
Message from Author

The idea of this book was born in 2011 because of the necessity of a proper “Thermodynamics” text book for the students in the Material Sciences Faculty in Yokohama City University, Japan. This university is highly internationalized and has a number of foreigner teachers that teach sciences courses in English.

Japanese and foreigner exchange students follow classes, but since majority of them are Japanese we matured the idea of the necessity of an appropriate text book in both languages. We contacted the Editor and the reaction was enthusiastic.

The “Thermodynamics” course is given by one of the authors in the autumn semester and lasts about 22 hours (15 classes of 90 minutes). It gives the fundamental of thermodynamics, demonstrates from scratch the ideal gas law, the kinetic theory and Boltzmann principles, teaches what is Brownian motions, its central laws and implications, goes through phenomena like thermal drift and thermal noise, explains key concepts like the thermodynamics fundamental laws, thermodynamical machines and entropy and even touches electrical phenomena and demonstrate the Ohm law.

The class finishes where quantum mechanics begins. At the end of the course the last lectures introduce the limitations of thermodynamics, explain and derive step by step the very first quantum mechanical equation: the Planck “Black Body” radiation formula.

Thermodynamics can be a rather cold and sometimes boring subject. So we focused to keep reader alert and motivated. In this book we never give concepts from above, but incite students to understand the fundamental

meaning of things in the real world. We try always to give reasons why those concepts were developed and explain what practical problems a theory solves.

For example, the ideal gas law, usually given as a starting proposition in many textbooks, it is instead derived gradually here from basic concepts of first-year physics. Or, as another example of our approach, after introducing and deriving Boltzmann distribution, we apply it to a column of air and show how it explains everyday life problems like diminished pressure with height or the weaker concentration of oxygen at higher elevations.

At the end of this course students are satisfied from the feeling that they really understood the physical meaning of each formula learned. Instead of forcing students to just learn and memorize abstract things in order to pass an exam, we focused on transmitting the essence of the meaning of things, and give the students the ability of deriving their own physical model so they feel they are really in control of physical concepts.

We hope this book will transmit the same feeling as our course. Yokohama City University score each year in the top 10% as student satisfaction and top 1% in students employment-ratio in Japan, surpassing several Japanese world class universities.

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