

the Riemann zeta function to the type of problem to which Waring's theorem belongs. In his inaugural address to the University of Oxford on his appointment as Savilian professor of geometry, Prof. Hardy gives a most lucid account of the work on which he has been engaged along with Messrs. Littlewood and Ramanujan. The whole of it is expressed in non-technical language, and many gaps in the theory are explained. We specially note the first few pages as forming a model introduction to a professor's inaugural address. A statement on p. 15 needs amendment, integers expressible as a sum of two squares being of either of the two forms

$$M^2P \text{ or } 2M^2P,$$

where  $P$  is a product of positive primes  $4k+1$ .

W. E. H. B.

*On Gravitation and Relativity: being the Halley Lecture delivered on June 12, 1920.* By Prof. R. A. Sampson. Pp. 24. (Oxford: At the Clarendon Press, 1920.) Price 2s. net.

THERE is a special appropriateness, as Prof. Sampson points out, in choosing a gravitational subject for the Halley Lecture, in view of the important part that Halley played in securing the publication of the "Principia." The lecture is an able *résumé* of the various speculations on the subject, from Galileo's "Dialogues" and Newton's hypothesis of æther-pressure down to Einstein's theory. The author evinces the highest admiration for Einstein's skill in devising a formula which expresses his results "without redundancy, defect, or effort, and whose boldness, range, brilliance, and resounding successes" have commanded universal attention; but on proceeding to examine the formula in detail he confesses to his dislike of some of the devices employed, in particular imaginary time and the obliteration of the distinction between past and future. He alludes to Newton's experiment of the rotating bucket and to Foucault's pendulum experiment as establishing the possibility of detecting the absolute direction of an axis of rotation. It will probably be admitted, even by the convinced relativist, that it is of advantage to students to have the claims of the older "common-sense" kinematics placed before them in an attractive form, which the author has certainly done.

A. C. D. CROMMELIN.

*A Primer of Air Navigation.* By H. E. Wimperis. Pp. xiv+128. (London: Constable and Co., Ltd., 1920.) Price 8s. 6d. net.

THIS book provides an interesting and sound introduction to the subject of finding one's way in the air. In many ways the investigation of methods of air navigation is based on nautical experience, but the author points out that the reverse process is beginning to apply. The chief differences appear to arise from the greater speed of aircraft as compared with the steamship, and the considerable altitudes above sea-level reached by the aeroplane and airship. Height in itself gives a wider range of vision, and in clear

weather allows a greater permissible error in dead-reckoning without loss of port than is required for a ship seeking harbour. These points are clearly brought out in the little book under notice, and the various steps involved, both of observation and calculation, are developed simply. Whilst non-mathematical in character, we suggest that "Air Navigation" would provide a suitable starting-point for the more complex studies of advanced works and, what is perhaps more important in the present state of aeronautics, encourage capable students to extend the subject into regions yet unexplored. The main ideas of navigation are illustrated by examples from the great flights of the post-war period—Atlantic and Australasian. The correction for wind for aircraft is more important than that for tide and steamship, and clouds interfere with surface observations to an undesirable extent. Such difficulties, at any rate near land, will be countered by the use of direction-finding wireless telegraphy, a subject dealt with in one of the chapters of the book, which may be recommended as covering the essentials of present-day knowledge.

*A Junior Inorganic Chemistry.* By R. H. Spear. Pp. viii+386. (London: J. and A. Churchill, 1920.) Price 10s. 6d. net.

ALTHOUGH this does not seem to possess any features differentiating it from many other elementary text-books on chemistry, it is clearly written, and obviously the work of an experienced teacher. In some cases the information is not up-to-date, as on p. 128, where it is stated that "experiments carried out with the most elaborate precautions have shown that 1 grm. of hydrogen combines with 7.98 grm. of oxygen." Ozone is said (p. 177) to have "a faint, peculiar smell." Although molecular formulæ and equations are used freely from p. 152, the molecular theory is not explained until p. 278 is reached. Instructions for experiments are given throughout the book, which provides a good introduction to chemistry.

Part i. of the book, containing the first thirteen chapters, which lead up to, but do not include, the atomic theory, is published separately at the price of 5s. net. It provides an introductory course for junior forms in schools.

*Atomic and Molecular Theory.* By D. L. Hammick. Pp. 82. (Winchester: P. and G. Wells, 1920.)

As an exposition of the simple applications of the atomic theory to chemistry, this account leaves little to be desired in clearness and accuracy. Nothing, however, is said of the recent work which has put the atomic theory on an entirely new basis, and the point of view is that of twenty years ago. One cannot now truthfully say that "Dalton's hypothesis merely restates the facts about the elements and their modes of combination in terms of atoms and, as an 'explanation,' is not very satisfying."