

General Physics - E&M (PHY 1308) Lecture

Notes

Quiz006

SteveSekula, 6 October 2010 (created 6 October 2010)

Name: _____

no tags

Date: _____

Rules for the Quiz:

- You are given **5 minutes at the beginning** to look over the quiz quietly and jot some notes on a 3x5-inch notecard. Use this time to think about how to attack the quiz problem(s)
- You are given **10 minutes in the middle** to discuss the quiz with your teammates. Use this time to develop strategies across the group for attacking the problem(s). You are allowed to keep notes from this discussion on the SAME 3x5-inch notecard.
- You then have **15 minutes at the end** to work individually (NO MORE DISCUSSION) to solve the problem(s). Use your notes on the 3x5-inch card to help you attack the problem(s)
- You are allowed to use a calculator
- Your grade will be determined from the weighted-average of your group and not from your individual performance. The highest grade will be weighted the most, and the lowest the least. Low grades will drag the average down, so it is in your best interest to collaborate during the discussion part of this quiz. All members of your team get the same grade, determined from that weighted average.

Problem: Electricity in the Cell (30 Points)

Food is converted by our bodies into ATP (Adenosine triphosphate), which is then the source of energy for powering individual cellular processes. The use of ATP releases 30.0 kJ per mol of ATP (where $1 \text{ mol} = 6.02 \times 10^{23}$). ATP is produced and spent continuously in cells, because it cannot be stored by the body, and as a result each cell in your body produces and "burns" ATP

at a rate of about $2.0 \times 10^{-17} \text{ mol/s}$.

1. (10 Points) How much power is represented by the "burning" of ATP by a cell?
2. (10 Points) Assume the full power you calculated in Part 1 is available to the cell to transport sodium ions out of the cell and into the extracellular medium. If the potential across a cell membrane is 75.0mV, how many singly-charged sodium ions (Na^+) can be pushed through the membrane in 1.0 millisecond?
3. (10 Points) What is the resistance of the cell membrane?