of both windows are 15ft under the surface. Images of the subs are below.

1. Sub 1 has a 2ft by 2ft window. Find the hydrostatic force on the window.
2. Sub 2 has a 2ft diameter circular window. Find the hydrostatic force on the window.
3. Determine which is safer and which can handle more lbs/sq ft.





Contract #3: Bertie's Pharmaceuticals has a plant with various canals through which the Isopropyl Alcohol is transported before bottling. The gates in these canals fit exactly to block the flow of the fluid. The gates are trapezoids with a bottom base of 1m, top base of 2m and height of .5m. The gate is pictured below.

1. If the canal is filled up the top of the gate, find the hydrostatic force on the gate if the density of isopropyl alcohol is 801 kg/cub. m .
2. The company has decided there is no money in isopropyl alcohol and want to use the same machinery to bottle beer, but the force found in #1 is the maximal force the gate can hold. How high can they put the beer in the canals and keep a working gate? Given that the density of the beer is 1020 kg/m3.