April-June 2019

Thermodynamics Project

Assignment
Subproject 4: blue energy

The assignment for subproject 4 is to gain as much information about "blue energy" by doing experiments. Blue energy is based on the possibility to directly generate electricity from the difference in salt concentration of sea- and fresh water. This can be done where the two come in contact with each other, like river deltas.
The **goal** of this subproject is:
-We want to use our knowledge of thermodynamics to determine the feasibility of blue energy as a source of energy. Especially the efficiencies of the electrochemical cells is a main concern.

***Insight, innovatively* and *teamwork* will play a leading role in this subproject.**

You have to realize that the efficiency is determined by the useful power output and the total power input.
From a thermodynamic standpoint, electrical energy is delivered ($P = V\,I$) with blue energy, while there is only a difference in salt-concentrations at the source. Furthermore, the production and continuity of the "fuel" plays an important role in the efficiency of the total cycle.

Available equipment and reactions
We will conduct experiments on the different aspects of blue energy. The primary "fuels" are different salts. The setup of the "fuel cells" to be measured can differ as well, but will be limited due to the available glassware etc. The available equipment includes; digital multimeters, sensitive voltmeters with high R_i, a couple of decade resistance instruments and power supplies. Each group should design, build and characterize a large span of blue energy cells, and those experiments should be divided over the pairs.

Scheme
The subproject consists of 5 phases.
Make a good time plan so that you have enough but not too much time for each of the following phases.

Phase 1: preparation by each pair separate
-Study the principle and possible practical realization of a blue energy setup.
-Find out which parameters play an important role.
-Find in particular the parameters that determine the efficiency.
-Design simple experiments that provide as much relevant experimental data as possible.

Phase 2: Preparation by whole group
The choices and considerations of the pairs will then be exchanged in the presence of the assistant. The final goal, achievability and distribution of tasks will follow from this discussion.

The aim is to have different pairs do different experiments. The assistant will point out what equipment and chemicals are available.

Phase 3: Experiments by the pairs individually

The pairs will, if necessary, conduct a couple of test experiments, in which they try different reactions. The quantitative experiments which seem feasible will be chosen. The pairs will then build up and conduct the experiment.
Before conducting the experiment, the assistant has to give permission for safety reasons.

Phase 4: Report to the group

After the experiments the next step is: share the results of each pair with the rest of the group. If necessary, it can be discussed how to process the disappointments to still write a sensible report.

Phase 5: Writing the report by the pairs

The pairs should write the report during scheduled project hours.
The report is to be handed to the assistant at the beginning of the next subproject.
If this is not possible, a new date has to be discussed for both handing in and evaluation.