Table 11-1 Comparison of the Three Distribution Functions

	Boltzmann	Bose	Fermi
Basic characteristic	Applies to distinguishable particles	Applies to indistinguishable particles not obeying the exclusion principle	Applies to indistinguishable particles obeying the exclusion principle
Example of system	Distinguishable particles, or approximation to quantum distributions at $\mathscr{E} \gg kT$	Bosons—identical particles of zero or integral spin	Fermions—identical particles of odd half integral spin
Eigenfunctions of particles	No symmetry requirements	Symmetric under exchange of particle labels	Antisymmetric under exchange of particle labels
Distribution function	$Ae^{-\mathscr{E}/kT}$	$\dfrac{1}{e^{\alpha}e^{\mathscr{E}/kT} - 1}$	$\dfrac{1}{e^{(\mathscr{E}-\mathscr{E}_F)/kT} + 1}$
Behavior of distribution function versus $\mathscr{E}/kT$	Exponential	For $\mathscr{E} \gg kT$, exponential For $\mathscr{E} \ll kT$, lies above Boltzmann	For $\mathscr{E} \gg kT$, exponential where $\mathscr{E} \gg \mathscr{E}_F$ If $\mathscr{E}_F \gg kT$, decreases abruptly near $\mathscr{E}_F$
Specific problems applied to in this chapter	Gases at essentially any temperature; modes of vibration in an isothermal enclosure	Photon gas (cavity radiation); phonon gas (heat capacity); liquid helium	Electron gas (electronic specific heat, contact potential, thermionic emission)