SPEED OF SOUND IN VARIOUS MEDIA

The speed of sound in various solids, liquids, and gases is given in these tables. While only a single parameter v is needed for liquids and gases, sound propagation in isotropic solids is characterized by three velocity parameters. For a solid of infinite extent (or of finite extent if all dimensions are much larger than a wavelength), there are two relevant quantities,

v_l: velocity of longitudinal waves
v_s: velocity of shear waves.

For a cylindrical rod with diameter much smaller than a wavelength,

v_{ext}: velocity of extensional waves along the rod. (Torsional waves in the rod are propagated at the same speed as sheer waves in an infinite solid.)

Table 1 lists values for a variety of solid materials. Table 2 covers gases liquids and gases; values for cryogenic liquids are given at the normal boiling point. Table 3 gives the speed of sound in pure water and in seawater of salinity S = 3.5% as a function of temperature. All values are in meters per second and are given for normal atmospheric pressure.

References

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TABLE 1. Speed of Sound in Solids at Room Temperature

Name	v_l/m s^{-1}	v_s/m s^{-1}	v_{ext}/m s^{-1}
Metals			
Aluminum, rolled	6420	3040	5000
Beryllium	12890	8880	12870
Brass (70 Cu, 30 Zn)	4700	2110	3480
Constantan	5177	2625	4270
Copper, annealed	4760	2325	3810
Copper, rolled	5010	2270	3750
Duralumin 17S	6320	3130	5150
Gold, hard-drawn	3240	1200	2030
Iron, cast	4994	2809	4480
Iron, electrolytic	5950	3240	5120
Iron, Armco	5960	3240	5200
Lead, annealed	2160	700	1190
Lead, rolled	1960	690	1210
Magnesium, annealed	5770	3050	4940
Molybdenum	6250	3350	5400
Monel metal	5350	2720	4400
Nickel	6040	3000	4900
Platinum	3260	1730	2800
Silver	3650	1610	2680
Steel (1% C)	5940	3220	5180
Steel, 347 Stainless	5790	3100	5000
Steel, K9	5940	3250	5250
Tin, rolled	3320	1670	2730
Titanium	6070	3125	5090
Tungsten, annealed	5220	2890	4620
Tungsten, drawn	5410	2640	4320
Zinc, rolled	4210	2440	3850
Other materials			
Fused silica	5968	3764	5760
Glass, heavy silicate flint	3980	2380	3720
Glass, light borate crown	5100	2840	4540
Glass, pyrex	5640	3280	5170
Lucite	2680	1100	1840
Nylon 6-6	2620	1070	1800
Polyethylene	1950	540	920
Polystyrene	2350	1120	1840
Rubber, butyl	1830		
Rubber, gum	1550		
Rubber, neoprene	1600		
Tungsten carbide	6655	3980	6220

TABLE 2. Speed of Sound in Liquids and Gases

Name	t/°C	v/m s^{-1}
Liquids		
Acetone	20	1203
Argon	–185.9	813
Benzene	25	1310
Bromobenzene	20	1169
Butane	–0.5	1034
1-Butanol	20	1258
Carbon disulphide	25	1140
Chlorobenzene	20	1311
Cyclohexane	19	1280
1-Decene	20	1250
Diethyl ether	25	976
Ethane	–88.6	1326
Ethanol	20	1162
Ethylene	–103.8	1309
Ethylene glycol	25	1658
Fluorobenzene	20	1183
Glycerol	25	1904
Helium	–268.9	180
Heptane	20	1162
1-Heptene	20	1128
Hexane	20	1083
Hydrogen	–252.9	1101
Iodobenzene	20	1114
Mercury	25	1450
Methane	–161.5	1337
Methanol	20	1121
Nitrobenzene	25	1463
Nitrogen	–195.8	939
1-Nonene	20	1218
Octane	20	1197
1-Octene	20	1184
Oxygen	–183.0	906
1-Pentadecene	20	1351
Pentane	20	1008
Propane	–42.1	1158
1-Propanol	20	1223
Tetrachloromethane	25	930
Trichloromethane	25	987
1-Undecene	20	1275
Water	25	1497
Water (sea, S = 3.5%)	25	1535
Gases at 1 atm		
Air, dry	25	346
Ammonia	0	415
Argon	27	323
Carbon monoxide	0	338
Carbon dioxide	0	259
Chlorine	0	206
Deuterium	0	890
Ethane	27	312
Ethylene	27	331
Helium	0	965
Hydrogen	27	1310
Hydrogen bromide	0	200
Hydrogen chloride	0	296
Hydrogen iodide	0	157
Hydrogen sulfide	0	289
Methane	27	450
Neon	0	435
Nitric oxide	10	325
Nitrogen	27	353
Nitrous oxide	0	263
Oxygen	27	330
Sulfur dioxide	0	213
Water (steam)	100	473

TABLE 3. Speed of Sound in Water and Seawater (S = 3.5%) at Different Temperatures

	v/m s^{-1}	
t/°C	Water	Seawater
0	1401.0	1449.4
10	1447.8	1490.4
20	1483.2	1522.2
25	1497.4	1535.1
30	1509.5	1546.2
40	1528.4	
50	1541.4	
60	1549.5	
70	1553.2	
80	1552.8	