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*To Terry,
Anthony, Jeffrey, Megan, Peter, Michael, and Karen,
Frank and Lucy,
Jack and Ann,
and
Sammy and Chelsea*



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Preface to the Second Edition

The Second Edition of *Basic Health Physics: Problems and Solutions* has been expanded to reflect new recommendations and reports and emerging radiation-generating technologies. Recent recommendations of the National Council on Radiation Protection and Measurements (NCRP), the International Commission on Radiological Protection (ICRP), International Atomic Energy Agency (IAEA), and National Academy of Sciences have been incorporated into the Second Edition. Revised standards and regulations are also included.

Significant additions to the Second Edition include discussion of:

- Updated ICRP internal dosimetry models, including the human alimentary tract and the human respiratory tract models.
- The 2007 Recommendations of the ICRP.
- The BEIR VII Report that evaluates health risks from exposure to low levels of ionizing radiation.
- Neutron, heavy ion, and antimatter therapy techniques.
- Alpha-emitting radiopharmaceuticals.
- Recent recommendations of the NCRP regarding shielding in imaging and therapy facilities.
- Management of radionuclide therapy patients.
- Adoption of IAEA transportation methodology into US Regulations.
- Recent developments in fusion energy.
- Open and closed fuel cycles.
- Generation I, II, III, and IV reactors.
- Major power reactor radiation instrumentation systems.
- New NCRP hot particle recommendations.
- Isotopes and pathways associated with reprocessing options in open and closed fuel cycles.
- Intentional dispersal of radioactive material.
- Muon colliders and associated neutrino doses.
- Synchrotron light sources.
- Free electron lasers.
- Cascade reactions associated with high-energy accelerators.

Basic Health Physics. Problems and Solutions. Second Ed. Joseph John Bevelacqua
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- The Large Hadron Collider.
- ALARA aspects of shielding high-energy accelerators.

The problem set was expanded from 700 to over 900 entries. This expansion further develops the text material and provides additional practical application examples. These problems capture the evolving nature of Part I of the American Board of Health Physics Certification Examination. Solutions are provided for all problems.

The author is fortunate to have worked with colleagues, students, mentors, and teachers who have shared their wisdom and knowledge, provided encouragement, or have otherwise influenced the content of this text. The following individuals are acknowledged for their assistance during the author's career: Dick Amato, John Auxier, Lee Booth, Ed Carr, Paul Dirac, Bill Halliday, Tom Hess, Gordon Lodde, Bob Nelson, John Philpott, Lew Pitchford, John Poston, John Rawlings, Don Robson, Bob Rogan, Mike Slobodien, Jim Tarpinian, Jim Turner, and George Vargo. The continuing encouragement of my wife Terry is gratefully acknowledged.

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Preface to the First Edition

This book provides a broad introductory survey of the health physics field. It introduces radiation protection principles and their practical application through traditional text and a wide variety of problems. It is through the problems that the reader experiences a broad spectrum of the application of the health physics field.

Basic Health Physics assumes that the reader is familiar with the physics of radiation protection and is either a student in the field or is interested in learning more about the health physics profession. In particular, this text is useful to individuals preparing for the American Board of Health Physics Certification Examination, especially Part I.

The first four parts of this book present radiation protection fundamentals, an introduction to radiation protection, applications, and specialty health physics areas. This treatment includes natural sources of radiation, standards and regulation, biological effects, instrumentation, external dosimetry, internal dosimetry, statistics, operational health physics, nuclear emergencies, transportation and waste, medical health physics, university health physics, power reactor and research reactor health physics, fuel cycle health physics, environmental health physics, non-ionizing radiation, and emergency preparedness.

This book contains about 700 problems in health physics and their practical applications. The fifth part of the book provides detailed solutions to the problems to further illustrate and emphasize the concepts introduced in Parts I to IV.

Part VI provides a number of appendixes that supplement and expand on the presentation of Parts I to IV. These should be carefully reviewed by the student.

I am fortunate in having worked with colleagues, students, and teachers who have directly influenced the content of this text and who have shared their knowledge and unique talents. The following persons are acknowledged for their help over the years: Dick Amato, Lee Booth, Tom Hess, Gordon Lodde, Bob Nelson, John Philpott, Lew Pitchford, John Poston, Don Robson, Mike Slobodien, Jim Tarpinian, and Jim Turner. The continuing help and encouragement of my wife, Terry, is gratefully acknowledged. I would also like to thank the staff of John Wiley & Sons, with whom I have enjoyed working, particularly Gregory T. Franklin, John P. Falcone, Angiolina Loredo, and Andrew Prince.

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