

## Exercises for Experimental Physics 2 – IPSP

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### Exercise Sheet 13 (SoSe 2012)

Date of Issue: July 6<sup>th</sup> 2012

**Date of Submission: July 13<sup>th</sup> 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. Chlorine has two stable isotopes,  $^{35}\text{Cl}$  and  $^{37}\text{Cl}$ . Chlorine gas which consists of singly-ionized ions is to be separated into its isotopic components using a mass spectrometer. The magnetic field strength in the spectrometer is 1.2 T. What is the minimum value of the potential difference through which these ions must be accelerated so that the separation between them, after they complete their semicircular path, is 1.4 cm? (7 Points)
2. A hollow uniformly charged nonconducting cylindrical shell (Figure 1) has length  $L$ , inner and outer radii  $R_i$  and  $R_o$ , respectively, a charge density  $\rho$ , and an angular velocity  $\omega$  about its axis. Derive an expression for the magnetic moment of the cylinder. (7 Points)
3. The current in the wire shown in Figure 2 is 8.0 A. Find the magnetic field at point  $P$  and state the direction. (6 Points)
4. A long cylindrical shell has an inner radius  $a$  and an outer radius  $b$  and carries a current  $I$  parallel to the central axis. Assume that within the material of the shell the current density is uniformly distributed. Find an expression for the magnitude of the magnetic field for (a)  $0 < R < a$ , (b)  $a < R < b$ , and (c)  $R > b$ .

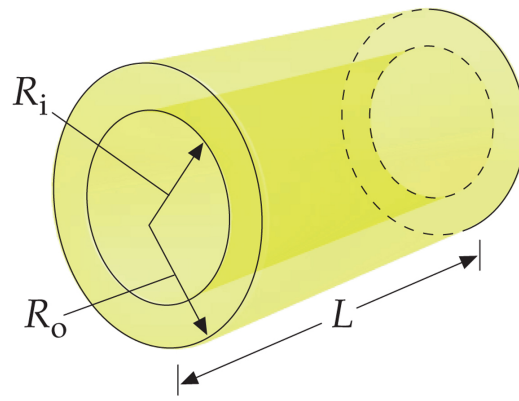


Figure 1: Exercise 2

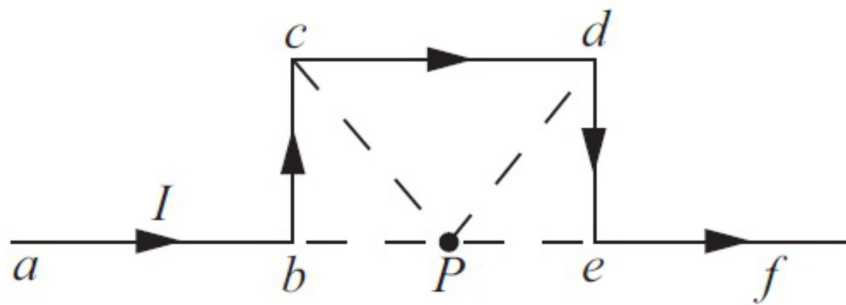


Figure 2: Exercise 3