NOTE: Use non-engineering format for problem 1 and 2, and use engineering format for problems 3 and 4. This is an individual assignment.

1. Learn more about transistors. Investigate such things as . . .
   - Why do we keep trying to make them smaller and smaller?
   - What are the limitations on making them smaller?
   - Based on your readings, what comes next (is there a replacement for transistors on the horizon, and if so, what are some possibilities)?

Summarize your findings in a paragraph or two written in your own words.

2. Implement photoresistor AND transistor/LED circuits on your Arduino as shown below.

Note that the photoresistor circuit is similar to the circuit implemented for calibrating the conductivity sensor (photoresistor replaces conductivity sensor); the transistor circuit was implemented in class. Write a sketch that causes your LCD to display the voltage read at the analog input (the raw value which ranges from 0 to 1023 and the actual voltage which ranges from 0 to 5V) and the status of the LED (on or off) as depicted below.
This is an individual assignment; one student in the group should implement the problem on their Arduino and the other should implement the problem on the fishtank system (since their Arduino and LCD are tied to the fishtank structure). Bring your system to class ready to demonstrate to your instructor.

3. Assume that $5.21 \times 10^{19}$ electrons pass through the cathode of a conductivity sensor over a 10 minute period.
   (a) How many $H_2$ gas molecules are formed during the 10 minute period? $2.61 \times 10^{19}$
   (b) What is the electrical current through the cathode? 13.9 mA

4. A batch of masonry cement is made by mixing three 5-gallon buckets of wet sand with one 70 lb. bag of masonry mix and 3 gallons of water. The sand used in the mix is partially wet, containing an unknown amount of water.
   (a) If the final batch of “mud” contains 11.3% water when the desired consistency is reached, then how many gallons of water did the sand used in the mixture contain? Assume wet sand and dry sand occupy the same volume. 1.48 gal
   (b) What is the weight of the final batch of mud? 330 lbs

Useful information for this problem:
- Be sure to apply the “tips” presented in class when solving this problem. Remember that learning the correct solution process is just as important as getting the correct answer.
- Density of water = 8.33 lbs/gal  
  Density of dry sand = 111 lbs/ft$^3$  
  1 gal = 0.1337 ft$^3$

5. Don’t forget about the quiz next time. Anything covered so far in the quarter is fair game. So, study the notes and know how to solve the types of problems worked in class and for homework.