Quantum Mechanics
Physics 237

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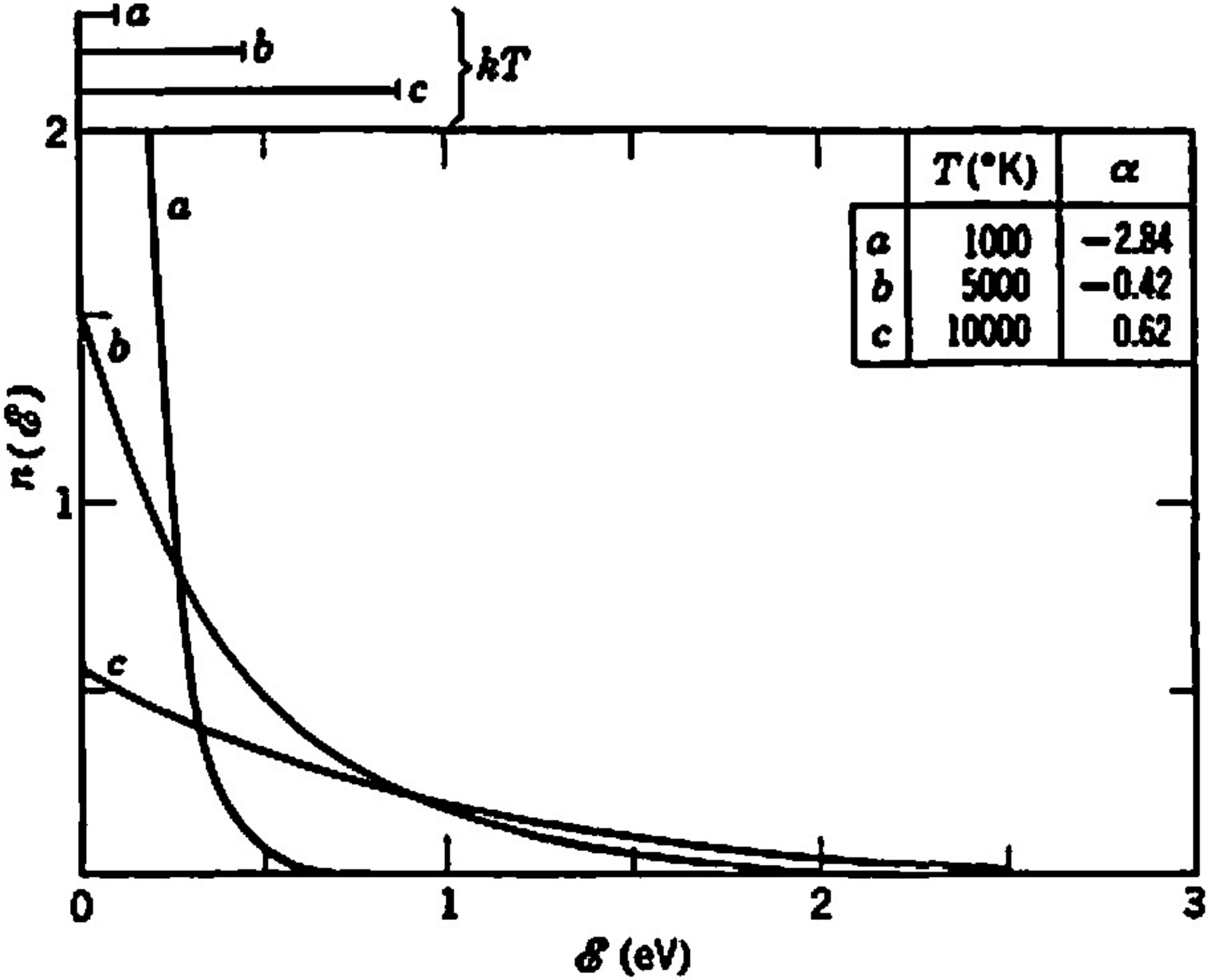
Course Information

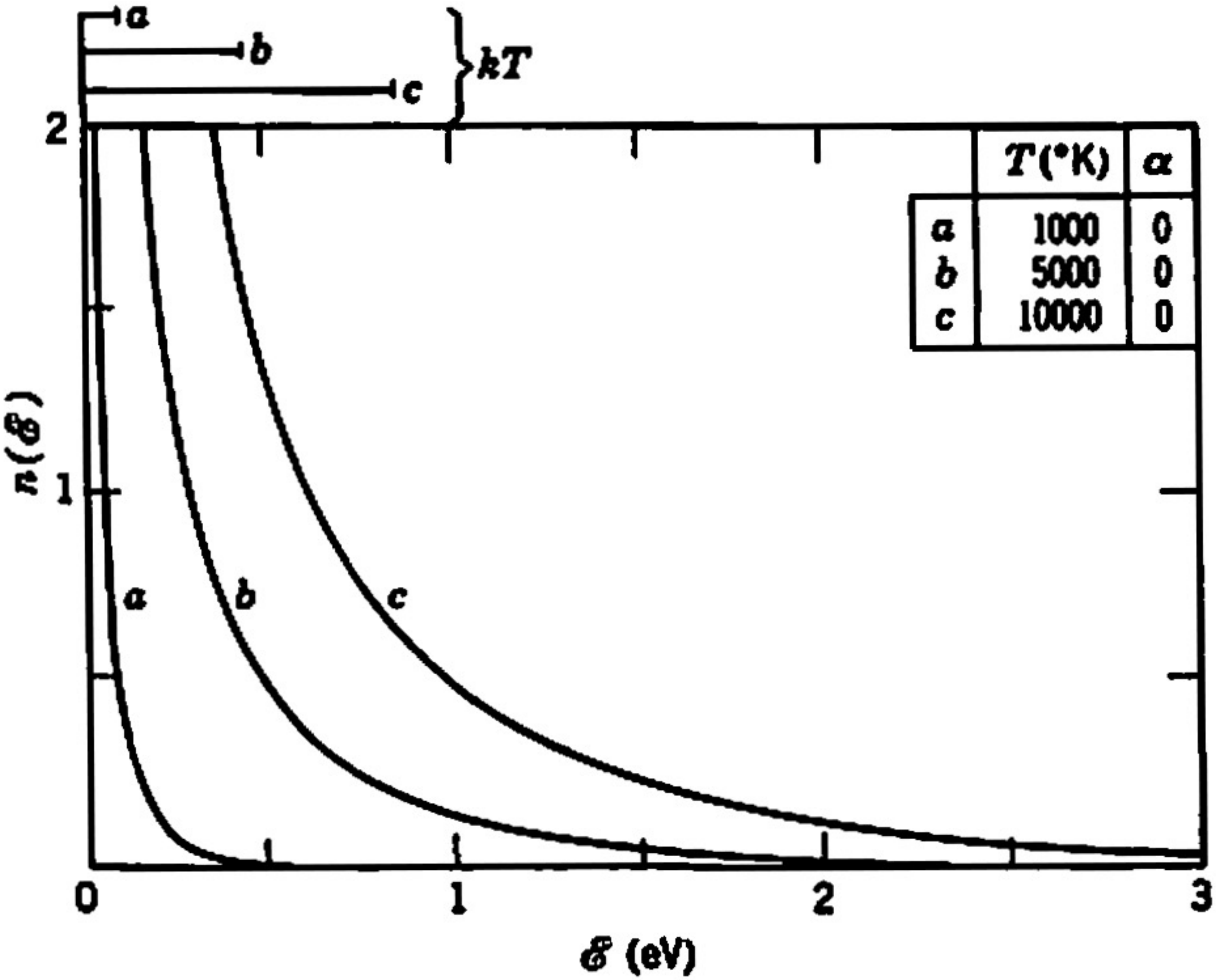
- Today's lecture continues the discussion of Chapter 11. We will complete the discussion of Chapter 11 next week on Tuesday.
- Next week on Thursday we will start the discussion of Chapter 17. **Yes, we will skip Chapter 12 – 16.**

- The next midterm exam on April 19, will cover the material discussed in Chapters 9, 10, and 11.
- You can be sure that there will be one analytical question from each of these three chapter.

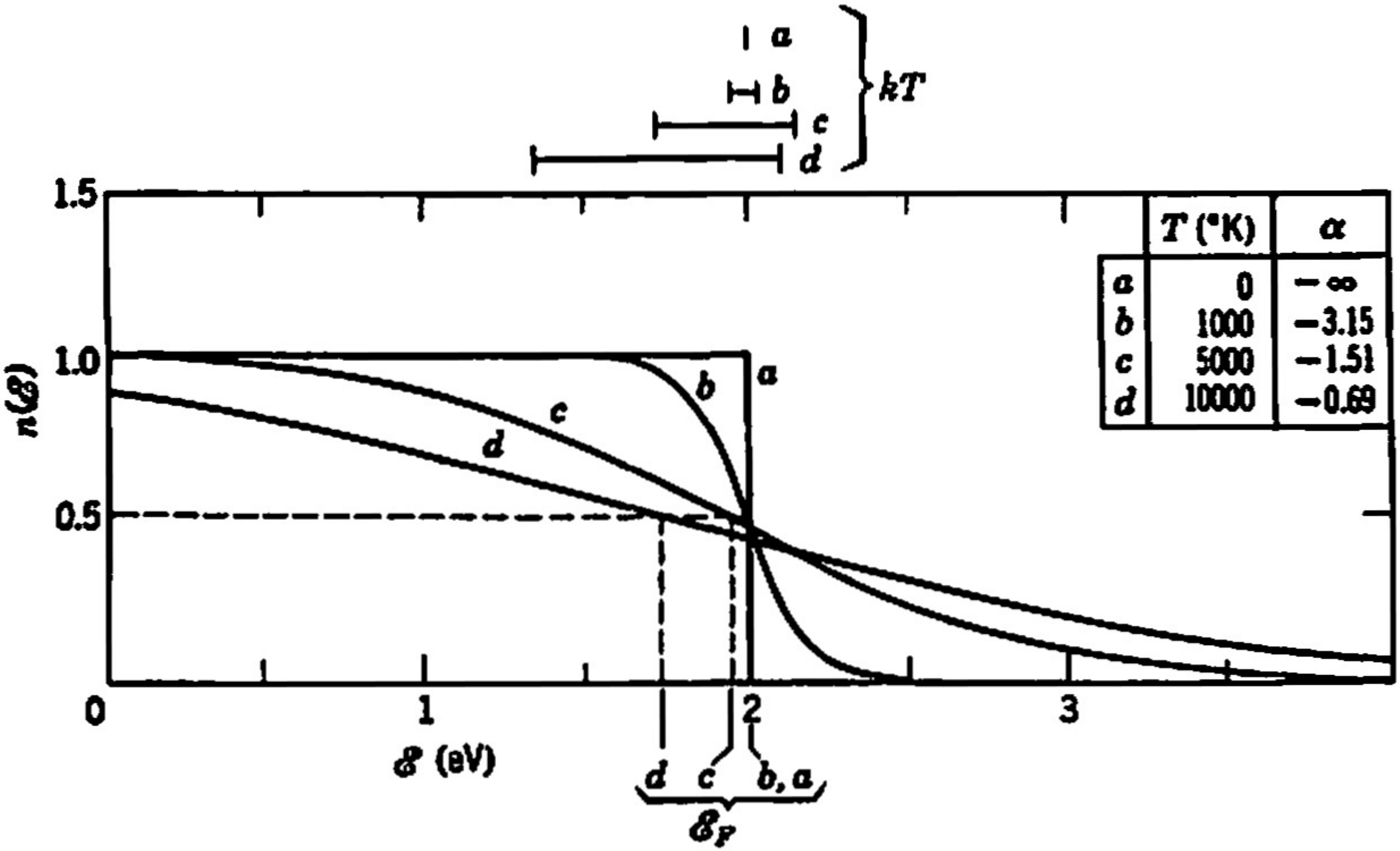
The Boltzmann distribution. Particle distributions at constant density.



The Bose distribution.

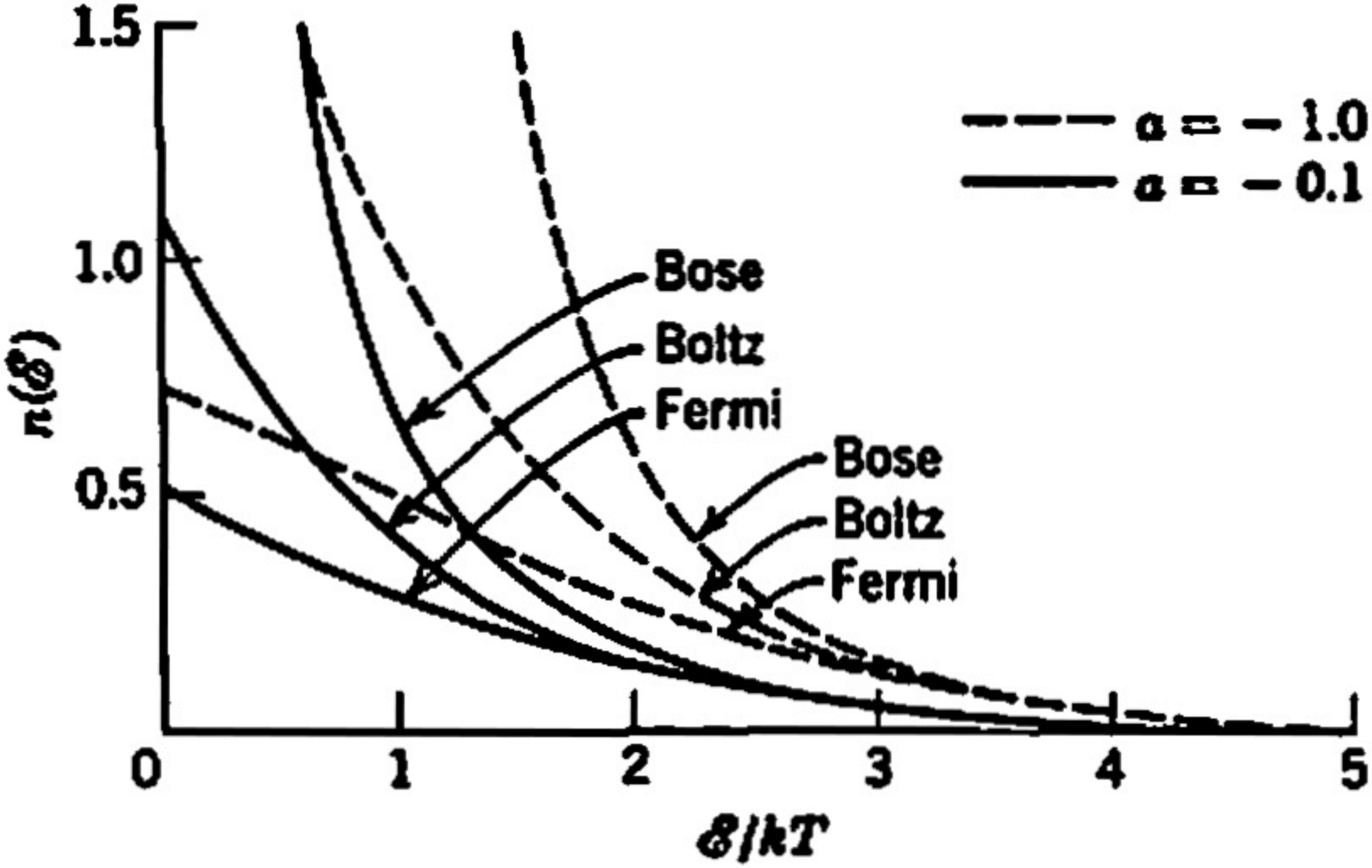


The Fermi Distribution.



	T (°K)	α
a	0	−∞
b	1000	−3.15
c	5000	−1.51
d	10000	−0.69

Comparing the distributions.



Quantum Statistics. Comparing density distributions.

Table 11-1 Comparison of the Three Distribution Functions

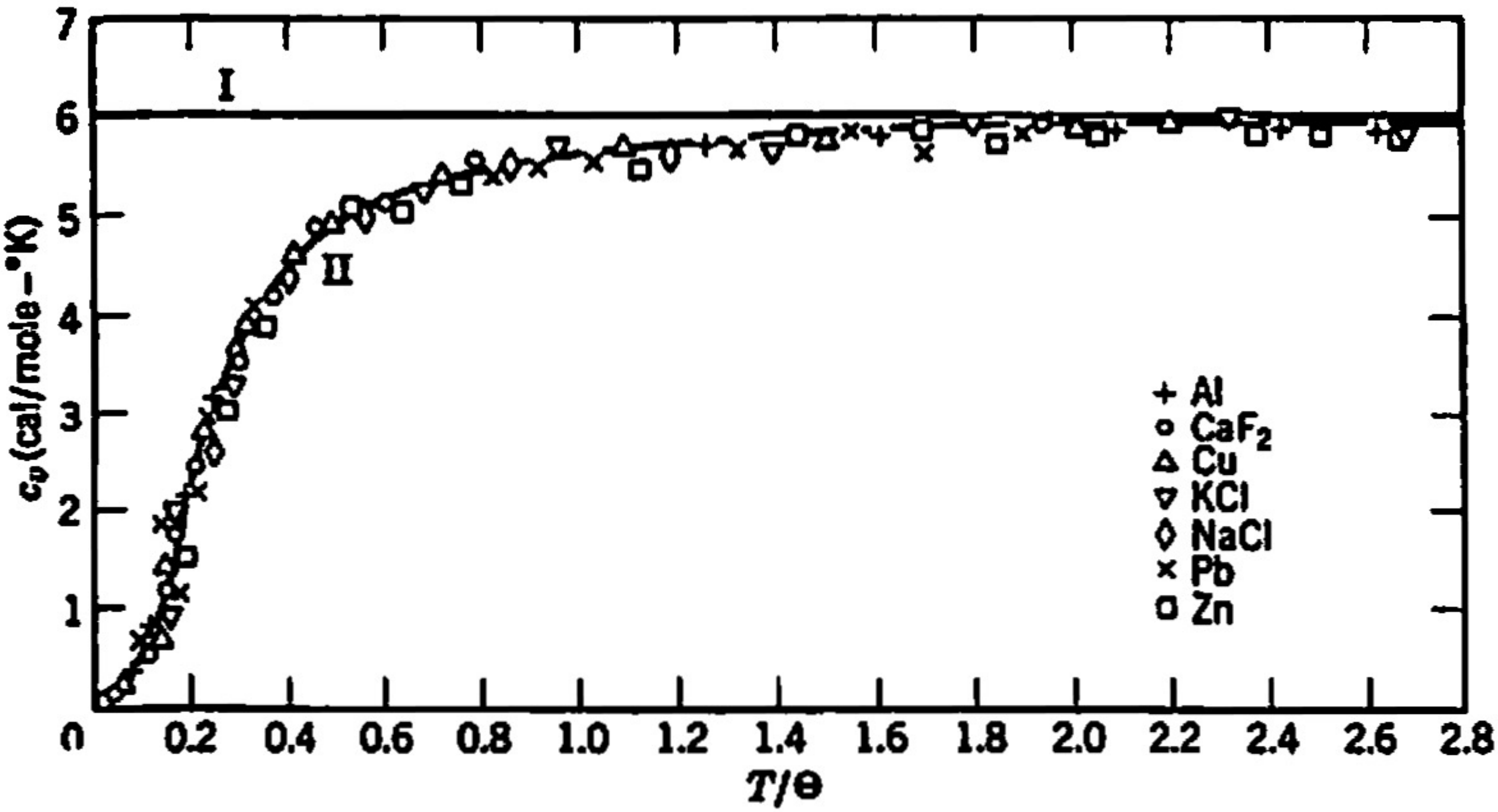
	Boltzmann	Bose	Fermi
Basic characteristic	Applies to distinguishable particles	Applies to indistinguishable particles not obeying the exclusion principle	Applies to indistinguishable particles obeying the exclusion principle
Example of system	Distinguishable particles, or approximation to quantum distributions at $\mathcal{E} \gg kT$	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	$Ae^{-\mathcal{E}/kT}$	$\dfrac{1}{e^{\alpha}e^{\mathcal{E}/kT} - 1}$	$\dfrac{1}{e^{(\mathcal{E}-\mathcal{E}_F)/kT} + 1}$
Behavior of distribution function versus $\mathcal{E}/kT$	Exponential	For $\mathcal{E} \gg kT$, exponential For $\mathcal{E} \ll kT$, lies above Boltzmann	For $\mathcal{E} \gg kT$, exponential where $\mathcal{E} \gg \mathcal{E}_F$ If $\mathcal{E}_F \gg kT$, decreases abruptly near $\mathcal{E}_F$
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)

2 Minute 45 Second Intermission.

- Since paying attention for 1 hour and 15 minutes is hard when the topic is physics, let's take a 2 minute 45 second intermission.

- You can:
  - Stretch out.
  - Talk to your neighbors.
  - Ask me a quick question.
  - Enjoy the fantastic music.

Applications of Quantum Statistics.
Heat Capacity.



ENOUGH FOR TODAY?