

PHYS 205-Section 03
Electricity and Magnetism - Winter 2018
Assignment 3 – Due on March 2nd

Instructions

You should hand in your answers, written or typed in standard letter sized papers, in class on the due date (to be posted with the assignment). Make sure to clearly indicate:

1. Your class (PHYS 205/03)
2. The sequence number of the actual assignment (Assignment # 2)
3. The name of your instructor (Nima Nateghi)
4. Your name
5. Your student ID#
6. The due date (Feb. 9th)

In case of multiple pages **you should staple the pages together** properly. We are not held responsible for lost pages of home works due to inadequate grouping of pages.

In case of **late submission**, drop your assignment in the physics department's dropbox (SP building, 3rd floor). There will be a 20% late submission penalty for each day after the due date. No electronic submission will be accepted. After the answers are posted, not assignments will be accepted (under no circumstances).

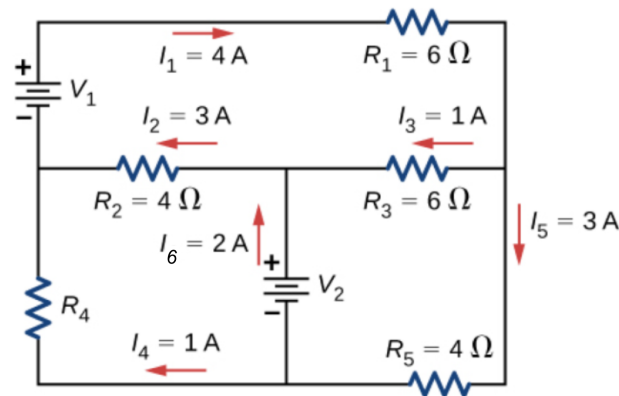
Problems

1. The current passing through a conductor is described by $I(t) = I_0 e^{-t/\tau}$. If $I_0 = 2A$ and $\tau = 0.5 s$, how many electrons flow through the conductor during the first 3 seconds? Take $e = 1.6 \times 10^{-19} C$. **(5 marks)**
2. During certain cellular activities, an ionic channel opens up for 1 ms (millisecond), during which it allows about 5000 Na⁺ ions to pass through. Calculate the current passing through this channel. Take $e = 1.6 \times 10^{-19} C$. **(5 marks)**
3. The resistance of a copper wire with circular cross section of radius a and length L is R . If we melt this wire and reshape it into a wire with square cross section of side a , what would be the resistance of the new wire? **(5 marks)**
4. The electrical resistance of human body is about 50 kΩ on average. If a person inadvertently touches the terminals of a 20 kV power supply, which has an internal resistance of 2 kV, determine:

- a) What would be the current passing through him? Given that a 0.1 mA (milliamp) current can kill a person, does he survive? **(2 marks)**
- b) The electrical resistance of a wet or damaged skin can be as low as $1\text{ k}\Omega$. What should be the internal resistance of such power supply to be considered safe for human being? **(3 marks)**

5. The maximum current that can be provided to two resistors of same resistance R that are connected in series, is I . A larger current will melt the resistors! What is the maximum current that can be provided to the same resistors, but connected in parallel? **(5 marks)**

6. In the circuit below, find V_1 , V_2 , and R_4 . **(5 marks)**



7. In the figure below, the switch S is closed for a long time such that the system reaches a steady state (capacitor is fully charged). Find the current passing through R_2 , 4 ms after the switch is opened. $R_1 = 10\text{ k}\Omega$, $R_2 = 15\text{ k}\Omega$, $E = 20\text{ V}$, $C = 0.4\text{ }\mu\text{F}$. **(5 marks)**

