

MS/EST 143 Homework #1
Due by Friday April 1 at 4pm

1. Give concise definitions for the following terms: electrochemical cell, electrolyte, anode, cathode, ionics
2. A number of solid state electrochemical devices are listed below in three groups A, B, and C. From each group, choose a device that sounds interesting to you. Sketch by hand a cross-section of the device. (The sketch does not need to be to scale.) Label the electrolyte, anode, cathode, and any flowing gases. Also label any other components that will be useful in explaining how the device works (seals, interconnects, voltmeters, heaters, etc.). Write down the overall electrochemical reaction that occurs. Give a one paragraph explanation of what the device does and how it works. We will compile the best diagrams and explanations and distribute them to the class.

You will need to do a bit of independent reading to learn about these devices. Suggested resources:

- The CRC Handbook for Solid State Electrochemistry is an excellent reference and describes many of these devices.
- Nanoionic atomic switches are well-described in this interesting, accessible article: T. Hasegawa et al. Nanoionics Switching Devices: "Atomic Switches". *MRS Bulletin* **34**, 12 (2011) p. 929-934.
- Web resources may also be used.

Group A

stack of 2 oxygen-ion-conducting fuel cells
stack of 2 oxygen-ion-conducting electrolyzer cells
oxygen concentration sensor
oxygen separation membrane

Group B

lithium ion battery
sodium sulfur battery
lithium air battery
nickel metal hydride battery

Group C

nanoionic "atomic switch"
Nernst lamp
electrochromic "smart window"