

PH202 Reading Guide

Chapter 13: Fluids

It is time for us to discuss fluids. We will start with introducing the density of fluids, and then continue with static pressure in liquids and gases. How come we can have a steel ship transporting all kinds of heavy stuff like cars and heavy machinery from the US to China and from China to the US, even though a car sinks when you drive it into a lake (do not test this!). Why do we feel lighter when we swim in water? In the later part of the chapter we will learn how airplanes fly, and why the shower curtain is always dragged towards us, when we run the shower. Did you ever realize that phenomenon?

Student Learning Objectives

In covering the material of this chapter, students will learn to

- Understand pressure in liquids and gases.
- Understand how manometers and barometers work.
- Use Archimedes' principle to calculate the buoyant force on an object and whether an object will float or sink.
- Use the equation of continuity to calculate flow rates in tubes.
- Apply Bernoulli's principle from both qualitative and quantitative (Bernoulli's equation) standpoints.

Physics Tools

- Pictures
- Free body diagrams
- Conservation of mass and energy, bar charts

When reading the text

- Answer all "Stop To Think" questions (the answers are in the back of the chapter)
- Understand all examples
- Answer the following questions to ensure you understood the text

Some questions that successful students can answer after reading the text:

Section 13.1 (page 399-400): Density

What is the mass density of an object of mass m and volume V ?

What are mass density values for typical liquids, gases? You might like to look up a few densities of metals on the internet.

What is the mass of the air in the living room calculated in this section?

Section 13.2(page 400-404): Pressure

How again was pressure defined?

What is the standard unit for pressure?

Is pressure a scalar or a vector?

When you determine pressure in a liquid, what parameters does pressure depend on?

What is the standard atmospheric pressure of 1 atm in standard units?

Section 13.3(page 404-407): Measuring and using Pressure

What is the first step of solving hydrostatics problems? (-:

How can you measure the pressure in a liquid or gas?

Draw a simple manometer

Draw a simple barometer

What does a blood pressure of 120 over 80 mean? What are the units of 120 and 80?

Is the blood pressure of a giraffe higher or lower than the blood pressure of humans?

Sections 13.4 (page 407-412): Buoyancy

What is the buoyant force?

What is Archimedes Principle?

What is the density of pure gold?

What is the density of the crown that is investigated in example 13.6?

What is the net force on the free body diagram in figure 13.17?

What does it mean when an object has neutral buoyancy?

Sections 13.5 (page 412-415): Fluids in Motion

What are the assumptions used for a simplified model of an ideal fluid?

What is the continuity equation?

Sections 13.6 (page 415-420), Fluid Dynamics, Bernoulli effect:

How does an airplane stay in the air?

How can wind lift a roof from a house?

Sections 13.7: We will not cover Poiseuille's equation

Suggested Workbook Problems (best is answering all workbook questions)

There are quite a few good questions to practice proportional reasoning, and using graphs

Chapter 13: 1, 3, 5, 8, 9, 10, 11, 13, 14