PHYSICS OF THE ENVIRONMENT

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A. W. Brinkman

Durham University, UK

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*To Jeannette
whose patience and support
has been beyond the call of duty*

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PREFACE

It is a truism to state that we are all subject to the environment within which we live. From it we derive the food and water that sustains life, the material and energy resources that makes that life more comfortable, and consign to it our waste products. Until very recently, these things were taken for granted. The resources seemed inexhaustible, while inexorable technological advances promised ever more comfortable lifestyles. Gradually, these perceptions have been changing under the irrefutable evidence of climate change.

The first intimations that all was not well came from the unexpected discovery of ozone depletion and the dramatic ‘hole’ over Antarctica. It soon became apparent that this was a direct result of human activity — the planet is not necessarily able to absorb all our waste. It is now widely appreciated that resources are indeed limited and that consumption, particularly in the developed world, might need to be reined in if others less fortunate are to be able to enjoy some of the benefits. However, it is the consequences of climate change that have engaged the news media the most and set political agendas, at least in Europe. While few among the scientific community dispute the twin observations of steadily increasing temperatures and rising levels of carbon dioxide, the actions required to reverse the trends are necessarily political and economic. Science alone cannot do this; it can name the dangers and even suggest possible solutions, but ultimately there are some decisions that are not within its province.

This book is a somewhat expanded version of a course on Environmental Science given by the author to second and third year Physics honours undergraduate students at Durham University. The course was intended to provide a bridge between the different individual specialisms that make up the general field of environmental science — one that would be accessible to the average student at this level of his or her degree programme. Too brief in many aspects to be in any sense comprehensive, the course did set out to introduce students to the diversity of the subject. The approach was meant to be rigorous and therefore to some degree mathematical, though with the hope that the physics would not be obscured by the mathematical ‘trees’. The same philosophy has been adopted in ‘Physics of the Environment’ and the mathematical content has been kept to a minimum that is commensurate with a proper understanding of the subject.

There is in reality a dearth of physics textbooks that cover the breadth of material at a level appropriate for undergraduate students of physics.^a Specialist texts are by definition ‘specialist’, focusing in depth on the particular field in question and are usually more suitable for postgraduate study. Often texts on environmental science are primarily concerned with ecological matters and on the whole do not address themselves to the physical sciences, or if they do, it is only at a superficial level. Some have clear polemic agendas.

With the exception of the final chapter, the rationale behind this book has been to develop the science and technology of the subject. That is not to say that there is an absence of material that some might deem controversial e.g. the inclusion of a section on nuclear power, a critique of the shortfalls of renewable energy, the so-called hydrogen economy all being cases in point. As part of the current and possible future environmental science landscape, such topics should not be ignored, but the intention has been to discuss the science in as neutral and unbiased manner as possible.

Finally, the book is by now long overdue and it would be unjust not to acknowledge the patience and forbearance of the editor, Katie Lydon, on this project.

A. W. Brinkman
Durham, December 2007

^aEnvironmental Physics, 2nd edn by Egbert Boeker and Rienk van Grondelle, Wiley (1999) being an honourable exception — it was also the course text.

CONTENTS

Preface	vii
1. Introduction	1
1.1 Introduction	1
1.2 Scientific Method	2
1.3 Contents	3
2. Structure and Dynamics of the Atmosphere	6
2.1 Introduction	6
2.2 Structure and Composition of the Atmosphere	6
2.2.1 Large scale vertical structure of the atmosphere	6
2.2.2 Composition of the atmosphere	7
2.3 Vertical Motion of Air	9
2.3.1 Hydrostatic equation and lapse rate	9
2.3.2 Saturated lapse rate and vertical stability	11
2.3.3 Cloud formation and precipitation	13
2.4 Horizontal Motion of the Air	15
2.4.1 General circulation	15
2.4.2 Forces driving horizontal motion	16
2.4.3 Geostrophic flow	19
2.4.4 Vertical wind shear	20
2.4.5 Horizontal wind shear — weather fronts	22
2.4.6 Tropical cyclones — hurricanes	27
2.5 Summary	28
2.6 Problems	29
References	29
3. The Global Climate	30
3.1 Introduction	30
3.2 Solar Spectrum	31
3.3 Radiative Balance and the Temperature of the Earth's Surface	34
3.4 Global Warming and Radiative Forcing	36

3.5	Feedback Effects	37
3.6	The Role of Carbon Dioxide	40
3.7	Climate Variations	41
3.8	The Impact of Global Climate Change	43
3.9	The International Politics of Global Climate Change: Rio de Janeiro and Kyoto	45
3.10	Problems	47
	References	48
4.	Solar Ultraviolet Radiation and Life	49
4.1	Solar Ultraviolet Spectrum	49
4.2	The Ozone Filter	50
4.2.1	The Chapman reactions	50
4.2.2	Reaction rates	52
4.3	Ozone Depletion	54
4.3.1	Thinning of the ozone layer and ‘ozone holes’	54
4.3.2	Chlorine cycle	55
4.3.3	Destruction of ozone by NO _x and HO _x reactions	56
4.3.4	The Antarctic ozone hole	58
4.4	Biological Impact of Ultraviolet Radiation	59
4.4.1	Action spectra and damage	59
4.4.2	Absorption by DNA and proteins	60
4.5	Ozone in the Troposphere	60
4.6	Montreal Protocol	61
4.7	Problems	61
	References	62
5.	Heat Transfer Processes	63
5.1	Modes of Heat Transfer	63
5.2	Diffusion of Heat: Heat Equation	64
5.3	Examples of Heat Transfer by Conduction	65
5.3.1	Double glazing	65
5.3.2	Periodic temperature variations: Annual cycle	67
5.3.3	Contact temperature	68
5.4	Problems	69
6.	Generation of Power from Fossil Fuels	71
6.1	Introduction	71
6.2	Review of Thermodynamics	71
6.2.1	The First Law of Thermodynamics	71
6.2.2	The Second Law of Thermodynamics	74
6.2.3	Heat engine	74
6.2.4	Vapour power cycles	76
6.2.5	Carnot cycle	78

6.3	Steam Generating Power Stations: Rankine Cycle	79
6.4	Gas Turbine Generating Systems: Joule Cycle	81
6.5	Combined Power Cycle Generating Stations	84
6.6	Distribution of Electrical Power	85
6.7	Sequestration of Carbon Dioxide	86
6.8	Summary and the Future of Fossil Fuel Burning Power Stations	87
6.9	Problems	89

7. Nuclear Power Generation 90

7.1	Nuclear Energy: Equivalence of Mass and Energy	90
7.2	Nuclear Power	92
7.3	Neutron Dynamics	93
7.3.1	Neutron cross sections	93
7.3.2	Scattering of neutrons	95
7.4	Reactor Physics	99
7.4.1	The nuclear chain reaction	99
7.4.2	Thermal neutron diffusion and leakage	101
7.4.3	Fast neutron diffusion and leakage	103
7.4.4	Critical equation	106
7.4.5	Reactor kinetics	108
7.5	Reactor Systems	109
7.5.1	Materials constraints	109
7.5.2	Magnox gas cooled reactor	110
7.5.3	Advanced Gas Cooled Reactor	111
7.5.4	Pressurised Water Reactor	113
7.5.5	Boiling Water Reactor	114
7.5.6	RBMK reactor	114
7.5.7	Advanced Light Water Reactor	115
7.6	Safety of Nuclear Power	115
7.7	Nuclear Waste	117
7.8	Problems	118
	References	119

8. Renewable Energy 120

8.1	Introduction	120
8.2	Photovoltaic Solar Cells	121
8.2.1	The photovoltaic effect	121
8.2.2	Performance parameters for solar cells	124
8.2.3	Types of solar cell	128
8.2.3.1	Silicon solar cells	128
8.2.3.2	Thin film solar cells	129
8.2.3.3	Utilisation of photovoltaic solar power	131

8.3 Thermal Solar Power 132

8.3.1 Solar collectors 132

8.3.2 Generation of electricity by solar heat 133

8.4 Wind Power 135

8.4.1 Principles of wind power 135

8.4.2 Performance criteria: Betz limit 136

8.4.3 Vertical dependence of wind speed 139

8.5 Biomass Energy 140

8.5.1 Photosynthesis 140

8.5.2 Generation of electricity using biomass 142

8.6 Hydroelectric Power 143

8.6.1 Large scale hydroelectric power 143

8.6.2 Generation of hydroelectric power 143

8.6.3 Small scale hydroelectric and micro-hydro
power generation 145

8.7 Ground Source Heat Pumps 146

8.8 Geothermal Energy 147

8.9 Problems 149

References 150

9. Transportation 151

9.1 Introduction 151

9.2 Steam Powered Transport 152

9.3 The Internal Combustion Engine 154

9.3.1 The Otto cycle petrol engine 154

9.3.2 The Diesel cycle engine 156

9.3.3 Emissions and catalytic converters 158

9.3.4 Alternative hydrocarbon fuels 160

9.4 Hydrogen powered vehicles 160

9.4.1 The hydrogen economy 160

9.4.2 The hydrogen fuel cell 161

9.4.3 The electrical characteristics of hydrogen fuel cells 162

9.4.4 Types of fuel cell 164

9.4.5 Production of hydrogen 165

9.4.6 On-board hydrogen systems in vehicles 167

9.5 Electrically Powered Vehicles 168

9.5.1 Principle of the electric motor 168

9.5.2 Direct current (DC) electric motors 172

9.5.3 Alternating current (AC) electric motors:
Induction motors 174

9.6 Problems 175

References 176

10. Transport and Dispersal of Pollutants in the Environment	177
10.1 Introduction	177
10.2 Transport Physics: Diffusion and Advection	177
10.3 Generic Examples	180
10.3.1 Instantaneous point source in a stationary medium . . .	180
10.3.2 Continuous point source	181
10.3.3 Continuous point source in a flowing medium	182
10.4 Dispersal in Turbulent Rivers	183
10.5 Emission of Smoke from Chimneys	187
10.6 Ground Water Flow	189
10.6.1 Darcy's Equation	189
10.6.2 Unconfined aquifers: Dupuit approximation	191
10.6.3 Wells in unconfined aquifers	193
10.6.4 Wells in confined aquifers	194
10.6.5 Equipotentials and stream lines	195
10.7 Problems	198
References	199
11. Stewarding the Environment	200
11.1 Introduction	200
11.2 Technical Solutions and Public Perceptions	200
11.3 Future Energy Supplies	201
11.4 Pollution Issues	203
11.5 Uncertainty and Risk	204
11.6 Choices and Stewardship	205
References	206
Index	207