than with either physics or chemistry. Without a sound knowledge of at least the fundamental principles of these two sciences, the scientific treatment of smoke abatement is bound to suffer, and the result is that the scientific part, if it may be so called, is ill expressed and arranged, incomplete, and often incorrect. For example, the term "British Thermal Unit" is defined and used; but the method of estimating the calorific value of fuels is never mentioned, or its relation to temperature, though the two are frequently referred to together. The confusion between molecular and atomic weights (p. 16) is not perhaps a serious error, but the statement that at low temperatures "hydrogen and carbon in the coal partially combine, producing hydro-carbons causing smoke" (p. 15), cannot be passed over so lightly. The statement on p. 12 that *excessive admission of air* produces carbon monoxide must surely be an oversight.

The author is evidently more at home with furnaces, boilers, and mechanical stokers, and the fact that he has qualified as smoke inspector by examination of the Royal Sanitary Institute explains the clear and full descriptive account of these appliances, together with various forms of gas-producers and fire-grates. Everyone must sympathise with the vigorous condemnation levelled by the author against smoke and those responsible for it, but we doubt whether the volume before us, either by suggestion or experiment or new appliances, has thrown very much fresh light on the problem, or added many facts to those already known. J. B. C.

Laboratory Manual of Bituminous Materials for the Use of Students in Highway Engineering. By Prévost Hubbard. Pp. xi+153 (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1916.) Price 6*s.* net.

SINCE the advent of the motor-car the use of bituminous materials in road-making has become more and more widespread, and a definite knowledge of the chemical and physical characters of these substances is of increasing importance to the road constructor. In the United States a number of the leading universities have instituted courses of instruction in highway engineering, which include laboratory practice in the testing of bituminous materials, and the manual under notice has been prepared by the author to meet the wants of students and instructors attending such courses.

The first part of the book deals with the definition and classification of the various bituminous substances used by the highway engineer, and also with general matters such as the sampling and preparation of the bitumens for analysis. In the second and main division the author describes the methods of applying the various tests—chemical, physical, and mechanical—by which the materials are assayed and evaluated. The descriptions are lucid and concise; they have evidently been drawn up by a writer who has first-hand knowledge of the special difficulties attending this class of analytical work. In the concluding part of the book the characteristics of the more important bituminous substances are discussed, including those of the fluid, semi-solid, and solid petroleum products, tars, asphalts, pitches, creosote oils, and bituminous aggregates. Typical analyses are given, and these are carefully dissected in order to bring out clearly the proper interpretation of the results. The book should prove of value to municipal and other chemists who may have to deal with the substances in question, as well as to the students for whom it is especially written. C. S.

THE DANGERS OF ELECTRICAL CURRENTS.

ON account of the widespread use of electricity at the present time, the small book before us, by M. Rodet,[1] is of considerable practical value. We note that an actual current must pass through the tissues of the body if any effect is to be produced. A static charge is harmless. A bird may perch on a high-tension main without any serious results. The resistance of the human body resides chiefly in the skin, and is very high if the skin is dry—from 20,000 to 80,000 ohms. But if the skin is moist and a good earth contact is made by bare feet in a wet mass, a man may be killed by touching a 100-volt main. A brief summary is given of the general physiological effects of stimulating various nerves by electrical currents. The development of heat is also discussed; burns are produced where the current density is great, as when it enters by a relatively small contact surface. With respect to high-frequency alternating currents, the interesting experiments of Kennelly and Anderson in America are described. They showed that, at an alternation of 100,000 per second, a voltage of 250 can send a current of half an ampere through the body without any sensation beyond that of warmth. The explanation is probably that given by Nernst, namely, that certain ions in the nerves must attain a certain minimal local concentration in order that stimulation may take place. Each half-wave of so rapid an alternation cannot, in the time permitted, effect this concentration before the opposite half-wave comes in and reverses what little has been done. The energy of the current is thus converted into heat without being able to produce electrolytic changes.

The second chapter is devoted to the nature of the accidents which may happen. These are indirect and direct. The former are due to a momentary shock, harmless in itself, but which may cause a fall from a height or similar result. The protection is obvious: to take care either that no live wires are within reach, or that the workman wears efficient insulating gloves, stands on insulators, and so on, if disconnection from the generator is impossible. The *direct accidents* are due to actual passage of current through the body. So many different effects are possible that it is frequently a matter of difficulty to say what

[1] "Actions Physiologiques et Dangers des Courants Électriques." Par J. Rodet. (Paris: Gauthier-Villars et Cie, 1917.) Price 3.25 francs.