Survey of Materials
Homework 3, due date is set in Canvas LMS

***Notes**: In multiple choice problems explain your answer. Be concise: if your answer is correct but the explanations contain mistakes or irrelevant information the grade will be decreased. Add references if needed. Upload solution as a single file "YourName.pdf" or "YourName.zip".*

Batteries

1. List 3-5 most important material requirements for membrane in redox flow batteries.

2. Determine anode/cathode and calculate EMF of electrochemical cell composed of Pb and Zn electrodes. Write the electrochemical reaction.

3. Estimate the maximum specific capacity of Li_2CoPO_4F cathode.

4. Estimate the maximum specific energy of the battery based on $LiFePO_4$ cathode and graphite anode (excluding battery case, electrolyte, current collectors etc.). Hint: electrode potential of $LiFePO_4$ is 3.4 V, of graphite is 0.3 V with up to one Li per six carbon atoms insertable.

5. Why $LiCoO_2$ is only half-charged in real batteries (up to Li_xCoO_2 where $x = 0.4 - 0.5$)?

6. Calculate solvation free energy for Li and Rb cations in methanol (in kJ/mol).