PHY 166, Fall 2021, TEST 3   – Practice
3 points maximum for each problem, 15 points maximum for the whole.

1. In a hydraulic system, a student of mass m is standing on one of the movable pistons that is a circle of diameter d. (a) What is the pressure in the hydraulic fluid? (b) What is the magnitude of the force exerted on another movable piston that is a circle of diameter D?

2. A mass m of a metal with heat capacity c_M at initial temperature T_M is added to the volume V of a liquid with density ρ and heat capacity c_L at initial temperature T_L. What is the final temperature of the system?

3. The liquid in a horizontal pipe of diameter d_1 before a constriction is at pressure P_1 and flowing with the speed v_1, and then in the constriction with diameter d_2 the gauge measures pressure P_2. What is the density ρ of the liquid?

4. A body of a rectangular shape has sides a_0, b_0, and c_0 at temperature T_0. What will be the volume at temperature T if the coefficient of linear expansion is α?

5. A storage tank contains mass M of oxygen (O_2) at an absolute pressure of P and temperature T. Another tank of the same volume contains the same mass of CO_2 at the same pressure. What is the temperature in the CO_2 tank? (The combined numbers of protons and neutrons in atoms of C and O are 12 and 16, respectively. Do not use moles!).