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# Exercises and Complements for the Introduction to Physics II

# for Students

# of Biology, Pharmacy and Geoscience

Sheet 10 / 06.05.2021 Zoom - Q&A on the Exercises: **18.05.2021/19.05.2021**

**Exercise 37.**

A philatelist uses a convex lens of refractive power 12 dpt as a magnifying glass to observe with a stamp from a normal viewing distance ($s_0 = 0.25$ m). What is the angular magnification of the magnifying glass?

**Exercise 38.**

Horizontally polarized light falls onto a polarizing foil. It is found experimentally that it transmits only 15 % of the energy of the incident light. At which angle does the polarization axis of the foil lie with regard to the horizontal axis?

**Exercise 39.**

Unpolarized light with intensity $I_0$ falls onto a polarization filter which reduces the light's intensity to $I_1$. It then falls onto a second polarization filter, the polarization axis of which is rotated by 45° to the first filter, and then has the intensity $I_2$. Finally, it steps on a third filter, whose polarization axis is rotated by 90° to the second filter and has the intensity $I_3$.

Which of the following statements is true?

(a) No light passes through the complete array.

(b) The intensity after passing the first two filters is $I_2 = 0.5 \cdot I_1$.

(c) It must always be true: $I_2 = I_3$

(d) The magnitude of $I_1$ is independent of the direction of the first filter.

(e) The magnitude of $I_2$ is independent of the order of the first two filters.

**Exercise 40.**

You would like to determine the concentration of an optically active biomolecule in solution by measuring the rotation of linearly polarized light. The specific rotation of the solute dextrorotatory molecule for light of wavelength $\lambda = 589$ nm is $\varphi = 66.5^\circ$ l·g$^{-1}$m$^{-1}$.

(a) The required linearly polarized light is to be generated by reflection of unpolarized light of wavelength $\lambda = 589$ nm from a glass plate ($n_{Glass} = 1.4501$). At what angle of incidence must the light strike the glass plate to be reflected fully polarized?

(b) Determine the concentration of a solution of the biomolecules that rotates the direction of the polarized light by $\alpha = 20.0^\circ$ when it passes through the 0.10 m long cuvette.

(c) Which angle of rotation do you measure if you mix the solution from (b) with the same amount of a solution of the levorotatory variant of the biomolecule with an identical concentration?

**Answers.**

Exercise 37. 3

Exercise 38. 67.2°

Exercise 40. (a) $\alpha = 55.41^\circ$ (b) $c = 3.0$ g/l (c) $\alpha = 0^\circ$