

Foreword

For many graduate students of physics the written qualifying examination is the last and one of the most important of the hundreds of grueling examinations that they have had to take in their career. I remember vividly my own experience in 1947 at the University of Chicago. After the qualifying examination, I knew I was finally free from all future examinations, and that generated a wonderful feeling of liberation and relief.

Be that as it may, the written qualifying examination does serve a useful purpose, both for the faculty and for the students themselves. That is why so many universities give these exams year after year in all parts of the world.

Sidney Cahn and Boris Nadgorny have energetically collected and presented solutions to about 140 problems from the exams at many universities in the United States and one university in Russia, the Moscow Institute of Physics and Technology. Some of the problems are quite easy, others quite tough; some are routine, others ingenious. Sampling them I am reminded of the *trijos* questions of Cambridge University that I had spent so many hours on when I was an undergraduate student in China during the years 1938–1942, studying such books as Whittaker's *Analytical Dynamics*, Whittaker and Watson's *Modern Analysis*, Hardy's *Pure Mathematics*, and Jeans' *Electricity and Magnetism*.

It is perhaps interesting to the readers of this volume to note that the famous Stokes' theorem, so important to modern differential geometry and to physics, first appeared in public as problem No. 8 of the Smith Prize Examination of 1854. Stokes was the examiner and Maxwell was one of the takers of the examination. That Maxwell was impressed with this theorem, and made extensive use of it in 1856 in the first of his epoch-making series

of papers that led to Maxwell's equations, is obvious from his papers and from his *A Treatise on Electricity and Magnetism* (1873). Maybe a hundred years from now somebody will remember one of the problems of the present collection?

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