SIO 210 - Exercises - week 1 - due 2 Oct.

1. Consider a road (Highway 101) that narrows from two lanes to one (Torrey Pines beach). It is rush hour and the light at the south end of Del Mar is causing congestion to the south. Where is you speed greater, in the section with one lane, or the section with two lanes? How would the speed change if the flow was not congested, i.e. when the density of cars can change?

2. At home, turn the faucet on to a steady regular flow of water, and note that the diameter of the stream changes with distance from the faucet. What does the mass conservation principle let you conclude about the velocity of the flow.

3. Ignoring atmospheric pressure, compute the pressure exerted at the bottom of a glass filled with water to a depth h. From this compute the force exerted by the water on the bottom of the glass, and compare with the weight of the water.

4. Same problem, but for an Erlenmeyer flask filled to the same height. The flask has the same diameter as the glass at the bottom. At a distance h over the flask, the diameter is half that at the bottom. What is the force exerted by the water on the bottom? What is the weight of the water in the flask? Explain why this is different from the glass. (*Hint*: In the flask, can the water exert an *upward* force anywhere?)

5. Do the following experiment at home: while the faucet (above) is running, first measure the flow rate, by capturing the stream in a measuring cup, and measuring the time needed to fill the cup to a known volume. Then measure the diameter of the stream at two locations separated by a height h which you are free to choose, but will need to know. Given this information, estimate g the acceleration of gravity. repeat the experiment 4 times (vary flow rate and h) and note that your estimates of g vary quite a bit. Why do you think this is so?