Universität Leipzig, Fakultät für Physik und Geowissenschaften

Exercises for Experimental Physics 2 – IPSP

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Exercise Sheet 1 (SoSe 2012)

Date of Issue: Apr. 13^{th} 2012

Date of Submission: Apr. 20^{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. A small change in the volume of a liquid occurs when heating the liquid at constant pressure. Use the following data to estimate the fractional contribution this change makes to the heat capacity of water between 4.00°C and 100°C. The density of water at 4.00°C and 1.00 atm pressure is 1.000 g/cm^3. The density of liquid water at 100°C and 1.00 atm pressure is 0.9584 g/cm^3. (6 Points)

2. You are supervising the creation of some lead castings for use in the construction industry. Each casting involves one of your workers pouring 0.500 kg of molten lead that has a temperature of 327°C into a cavity in a large block of ice at 0°C. How much liquid water should you plan on draining per hour if there are 100 workers who are able to each average one casting every 10.0 min? (5 Points)

3. (a) Calculate the heat capacity per unit mass of air at constant volume and the heat capacity per unit mass of air at constant pressure. Assume that air has a temperature of 300 K and a pressure of $1.00 \cdot 10^5 N/m^2$. Also assume that air is composed of 74.0% N_2 molecules (molecular weight 28.0 g/mol) and 26.0% O_2 molecules (molar mass of 32.0 g/mol) and that both components are ideal gases. (b) Compare your answer for the specific heat at constant pressure to the value listed in the *Handbook of Chemistry and Physics* of 1.032 kJ/kg·K. (9 Points)

4. A 25.0-g glass tumbler contains 200 mL of water at 24.0°C. If two 15.0-g ice cubes, each at a temperature of -3.00°C, are dropped into the tumbler, what is the final temperature of the drink? Neglect any heat transfer between the tumbler and the room.