

Mechanics 2, exercises week 6, NWI-MOL160

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Question 1: Density of the moon

The free-fall acceleration on the surface of the Moon is about one-sixth that on the surface of the Earth. The radius of the Moon is about 0.250 RE (RE = Earth's radius = $6.37 \cdot 10^6$ m).

- 1a. What is the ratio of their average densities, $\rho_{\text{Moon}}/\rho_{\text{Earth}}$

Question 2: Measuring water depth

The spring of the pressure gauge shown in the figure has a force constant of 1250 N/m, and the piston has a diameter of 1.20 cm.

- 2a. As the gauge is lowered into water in a lake, what change in depth causes the piston to move in by 0.750 cm?

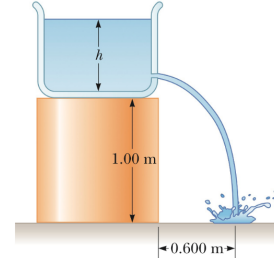
Question 3: Dropping a ball in liquid

You drop a ball of radius 9.0 cm and mass 2.10 kg into a (frictionless) liquid of density 1230 kg/m^3 from a height of 3.30 m above the surface.

- 3a. What is the speed at which the ball enters the liquid.
3b. Calculate the magnitudes of the two forces exerted on the ball as it moves through the liquid.
3c. Explain why the ball moves only a limited distance down into the liquid, and calculate this distance.
3d. With what speed will the ball pop out of the liquid?

Question 4: Leaking tank

A jet of water squirts out horizontally from a hole near the bottom of the tank resting on a 1.00 m high stand. The hole has a diameter that is much smaller than the tank diameter. The water jet hits the ground at a distance of 0.600 m (see Fig.)



- 4a. What is the speed of the water as it exits the tank (horizontally)?
4b. What is the height h of the water level in the tank? (*Hint: As the diameter of the tank is much larger than the hole, you can approximate that h remains constant for some time.*)

Question 5: Pulleys in equilibrium

The string (blue in Fig.) and the pulleys have negligible weight. The system is in equilibrium.

- 5a. What is the ratio of the masses m_2/m_1 ? Use the forces and tension in the string to solve the problem.
5b. Solve the problem again using the potential energy as a function of the vertical displacement of mass m_2 .

