Universität Leipzig, Fakultät für Physik und Geowissenschaften

Exercises for Experimental Physics 2 – IPSP

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Exercise Sheet 12 (SoSe 2012)

Date of Issue: June 29^{th} 2012

Date of Submission: July 6^{th} 2012

Submission Place: Marked mailbox next to room 302 (Linnestr. 5)
Submission Time: 11:00 a.m. at the submission day noted above

Please note: Write your name and matriculation number on EACH sheet of paper.
Only submit the calculations and results for exercise 1-3, exercise 4 will be discussed during the instruction classes.

Exercises:

1. The resistivity of tungsten increases approximately linearly with temperature from $56.0\,n\Omega \cdot m$ at 293 K to $1.10\,\mu\Omega \cdot m$ at 3500 K. A light bulb is powered by a 100-V dc power supply. Under these operating conditions the temperature of the tungsten filament is 2500 K, the length of the filament is equal to 5.00 cm and the power delivered to the filament is 40 W. Estimate (a) the resistance of the filament and (b) the diameter of the filament. (7 Points)

2. A parallel combination of an 8.00−Ω resistor and a resistor of unknown resistance is connected in series with a 16.0−Ω resistor and an ideal battery. This circuit is then disassembled and the three resistors are then connected in series with each other and the same battery. In both arrangements, the current through the 8.00−Ω resistor is the same. What is the resistance of the unknown resistor? (8 Points)

3. A wire bent in some arbitrary shape carries a current I. The wire is in a region with a uniform magnetic field $\vec{B}$. Show that the total force on the part of the wire from some arbitrary point on the wire (designated as a) to some other arbitrary point on the wire (designated as b) is $\vec{F} = I\vec{L} \times \vec{B}$, where $\vec{L}$ is the vector from point a to point b. In other words, show that the force on an arbitrary section of the bent wire is the same as the force would be on a straight section wire carrying the same current and connecting the two endpoints of the arbitrary section. (5 Points)

4. In the circuit shown in Figure 1, switch S has been open for a long time. At time $t = 0$ the switch is then closed. (a) What is the battery current just after switch S is closed? (b) What is the battery current a long time after switch S is closed? (c) The switch has been closed for a long time. At $t = 0$ the switch is then opened. Find the current through the $600-k\Omega$ resistor as a function of time.

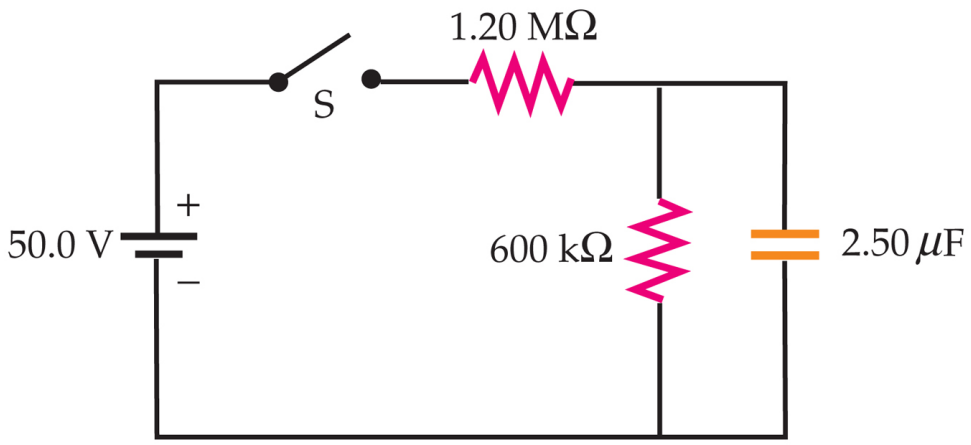

Figure 1: Exercise 4