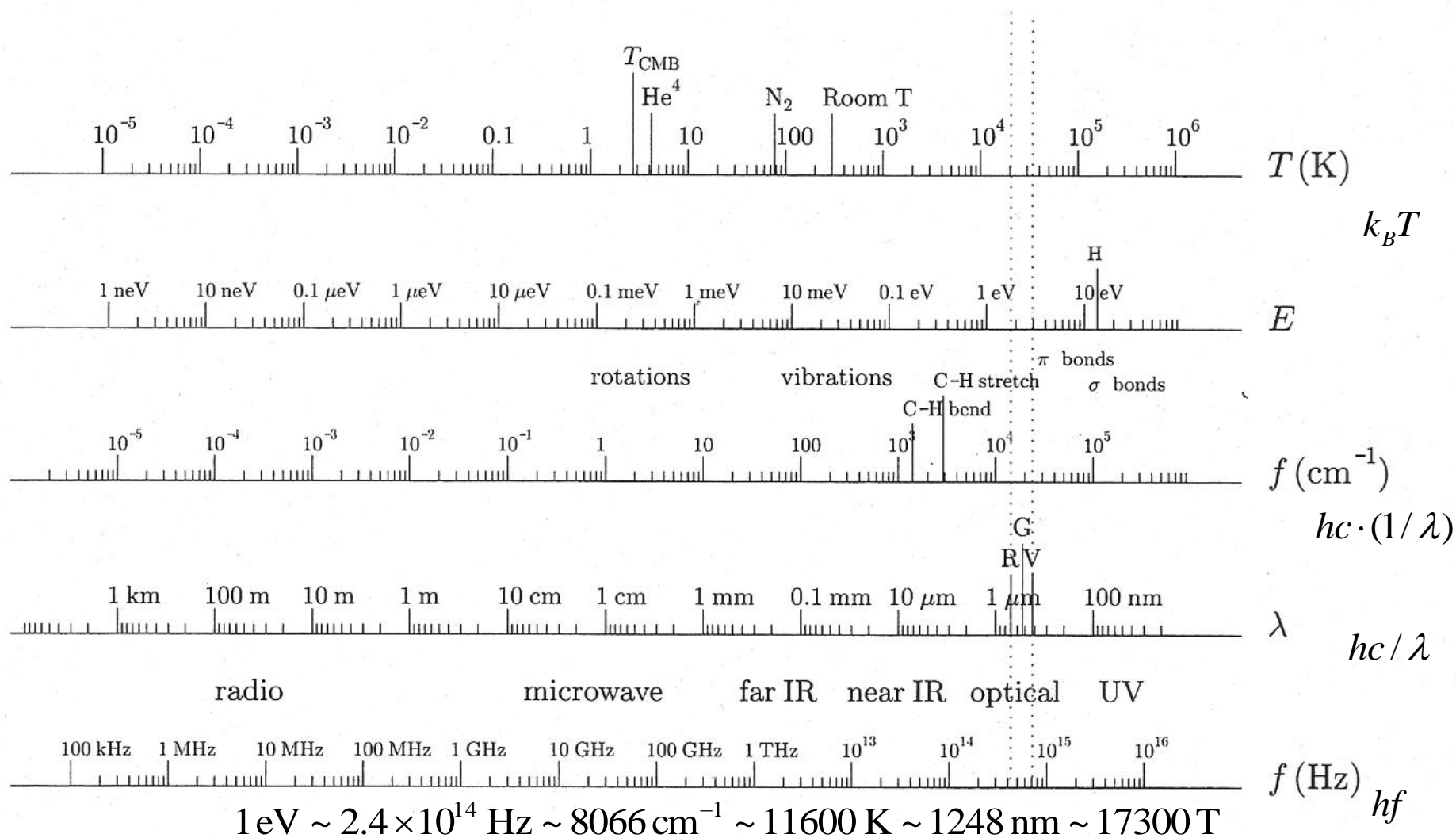


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**Fig. 3.8** The electromagnetic spectrum. The energy of a photon is shown as a temperature  $T = E/k_B$  in Kelvin and as an energy  $E$  in eV. The corresponding frequency  $f$  is shown in Hz and, because the unit is often quoted in spectroscopy, in  $\text{cm}^{-1}$ . The  $\text{cm}^{-1}$  scale is marked with some common molecular transitions and excitations (the typical range for molecular rotations and vibrations are shown, together with the C–H bending and stretching modes). The energy of typical  $\pi$  and  $\sigma$  bonds are also shown. The wavelength  $\lambda = c/f$  of the photon is shown (where  $c$  is the speed of light). The particular temperatures marked on the temperature scale are  $T_{\text{CMB}}$  (the temperature of the cosmic microwave background), the boiling points of liquid Helium ( $\text{He}^4$ ) and nitrogen ( $\text{N}_2$ ), both at atmospheric pressure, and also the value of room temperature. Other abbreviations on this diagram are IR = infrared, UV = ultraviolet, R = red, G = green, V = violet. The letter H marks 13.6 eV, the magnitude of the energy of the 1s electron in hydrogen. The frequency axis also contains descriptions of the main regions of the electromagnetic spectrum: radio, microwave, infrared (both ‘near’ and ‘far’), optical and UV.