Water Jet
Calculate the hydraulic pressure, flow and power that are needed to run a water jet of initial diameter of 107 mm that reaches the height of 156 m. The kinetic energy of water at the topmost point of the fountain can be considered negligible.

Pump
A pump produces a flow of 9000 litres per minute. Its horizontal aspiration pipe has a diameter of 30 cm and a pressure p_1 of 740 mm of Hg. The horizontal discharge pipe is at 1.22 m higher than the aspiration pipe and it has a diameter of 20 cm and at its axis there is a pressure p_2 of 0.7 bar higher than the atmospheric pressure. The efficiency of the pump is 80 %. What is the mechanical power of the pump?

Closed tank
A vertical cylindrical tank of big dimension, tall H metre, is filled with water up to the height h_0 and it is open to the atmospheric pressure P_a.
1. Calculate the initial output speed v_0 of the liquid that exits a hole of small size placed at a distance d from the tank bottom as a function of h_0, d and g (the Earth's gravity acceleration).
2. When the water is at height h_1 the tank is closed and the pressure above the water is increased to $2\,P_a$. Calculate the initial output speed v_1 of water from the little hole as a function of h_1, d, ρ the volumetric mass of water, P_a and g assuming that the around the tank the pressure is still P_a.
3. While the water flows as in the question 2, the gas above the water relaxes and the temperature of the system remains constant. Assuming that the air follows the perfect gas law, express the output speed v_1' as a function of h_1, d, H, ρ, P_a and g when the air overpressure inside the tank has reduced to $1.5\,P_a$.

Evacuation
A perfect and incompressible fluid is evacuating a tank that has a vertical axis of symmetry and it is open to air. The initial height and surface are respectively H and S_H. The surface varies with z as $S(z)$ being $z = 0$ the coordinate of the bottom of the tank. The evacuating hole is at $z = 0$, on the symmetry axis and has a small diameter.
1. Express the output speed of the liquid as a function of the given data considering the case of a cylindrical tank.
2. Express the relation between the quote z and the elapsed time.
3. Give the total emptying time T of the cylinder.
4. In order to have a linear relation between z and t, what should it be the tank shape? What was the application of that in the past times?