Gases and Plasmas: Chapter 14; 11th edition
pg. 260 Review questions

7. How does the pressure at the bottom of a 76 centimeter column of mercury in a barometer compare to one standard atmospheric pressure.
Ans. They are equal. If air pressure increases, it will push the mercury higher. If air pressure decreases, the mercury column will fall.

8. How does the weight of mercury in a barometer compare to the weight of a column of air from sea level to the top of the atmosphere which has an equal cross-sectional area?
Ans. They must be the same weight. This comes from solving P = F/A for force. F = PA. The same pressure multiplied by the same area must exert the same force.

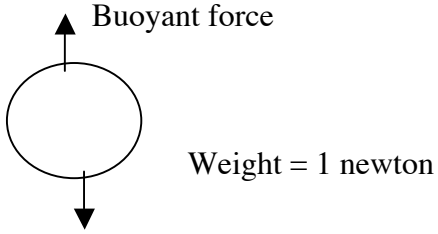
9. Why would a water barometer have to be 13.6 times higher that a mercury barometer?
Ans. Because water is only 1/13.6 the density of mercury, a column of water would have to be 13.6 times higher to produce the same pressure.
$P_{depth} = \rho_{fluid} \cdot g \cdot depth$.

10. Is soda sucked up a straw?
Ans. No. It is pushed up by the surrounding air pressure. Remember: Pressure pushes. Vacuums don't suck!

11. A shallow well pump, also known as a vacuum pump, will not work if the well is more than 10.3 meter (33 feet) deep. Why not?
Ans. A vacuum pump depends on air pressure to push the water up. The pump removes air from the pipe that leads to the well. The atmospheric pressure then pushes water up the pipe. A column of water 10.3 meters deep h as the same pressure as the atmosphere, so air pressure cannot push the water any higher than that.

13. What happens to the density of an air mass if its volume is cut in half?
Ans. You can see from the density equation, $\rho = m/v$ that density is inversely proportional to volume. If the volume of air is cut in half, its density must double because double (2) is the inverse of 1/2.

16. A balloon that weighs 1 newton is drifting in air. It is not moving up or down.



How much buoyant force is acting on the balloon?
Ans. 1 newton. Since the balloon is not accelerating up or down, we know from Newton's 1st law of motion that the net up-down force must be zero. If the buoyant force increases the balloon will accelerate up. If the buoyant force decreases, the balloon must accelerate down

Chapter 14 ; 11th edition
pg. 261 Review questions continued

19. What happens to the internal pressure in a fluid flowing in a horizontal pipe when its speed increases?
Ans. Conservation of energy tells us that if the fluid's velocity increases, its internal pressure must decrease. Although this may seem counter intuitive, Bernoulli's principle provides lift to air plane wings and soaring birds. You might want to ask about this one in class.

21. How does Bernoulli's principle apply to the flight of airplanes?
Ans. As the plane moves forward, wind rushes over the top of the wing faster than the bottom. Bernoulli's principle tells us that as the velocity of a fluid increases, its pressure decreases. Therefore, the air pressure over the top of the wing is less than the air pressure over the bottom of the wing. The wing is pushed up by higher air pressure under the bottom of the wing.

Ch. 14 pg. 262 Exercises

9. When an air bubble rises in water, what happens to it mass, volume and density?
Ans. Mass remains constant, its volume will increase and therefore its density will decrease. If you are confused by this, ask in class.

14. Would a vacuum cleaner pick up dust on the surface of the moon? Please not that the moon does not have an atmosphere.
Ans. It would not pick up dust on the moon's surface. Do you know why?

25. Why is it so difficult to breathe when snorkeling at a depth of 1 m, and practically impossible to breathe at a depth of 2-m. Why can't a diver10-m below the surface, breathe from a tube extending to the surface?
Ans. The pressure on an object submerged in a fluid is given by the equation:
$P = \rho_{fluid} \cdot g \cdot depth$.
The pressure at just 1 meter below the surface $= \frac{1000kg}{m^3} \cdot 10\frac{m}{s^2} \cdot 1m$ =10,000N/m^2. When you breath through a tube from 1 meter below the surface, your chest would have to exert a pressure of 10,000 Pascals.

54. What physics principle underlies these three observations? When passing an oncoming truck on the highway, your car tends to sway toward the truck. The canvas roof of a convertible automobile bulges upward when the car is traveling at high speeds. The windows of older trains sometimes break when a high-speed train pass by on the next track.
Ans. Bernoulli's principle. The fast moving air has lower internal pressure.

Chapter 14. ; 11th edition

Problems pg. 264

1. What change in pressure occurs in a party balloon that is squeezed to one-third its volume with no change in temperature?
   Ans. Its pressure triples.

Extra: Air in a cylinder is compressed to one-tenth its original volume with no change in temperature. What happens to its pressure?
Ans. Its pressure is increased by a factor of ten.