**PHYSICS 2414 - Fall 1999**
**Unit 7 - Fluids**

Reading: Sections 10.0 – 10.9
Homework: Chapter 10 - Questions 3,10
Problems 7,19,25,30,32,39,43,78,80
Problems A,B,C (on this sheet)

Dates:

- Reading Questions (Chapter 10) …… Monday, November 22, 8:00 a.m.*
- Homework Due …… Wednesday, December 1, 5:00 p.m.

*This is a change from the syllabus

Homework may be turned in during class on Wednesday, or placed in the box outside of my office before 5:00 p.m.

Reading questions are to be submitted directly from the World Wide Web using the form available at http://www.nhn.ou.edu/~strauss/phys2414. If you try to submit answers to the reading questions on the web, but the answers are rejected, please e-mail me at *mgstrauss@ou.edu* and describe the problem in detail.

READING QUESTIONS FOR CHAPTER 10:

1. What is a fluid? 2. What is density? 3. What is specific gravity? 4. What is pressure? 5. What are three things that the pressure of a stationary liquid depend on? 6. In order to derive the answer to the previous question, what fundamental principle of physics is used in the book? 7. What is the difference between gauge pressure and absolute pressure? 8. What does Pascal's principle state? 9. What are various units for measuring pressure? 10. Name three things that the buoyant force on an object depends on. 11. When an object is immersed in a fluid, does the buoyant force depend on the mass and volume of the object or on the mass and volume of the fluid displaced by the object? Explain. 12. When solving problems with buoyant force, which fundamental principle of physics from a previous chapter will you use? 13. What is "continuous" in the "equation of continuity?" 14. What happens in a moving fluid as the speed of the fluid increases? 15. Bernoulli's equation is a result of what fundamental law of physics? 16. What real physical effects are ignored by Bernoulli's equation? Final Question (must be answered to receive any credit on the reading assignment): What is one thing from the reading that you didn't understand or need clarified?

ADDITIONAL HOMEWORK PROBLEMS (not Reading Questions)

Problem A: A U-shaped tube open at both ends is partially filled with water (figure a). Oil ($\rho$ = 750 kg/m$^3$) is then poured into the right arm and forms a column $L$ = 5.00 cm high (figure b).

(a) Determine the difference, $h$, in the heights of the two liquid surfaces. Assume the density of air is 1.29 kg/m , and be sure to include the difference in atmospheric pressure due to changes in altitude.

(b) The right arm is then shielded from any air motion while air is blown across the top of the left arm until the surfaces of the two liquids are at the same height (figure c). Determine the speed of the air being blown across the left arm. (Hint: Determine where the pressure is the same in each arm, and remember that the moving air reduces the pressure at the top of the left arm.)

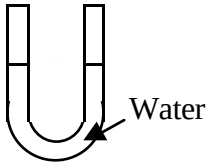


Figure (a)

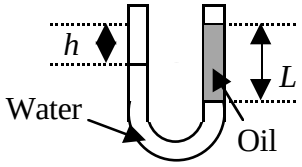


Figure (b)

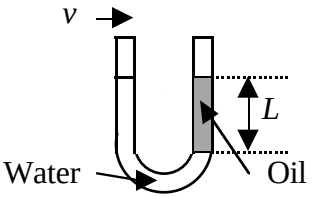


Figure (c)

(Problems B and C must be solved using the form and all the steps in *The Competent Problem Solver*)

B) You and some of your friends are hiking through a lush forest when you come to a large river that seems impossible to cross. However, one of your friends notices an old metal barrel. The barrel is shaped like a cylinder and is four feet high and two and a half feet in diameter. When you put the barrel in the water one third of it is submerged. You decide that if you want to use the barrel as a boat to cross the river, you better leave some of it still sticking out above the water. (You will have to decide how much). How much extra weight can you put in this barrel if you are to use it as a boat?

C) While flying across the country you look out the window and marvel at the wing that is holding you up in the air. You wonder how big the wing has to be to enable such a large airplane to fly. You then pick up a magazine and read an article on how an airplane can fly. The article says that because of the shape of the wing, the air flowing over the top of the wing moves faster than the air flowing over the bottom of the wing. This difference in air speed creates lift so the plane can fly. The magazine also states that the plane you are flying in weighs about 200,000 lbs (mass = 90,000 kg) and cruises at a speed of about 500 miles/hour (220 m/s), at an altitude of 35,000 feet (10,700 m) where the air density is about 1/4 of that at sea level. The shape of the wing is shown in the article and it appears almost flat on the bottom so that the air flows over the bottom of the wing at the same speed as the airplane flies. However, the wing is curved, so that the length of the top surface is about 10% longer than the length of the bottom surface. (A picture like Figure 10-24c is shown in the magazine.)
(*The answer you obtain in this problem is not precisely correct, because real airflow is somewhat turbulent and does not completely obey Bernoulli's equation, and also the body of the airplane provides lift, as well as the wings.*)