

1. A hollow sphere of inner radius 8.00 cm and outer radius 9.00 cm floats half submerged in a liquid of density 0.800 g/cm^3 . (a) What is the mass of the sphere? (b) What is the density of the material of which the sphere is made?

Answer: (b) 1.34 g/cm^3

2. A block of wood has a mass of 3.67 kg and a density of 600 kg/m^3 . It is to be loaded with lead so that it will float in water with 90% of its volume submerged. What mass of lead is needed if the lead is (a) on top of the wood; (b) attached to the bottom of the wood? The density of lead is $11.3 \times 10^3 \text{ kg/m}^3$.

Answer: (a) 1.84 kg

3. Water is moving with a speed of 5.0 m/s through a pipe with a cross-sectional area of 4.0 cm^2 . The water gradually descends 10.0 m as the pipe increases in area to 8.0 cm^2 . (a) What is the speed at the lower level? (b) If the pressure at the upper level is $1.5 \times 10^5 \text{ Pa}$, what is the pressure at the lower level?

Answer: (b) $2.6 \times 10^5 \text{ Pa}$

4. The windows in an office building are of dimensions 4.00 m by 5.00 m. On a stormy day, air is blowing at 30.0 m/s past a window. Calculate the net force on the window. The density of air is 1.23 kg/m^3 .

Answer: $1.11 \times 10^4 \text{ N}$

Additional assignment, due Thursday February 12:

Write a one-page paper (single-spaced, typed) on the Magnus effect. Your paper should have at least one page of text. References and any figures you want to include should go on additional pages. There are many different applications of the Magnus effect. Don't try to include them all in a one-page paper. The best approach is to explain the effect and then discuss one or two applications. Do not quote directly from any of your references, but cite any work from which you gather information (please do not use Wikipedia as a reference). You may work as a group on this project (no more than 4 people per group) and turn in one paper for the group BUT the paper must have a length of at least one page of single-spaced typed text PER PERSON. For the longer paper of a group project, you can think about discussing more applications. Papers will be graded on physics content and on writing style (grammar, spelling, etc.). The American Journal of Physics has some good articles on the Magnus effect.