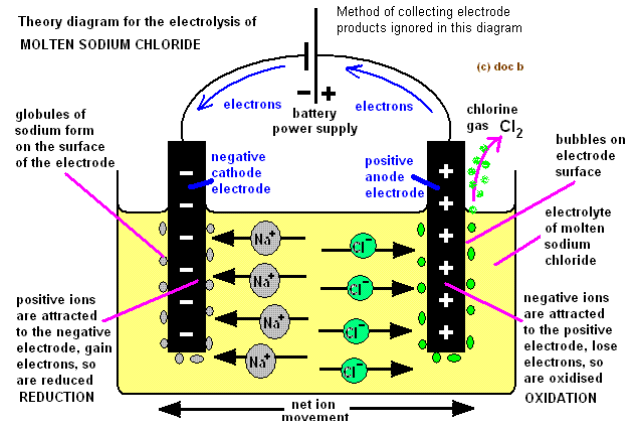


Bonus take-home quiz ECE4339 (to be added to Q1)

Note: For this quiz, there is no space to write your answer directly, hence use your text editing software (e.g. MS Word, Acrobat, or Mathematica,...) to do your work. Please copy and paste each question and answer beneath it.

- 1- (5 pts) **Prove rigorously whether the following statement is true or false:** Salt water (i. e. aqueous NaCl solution) cannot conduct electricity because the concentration of positive ions (Na^+) and negative ions (Cl^-) must be equal to each other and they move in opposite direction under an electric field. Hence they cancel each other out and the net current is zero. Thus, one cannot perform electrolysis with a sodium chloride solution.



- 2- (5 pts) Consider this argument: “Glass is an insulator. By definition, insulator cannot conduct electricity, therefore glass cannot conduct electricity.” Do you agree or disagree? Explain your answer **and cite any empirical evidence or demonstration to support your argument.**
- 3- (5 pts) Consider this statement: “A p-doped semiconductor can only have holes and absolutely no electrons in the conduction band.” Do you agree or disagree? Explain your answer.
- 4- (15 pts) **Below is NOT a multiple choice question. There are three possibilities but you must explain why you agree or disagree with each one (5 pts for each).**

A semiconductor is p-doped with hole density p_0 such that the electron density in the conduction band is so small that we can neglect it (treat it as zero). Since there are practically no electrons in the conduction band, electrical conductivity is entirely due to the movement of charges in the valence band. Since valence band electrons move in one direction and holes move in the opposite direction, the net current is:

- zero as they cancel each other out. Explain why you agree or disagree
- twice as much as each one of them because they add together. Explain why you agree or disagree
- your own answer and explain.