

## LAB EXAM 2

Name: .....

(12 points, suggested time 25 minutes)

Mean score in real exam = 3.29/12

Some students want to know what gets used up in an incandescent bulb when it is in series with a resistor: current, energy or both. They come up with the following two questions.

- (1) In one second, do fewer electrons leave the bulb than enter the bulb?
- (2) Does the electric potential energy of the electrons change while inside the bulb?

This question is actually straightforward once you remember the basics of what current and voltage mean and how they behave in series.

The students have an adjustable power source, insulated wire, lightbulbs, resistors, switches, voltmeters, ammeters and other standard lab equipment. Assume that the power supply and voltmeters are marked in 0.1 V increments and that the ammeters are marked in 0.01 A increments.

- a) Describe an experimental procedure that could be used to answer questions (1) and (2) above. In your description, state the measurements that you would make and how you would use the equipment to make them. Include a neat, labeled diagram of your set up.

**BEFORE YOU START** – Re-read the question a) and b) and be **clear** about what it is you are doing. Diagram should be a circuit diagram  
Recommend: bullet point style

- b) i) Explain how the data from the experiment you described can be used to answer question (1) above.

- ii) Explain how the data from the experiment you described can be used to answer question (2) above.

What is the nature of a current and how does it behave in series. What is meant by the voltage across a lightbulb?

A lightbulb is non-ohmic if its resistance changes as a function of current. Your set up from part a) is to be used or modified to determine whether the lightbulb is non-ohmic.

- c) i) How, if at all, does the set up need to be modified?

**We have done this experiment in S11 and AP-1. No excuses for full marks.**

- ii) What additional data, if any, would need to be collected?

- d) How would you analyse the data to determine whether the bulb is non-ohmic? Include a discussion of how the uncertainties in the voltmeter and ammeters would affect your argument for concluding whether the resistor is non-ohmic.

**By far the best method is to use a graph and sketch it. Describe the result.**

**Uncertainties are more challenging to deal with. Plotting graphs with error bars help, if you consider tables and means, then they are harder.**