Universität Leipzig, Fakultät für Physik und Geowissenschaften

Exercises for Experimental Physics 3 – IPSP

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Exercise Sheet 10 (WS 2012/13)

Date of Issue to Students: Jan. 4^{th} 2013

Date of Submission: Jan. 11^{th} 2013

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. At age 45, a person is fitted for reading glasses that have a power equal to 2.10 D in order to read at 25 cm. By the time she reaches the age of 55, she discovers herself holding her newspaper at a distance of 40 cm in order to see it clearly with her glasses on. (a) Where was her near point at age 45? (b) Where is her near point at age 55? (c) What power is now required for the lenses of her reading glasses so that she can again read at 25 cm? Assume the glasses are placed 2.2 cm from her eyes. (7 Points)

2. A concave side of a lens has a radius of curvature of magnitude equal to 17.0 cm, and the convex side of the lens that has a radius of curvature of magnitude equal to 8.00 cm. The focal length of the lens in air is 27.5 cm. When the lens is placed in a liquid that has an unknown index of refraction, the focal length increases to 109 cm. What is the index of refraction of the liquid? (5 Points)

3. A microscope has a magnifying power of 600. The eyepiece has an angular magnification of 15.0. The objective lens is 22.0 cm from the eyepiece. Calculate (a) the focal length of the eyepiece, (b) the location of the object so that it is in focus for a normal relaxed eye, and (c) the focal length of the objective lens. (Points 8)

4. A disadvantage of the astronomical telescope for terrestrial use (for example, at a football game) is that the image is inverted. A Galilean telescope uses a converging lens as its objective, but a diverging lens as its eyepiece. The image formed by the objective is at the second focal point of the eyepiece (the focal point on the refracted side of the eyepiece), so that the final image is virtual, upright, and at infinity. (a) Show that the magnifying power is given by $M = -f_0/f_e$, where f_0 is the focal length of the objective and f_e is that of the eyepiece (which is negative). (b) Draw a ray diagram to show that the final image is indeed virtual, upright, and at infinity.