

# 0601C: The Chemical Potential

## 09/13/21: Practice HW on the topic of Chemical Potential

1.

Calculate the difference in the chemical potential of a sphere of copper radius  $R$  sitting at the top of hill relative to being placed at the bottom of the hill. The physical height of the hill is "h" meters.

Substitute reasonable values for  $R$  and  $h$  and calculate the numerical value of the difference in the chemical potential of copper atoms in units of J and then in units of eV.

Now consider a mole of copper atoms instead of single copper atoms.. now calculate the difference in units of Joules.

2.

An ideal gas within a cylinder is compressed to one half of its volume by a piston. Calculate the change in the chemical potential of the gas atoms in eV. Now consider a mole of the atoms; now calculate the difference in Joules. Show how the two are related to one another.

3.

A capacitor is charged to a voltage  $V$  which creates a higher potential for the electrons (the charge) at one electrode with respect to the other electrode. Calculate this difference in the chemical potential in units of eV if the volts across the capacitor are 10 V.

Now consider that the thickness of the capacitor is increased by a factor of four. What is the change in the difference of the chemical potential at 10 V.

4.

A lithium-ion battery is made with anodes and electrodes. The chemical potential of lithium atoms in material that constitutes the anode, is greater than that in the material used for cathode,  $\mu_{Li}^B$ .

I checked the charge in the battery of my computer this morning. It is approximately 6,500 mAh. The battery is rated at 12 V. Calculate the difference in the chemical potential of Li atoms between the anode and the cathode in the battery in the current state of charge.