

## REDUCTION OF WEIGHINGS IN AIR TO VACUO

When the mass  $M$  of a body is determined in air, a correction is necessary for the buoyancy of the air. The corrected mass is given by  $M + kM/1000$ , where  $k$  is a function of the material used for the weights, given by

$$k = 1000\rho_{\text{air}}(1/\rho_{\text{body}} - 1/\rho_{\text{weight}})$$

and  $\rho$  is density. The table below is computed for an air density of 0.0012 g/cm<sup>3</sup> and for densities of three common weights:

Density of body (g/cm <sup>3</sup> )	Value of $k$ for weights of:		
	Pt-Ir	Brass	Quartz or Al
0.5	2.34	2.26	1.95
0.6	1.94	1.86	1.55
0.7	1.66	1.57	1.26
0.8	1.44	1.36	1.05
0.9	1.28	1.19	0.88
1.0	1.14	1.06	0.75
1.1	1.04	0.95	0.64
1.2	0.94	0.86	0.55
1.3	0.87	0.78	0.47
1.4	0.80	0.72	0.40
1.5	0.74	0.66	0.35
1.6	0.69	0.61	0.30
1.7	0.65	0.56	0.25

platinum-iridium (21.6 g/cm<sup>3</sup>), brass (8.5 g/cm<sup>3</sup>), and aluminum or quartz (2.65 g/cm<sup>3</sup>).

### References

1. Kaye, G. W. C., and Laby, T. H., *Tables of Physical and Chemical Constants, 16th Edition*, pp. 25-28, Longman, London, 1995.
2. Giacomo, P., *Metrologia*, 18, 33, 1982.
3. Davis, R. S., *Metrologia*, 29, 67, 1992.

Density of body (g/cm <sup>3</sup> )	Value of $k$ for weights of:		
	Pt-Ir	Brass	Quartz or Al
1.8	0.61	0.53	0.21
1.9	0.58	0.49	0.18
2.0	0.54	0.46	0.15
2.5	0.42	0.34	0.03
3.0	0.34	0.26	-0.05
4.0	0.24	0.16	-0.15
6.0	0.14	0.06	-0.25
8.0	0.09	0.01	-0.30
10.0	0.06	-0.02	-0.33
15.0	0.02	-0.06	-0.37
20.0	0.00	-0.08	-0.39
22.0	0.00	-0.09	-0.40

For a more accurate calculation, use the following values of the density of air (assuming 50% relative humidity and 0.04% CO<sub>2</sub>):

$P/\text{kPa}$	Air temperature		
	10°C	20°C	30°C
85	0.001043	0.001005	0.000968
90	0.001105	0.001065	0.001025
95	0.001166	0.001124	0.001083
100	0.001228	0.001184	0.001140
105	0.001290	0.001243	0.001198

Formulas for calculating the density of air over more extended ranges of temperature, pressure, and humidity may be found in the references.