may be employed for the latter—joule or erg. This procedure is much simpler than the introduction of the Kelvin scale in which the unit of temperature is arbitrarily selected so that the triple point of water is exactly 273.16 K. The triple point of water is the unique temperature at which water, ice, and water vapor coexist.

Historically, the conventional scale dates from an age in which it was possible to build accurate thermometers even though the relation of temperature to quantum states was as yet not understood. Even at present, it is still possible to measure temperatures with thermometers calibrated in kelvin to a higher precision than the accuracy with which the conversion factor k_B itself is known—about 32 parts per million. Questions of practical thermometry are discussed in Appendix B.

Comment. In (26) we defined the reciprocal of τ as the partial derivative $(\partial\sigma/\partial U)_N$. It is permissible to take the reciprocal of both sides to write

$$\tau = (\partial U/\partial\sigma)_N. \tag{28}$$

The two expressions (26) and (28) have a slightly different meaning. In (26), the entropy σ was given as a function of the independent variables U and N as $\sigma = \sigma(U,N)$. Hence τ determined from (26) has the same independent variables, $\tau = \tau(U,N)$. In (28), however, differentiation of U with respect to σ with N constant implies $U = U(\sigma,N)$, so that $\tau = \tau(\sigma,N)$. The definition of temperature is the same in both cases, but it is expressed as a function of different independent variables. The question "What are the independent variables?" arises frequently in thermal physics because in some experiments we control some variables, and in other experiments we control other variables.

ENTROPY

The quantity $\sigma \equiv \log g$ was introduced in (21) as the entropy of the system: **the entropy is defined as the logarithm of the number of states accessible to the system.** As defined, the entropy is a pure number. In classical thermodynamics the entropy S is defined by

$$\frac{1}{T} = \left(\frac{\partial S}{\partial U}\right)_N. \tag{29}$$