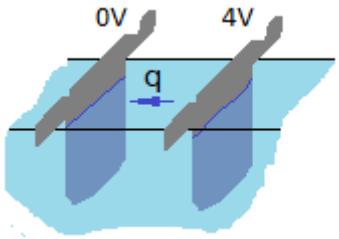
Physics II

Electric Current

Electric current: $I = \dfrac{\text{charge}}{\text{time}}$

Problem 1.- In electrolytic refining, current passes through a solution to accumulate a pure metal on one of the electrodes. Calculate how much time you would need to accumulate 1 mole of Zn (65.4 grams) with a current of 10.5 A.
Take into account that Zn ions have a charge of +2e or $+3.2\times10^{-19}$ C



Solution: The definition of electric current is Q/t so, knowing the charge and the current allows us to calculate the time:

$Q = (6.022\times10^{23}\ \text{ions})\times(3.2\times10^{-19}\ \text{C/ion}) = 192{,}700\ \text{C}$

So, the time is: $time = \dfrac{Q}{I} = \dfrac{192{,}700C}{10.5A} =$ **18,400 s**

Problem 2.- Some people think that water, separated by electrolysis into H_2 and O_2, could be a source of fuel and breathing oxygen for astronauts. Calculate how much current you need to produce 1mol of oxygen (O_2) in one hour.
Charge of one O^{--} ion = -3.2×10^{-19} C, 1 mole of $O_2 = 12.05\times10^{23}$ atoms

Solution: The charge will be: $Q = (12.05\times10^{23})\times(3.2\times10^{-19}) = 0.385\times10^{6}$ coulomb
The current will be:

$$I = \frac{Q}{t} = \frac{0.385\times10^{6}}{3600} =$$ **107 A**

Problem 3.- A headlamp in a car is rated 55W at 12V, which means that it uses 55 Joules per second and in turn it means that a charge of -4.6C goes through the lamp every second. How many electrons go through the lamp per second?

Solution: The charge is due to the electrons that go from one side of the circuit to the other, so we can calculate the number of electrons by doing the following:

$Q = Nq_e$, where Q is the total charge, N is the number of electrons and q_e is the charge of one electron and with the values of the problem:

$$N = \frac{Q}{q_e} = \frac{-4.6C}{1.6\times10^{-19}C} = \mathbf{2.88\times10^{19}\ electrons}$$