

Contents

Introduction: THE RULER, THE CLOCK, AND THE THERMOMETER	xi
Chapter 1: 37	1
Constant Temperature	4
Into the Sahara	10
Into the Antarctic	18
When Things Go Wrong	25
Shocks from Heat	33
Chapter 2: MEASURE FOR MEASURE	41
The First Sparks	42
The Thermometer's Four Inventors	48
The Count from Massachusetts	58
Steam Power	64
Thermodynamics' Three Laws	71
Entropy and Life	76
Chapter 3: READING THE EARTH	80
Copernicus's Harmony	86

The Minister, the Lawyer, and the Fossil Fish Expert	92
Cycles of Ice	97
The Tundra's Bloom	102
El Niño, Old and New	107
Greenhouse Effect: The Basic Science	111
Greenhouse Effect: The History	118
Greenhouse Effect: The Politics	126
 Chapter 4: LIFE IN THE EXTREMES	 131
Barton and Beebe's Bathysphere	132
Clambake I: Hydrothermal Vents	140
Some Like It Hot	148
Snowball Earth	154
The Third Branch of Life	161
Melting the Earth	165
Extraterrestrial Life	172
Life Under Two Miles of Ice	177
 Chapter 5: MESSAGES FROM THE SUN	 183
At the Core	184
Cosmic Gall	189
A Thermal Aside: Gamow, Rutherford, and Nuclear Barriers	196
A Star Is Born	200
Black Holes and Little Green Men	205
The Founding Elements: Hydrogen and Helium	212

Three-Degree Photons, Two-Degree Neutrinos	215
The Big Bang and the Big Crunch	222
 Chapter 6: THE QUANTUM LEAP	 227
Faraday's Perfect Gases	229
The Last Liquid	234
Superconductivity	241
Duality, Exclusion, and Uncertainty	248
The Low-Temperature World	255
Einstein's Refrigerator	259
Chandra's Journey	265
Into the Future	272
 References	 275
Acknowledgments	293
Index	295