

Answer all questions in the blue notebook provided. Show all your work and indicate your reasoning in order to receive most credit.

1. A nozzle is connected to a horizontal hose. The nozzle shoots out water at 10 m/s. Find the gauge pressure of the water in the hose. Neglect viscosity and assume that the diameter of the nozzle is much smaller than the inner diameter of the hose. The density of the water is 1000 kg/m^3
2. An airplane flies on a level path. There is a pressure difference of 500 Pa between the lower and upper surfaces of the wings. The area of each wing surface is about 50 m^2 . The air moves below the wings at a speed of 80 m/s. The density of the air is 1.2 kg/m^3
 - (a) Estimate the mass of the plane.
 - (b) Use Bernoulli's equation to estimate the air speed above the wings.

For the purposes of solving this problem, assume the acceleration of gravity $g = 10.0 \text{ m/s}^2$.

3. A cube of wood having an edge dimension of 40.0 cm and a density of 700 kg/m^3 floats on water.
 - (a) What is the distance from the horizontal top surface of the cube to the water level?
 - (b) What is the buoyant force on the cube when it is held completely submerged under water?
4. An ideal gas that occupies 1.0 m^3 at a temperature of 27°C is expanded to a volume of 2.0 m^3 while keeping the pressure constant.
 - (a) What is the new temperature?
 - (b) What is the new length of a meter stick made out of a material with the linear thermal expansion coefficient $5. \times 10^{-5} \text{ }^\circ\text{K}^{-1}$ at this temperature?
5. Vegetables with mass 2 kg, specific heat $0.9 \text{ cal/g}^\circ\text{C}$ and temperature 20°C are added to 4 kg of soup stock (essentially water) at 80°C . What is the equilibrium temperature?