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Exercises and Complements for the Introduction to Physics I for Students of Biology, Pharmacy and Geoscience

Sheet 11 / November 7, 2017 Discussion of the Exercises: **05.12.2017/06.12.2017**

Exercise 44.
The fixed ends of a string are at a distance of 1 m. The string is under tension so that the fundamental frequency is 440 Hz. What is the velocity of the propagation of the transverse waves on the string?

Exercise 45.
The three frequencies of successive harmonic series are 1310 Hz, 1834 Hz and 2358 Hz.

(a) Is the pipe open or closed?
(b) What is the fundamental frequency?
(c) How long is the pipe?

Exercise 46.
A detonation at the Earth's surface generates a compression wave. This wave propagates into the ground and gets reflected at a rock formation and received at the Earth's surface at a distance of $x = 200$ m after $t = 0.1$ s. How deep under the Earth's surface is the rock formation if the propagation velocity of the compression wave is $c = 2200$ m/s?

Exercise 47.
During demonstrations it is common to use thunder whistles in order to obtain more attention. But often the protesters do not know that with a thunder whistle you can reach a noise level of up to 120 dB. How many whistling people are needed in order that the pain threshold of 130 dB is exceeded and therefore serious hearing damages can occur?

Additional Exercise (for students which are looking for a challenge - not relevant for the exam).
A wave $B(t, x)$ in combination with the wave $A(t, x) = A_0 \cos(\omega t + kx + \varphi_A)$ where $\omega = 10\ \pi$/sec, $k = \pi\ \mathrm{m}^{-1}$ and $\varphi_A = 70°$, has the effect that a particle at the position $x_1 = 0.8$ m never moves (standing wave). Write down the function for the wave $B(t, x)$.

Solutions

Exercise 44. 880 m/s

Exercise 45. (b) 262 Hz, (c) 0.324 m

Exercise 46. 45.8 m

Exercise 47. $n > 10$

Additional Exercise $\varphi = 178^\circ$