Physics 216 HW Ch18&19 To hand in due beginning of class 4/3/2017.

To receive full credit:

- **clearly show your reasoning** (including any necessary calculations),
- **indicate your final answer in an unambiguous way** (such as by circling or underlining it).
- **Round your answers appropriately**

1. Ch 18 Exercises and Problems number 70
2. Ch 19 Concept Question 10
3. An old (and dangerous) technology for working underwater was a diving bell. It was essentially a chamber open at the bottom that was lowered into the water so that some air was trapped in it for workers to breath (for a while-later improvements would involve pumping air down) while they worked underwater. In general it would have to be weighted to keep it submerged as the buoyant forces would tend to make it stay on top. Once submerged, cutting some of the weights loose would cause it to rise up on its own.
   Consider a simple model of such a vessel: a cylindrical tube closed at one end 2.00 m in diameter and 3.00 m long. Take the mass to be 1000. kg and assume the volume of the metal of the bell is negligible compared to the internal volume. Imagine lowering it into the water with the open end down, trapping the volume air inside (assume 1.00 atm, 20.0 C). We will assume you have no extra weights and you are just forcing it down through unspecified means. Assume you are always in thermal equilibrium and all processes are quasistatic.
   a) Once you have lowered the bell into the water until it is ***just*** submerged, what is the volume of air trapped in the bell at this point? Assume the water is 20 C as well.
   b) What is the buoyant force on the bell at this point? What is the net force? Will it want to move up or down as a result?
   c) As you continue to lower the bell, the pressure of course increases and the gas compresses, decreasing the buoyant force. At some depth, the net force on the bell is no longer upward and the bell will sink, the air will compress more and more and so on, out of control. At what depth does the transition from “If I let it go it will float up” to “if I let it go it will sink in a death spiral” happen?