**Physics 100: Homework 5 Solutions**

Chapters 11 and 13: *due Mar 14*

1) a) A particular atom contains 29 electrons, 34 neutrons, and 29 protons. What is the atomic number of this element, and what is its name? b) If one proton is somehow added to the atom in (a), when what would its atomic number and name be? How about if an electron was instead added? And what about if instead a neutron was added?

a) The number of protons determines the atomic number, so this is 29. From the periodic table, we see the element with atomic number 29 is Copper, symbol Cu.

b) If one proton is added to Copper, we get Zinc (atomic number 30). If instead an electron is added to Copper, we still get Copper, but it is a negatively charged Copper ion. (In fact, if only one proton is added to Copper and no extra electron, it is a positively charged Zinc ion). If instead a neutron was added, we get an isotope of Copper, Cu-35.

2) Which contributes more to an atom’s mass: electrons or protons? Which contributes more to an atom’s size?

The protons contribute far more to an atom’s mass: one proton weighs about 2000 times more than one electron and there are equal numbers of protons and electrons in any neutral atom. The electrons contribute far more to the atom’s size: the diameter of the atom is about 10000 times the nuclear diameter.

3) If you cut your finger, why does holding it above your head reduce bleeding?

Because liquid pressure increases with depth, i.e. the pressure of the liquid (blood in this case) is less the higher up it is in the column.

4) Why is it inaccurate to say that heavy objects sink and that light objects float? Give exaggerated examples to support your answer.

Heavy or light objects may or may not sink, depending on their densities (a heavy log floats while a small rock sinks, or an ocean liner floats while a paper clip sinks, for example). People who say that heavy objects sink really mean that dense objects sink. Be careful to distinguish between how heavy an object is and how dense it is.

5) The relative densities of water, ice, and alcohol are 1.0, 0.9, and 0.8, respectively. Do ice cubes float higher or lower in a mixed alcoholic drink compared to a drink of water? What can you say about a cocktail in which the ice cubes lie submerged at the bottom of the glass?

Ice cubes will float lower in a mixed drink because the mixture of alcohol and water is less dense than water. In a less dense liquid a greater volume of liquid must be displaced to equal the weight of the floating ice. In pure alcohol, the volume of alcohol equal to that of the ice cubes weighs less than the ice cubes, and buoyancy is less than weight and ice cubes will sink. Submerged ice cubes in a cocktail indicate that it is predominantly alcohol.