

23.4: Thermodynamic Temperature

Equation (23.20) provides us with a physical definition of temperature that is independent of specific material properties such as the thermal expansion coefficient of some particular metal. Though different materials have different dependences of entropy on internal energy, the *derivative of entropy with respect to energy* will be the same for any two materials in thermal equilibrium with each other.

Note that the unit of temperature is the Kelvin degree according to this theory. If we had left off Boltzmann's constant in the definition of entropy, the dimensions of temperature would be that of energy. Boltzmann's constant is thus simply a scaling factor that changes temperature to energy just as multiplication by the speed of light converts time to distance.

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