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

Sheet 10 / November 4, 2019 Discussion of the Exercises: **26.11.2019/27.11.2019**

Exercise 46.

A wave has a wavelength of $\lambda = 34$ cm and period of $T = 1.0$ ms. Calculate the frequency f, the velocity of propagation v, the angular frequency ω and the wave number k.

Exercise 47.

A flat acoustic wave in air is described by the following equation:

$$y(x,t) = 5 \cdot 10^{-5}\ \mathrm{m} \cdot \sin(1980\ \mathrm{s}^{-1} \cdot t - 6\ \mathrm{m}^{-1} \cdot x)$$

Determine for this wave:

(a) the frequency f
(b) the wavelength λ
(c) the propagation velocity c
(d) the velocity-time-law $v(t)$
(e) the maximum value of the velocity v_{max}

Exercise 48.

Two waves are moving in the same direction along a string. They have the same frequency of 100 Hz, same wavelength of 2 cm and also the same amplitude of 2 cm.

(a) How big is the amplitude of the resulting wave, if the phases are shifted by $\pi/6$ respectively $\pi/3$?
(b) How big is the phase difference if the resulting amplitude is equal to the original amplitude of the waves?

Exercise 49.

The human ear can detect acoustic waves in the frequency range between 16 Hz and 20 kHz. What is the spectrum of wavelength which are covered in the range of audibility? How is the situation changing inside a He atmosphere?

Exercise 50.

You are standing on a street. An ambulance is passing by, whose siren ($f = 550$ Hz) is turned on. The ambulance is passing by with a constant velocity of $v_K = 120$ km/h.
(a) What are you observing if you pay attention to the sound (frequency) of the alarm?
(b) What is the frequency of the sound which you hear when the ambulance is driving towards you respectively when it is driving away from you?

Solutions:

Exercise 46. $f = 1$ kHz, $c = 340$ m/s, $\omega = 6.28 \cdot 10^3$ s^{-1}, $k = 18.5$ m^{-1}

Exercise 47. (a) 315.1 Hz; (b) 1.05 m; (c) 330 m/s; (e) 0.099 m/s

Exercise 48. (a) 3.86 cm and 3.46 cm (b) 120°

Exercise 49. $\lambda = 17$ mm ... 21 m in air and $\lambda = 50$ mm ... 63 m in He

Exercise 50. 610 Hz respectively 500.9 Hz