

23 Thermal expansion of liquids and solids

Subject:

The thermal expansion of liquids and solids

Deficiencies:

For temperature changes of 10 °C the effect is of the order of per mil. There are many other effects of this order of magnitude. In general we cannot afford to treat so small effects when teaching physics to beginners.

An argument in favor of the subject might be that there are phenomena in our everyday life that can be explained by the thermal expansion of liquid or solid bodies. An example is the Mercury thermometer. There are, however, other types of thermometers, that are just as important and for which we do not spend any teaching time.

Another example that is mentioned when teaching the subject is the expansion of railway rails and bridges. We believe that this subject is arguable. When explaining the expansion of bridges one should also explain why most of the other objects do not expand upon heating: houses, streets or even the whole Earth. And when citing the railway rails one should explain why in former times there was a gap at the rail bond and nowadays there is non.

There is another effect that sometimes is confused with the thermal expansion at constant pressure: the change of pressure at constant volume. This effect is big and impressive, in contrast to the thermal expansion. Both effects – volume change at constant pressure and pressure change at constant volume – are governed by two independent coefficients. The pressure change at constant volume in liquids and solids is normally not treated in the beginner's course. The reason seems to be that even this big effect is not important enough. Every subject competes with many other subjects. And there are so many that are important enough, but we do not have the time to discuss them.

Origin:

The reason why thermal expansion of liquids and solids occupies so much teaching time is not its importance in applications. It is the old mercury temperature scale. Before the thermodynamic temperature scale was introduced into physics, the definition of temperature depended on the thermal expansion of mercury. But this argument is not valid anymore.

Disposal:

Devote less time to the subject. There would be no harm if it were completely omitted.

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