## Reading Assignments for Week 9

- Monday, March 17: Sections 9.1 & 9.2 (pp. 355–360).
- Wednesday, March 19: Section 9.3 through 9.3.2 (pp. 360–370).
- Friday, March 21: No new reading. Catchup and review.

## Homework #7 — due Friday, March 21

*From lecture of Friday, March 7*

1. **Problem 8.1c.**
2. **Problem 8.9**
3. **Problem 8.10**

*From lecture of Monday, Mar 17*

4. **Problem 9.2**
5. **Problem K: The Temperature Dependence of pH.** Assume the standard chemical potential difference $\mu^0_{H^+} + \mu^0_{OH^-} - \mu^0_{H_20} \approx 79.9\,\text{kJ/mol}$ given at the bottom of p. 358 is independent of temperature. This is not really the case, but let's use it as an approximation. Use this to determine the pH of pure water as a function of temperature. Plot the pH versus temperature for the range 273 K to 373 K.

   *Optional challenge problem:* If you're curious, try to find data for the temperature dependence of pure water's pH. Is the real temperature dependence stronger or weaker than your calculation? What does this imply about $\Delta\mu^0$? Does it increase or decrease with temperature?

*From lecture of Wednesday, Mar 19*

6. ~~**Problem 9.4**~~
7. **Problem L: A Little Electricity & Magnetism.** Consider a medium with dielectric constant $D$ and a spherically symmetric charge distribution

$$\rho(\mathbf{r}) = A\frac{e^{-r/\lambda}}{r}$$

   Assume $A > 0$. *Continued* →.

(a) Use Gauss's Law, Eq. (9.17), to determine the electric field magnitude $E(r)$ as a function of the distance $r$ from the origin. Comment on the direction of the field.

(b) Determine the electric potential $V(r)$. Hint: use the first equation in Eq. (9.33).

(c) Show that your answer to part (b) satisfies Poisson's equation, Eq. (9.30). Hint: for spherically symmetric functions, the laplacian has the form

$$\nabla^2 V(r) = \frac{1}{r^2}\frac{\partial}{\partial r}\left(r^2 \frac{\partial V}{\partial r}\right)$$

(d) ~~Determine the electric potential energy $U$ stored in this charge distribution.~~