DETERMINATION OF THE SPEED OF SOUND IN WARM AIR

AKD 02.09b

Material:

Item Code	Qty	Description
DW280-2R	1	Tube for measuring sound velocity
DW280-2L	1	Loudspeaker, waterproof, on support
DW280-2G	1	Sound velocity meter "inno"
DS101-1G	1	Support base, large, L=500 mm
DS093-04	2	Sliding saddle "Sepp", H=40 mm
C7002-2A	2	Universal clamp, 0 - 80 mm, with cork
C9010-9A	1	Fine pressure regulation valve
C1520-1M	1	Vacuum hose, plastics, D=6 mm, L=100 cm
DE722-1T	1	Thermometer "inno", 1100 °C
DT701-4F	1	Hot air blower, 1200 W
	2	Connecting lead

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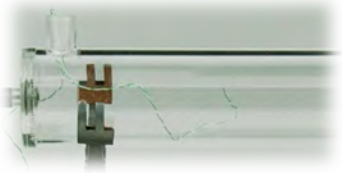
Goal:
Sound propagates faster in air at higher temperatures.

Setup:
The two sliding saddles are positioned on the support base. The universal clamps are fixed in the sliding saddles and opened completely. The sound velocity meter is connected to the loudspeaker, here the correct polarity must be ensured. The correct polarity is found out by measuring the "dead time" of the setup. For this purpose, the sound velocity meter is switched on and set to "Low". Now hold the microphone to the connected loudspeaker and perform a measurement. If there is the slightest deviation, the polarity is correct. The value obtained should be noted, as it should be included in the calculations. ($\sim 0{,}09\ ms$).

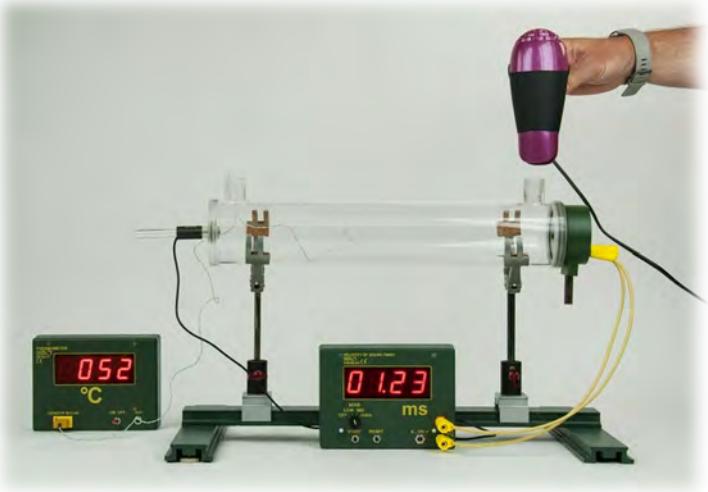
The waterproof loudspeaker is then inserted into the tube (be sure to insert it completely into the tube, otherwise the distance between the microphone and the loudspeaker will not be 40 cm).

The tube is placed in the opened universal clamps and brought into a horizontal position with them. The microphone of the sound velocity meter is inserted into the opening at the other end of the tube (do not insert the microphone too far).

The thermometer is inserted as deep as possible into the tube.



Experiment:
Now the hair dryer and the thermometer are taken to hand. The thermometer is inserted into one of the openings of the tube and positioned in the center of the tube if possible. The hair dryer is switched on and held towards the other opening of the tube. As soon as the temperature reaches the desired value, a measurement is taken (the "Low" setting is sufficient).
(To prevent the hot air from escaping too quickly, the openings can be turned downwards).



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Result:
The speed of sound is calculated:

$$c = \frac{0{,}4\ m}{(0{,}00123 - 0{,}09)s} = 350{,}87\ m/s$$

If the hot air exits too quickly, the measurement no longer matches the prediction of the formula in the note.

Note:
The temperature-related speed of sound c is calculated according to the formula:

$$c_t = c_0 + 0{,}6 * t \quad mit \quad c_0 = 331{,}45 m/s, \quad t = Temperature\ in\ °C$$