

Kinetic Theory.

A Kinetic Theory of Gases and Liquids. By Prof. R. D. Kleeman. Pp. xvi+272. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1920.) Price 16s. 6d. net.

THIS book deals mainly with the "free path phenomena" in the kinetic theory of gases, but this department of the subject is comprehensively treated. Whether the chief object of such a work—namely, to gain some information about the intermolecular forces—can ever be attained without taking account of the other parts of the subject seems somewhat doubtful.

The body of the book is concerned with the various forms of transfer which occur in gases and liquids—transfer of energy or heat conductivity, transfer of momentum measured by the viscosity, and transfer of matter as evidenced in diffusion. Some ten years ago it might have seemed that it was in these properties, which are a measure of the free path, that the key to the riddle of molecular interaction was to be found. To-day, one is inclined to feel, they have been over-emphasised when such a subject as the law of equipartition of energy is given only a couple of pages, and the fundamental problem of the reason why it breaks down is not considered at all. In particular, a statement (pp. 32-33) that "it is unnecessary and futile to endeavour to establish the law of equipartition of energy on assumptions relating to the interaction of molecules, when the law follows directly from the fact that a molecule is continually radiating heat energy," should really not occur in a modern book intended for university readers. The statement entirely begs the question of defining the temperature. The "fact," if such it be, should be established by more adequate proof than by a reference to the hot air rising from a surface, and the main point—namely, that the law which is represented as so obvious, in reality does not hold—should be mentioned. Far from being "unnecessary and futile," it is one of the most urgent problems in physics to examine why a law which can be proved to be a necessary consequence of the most general assumptions in dynamics should not hold in actual practice.

Apart from these and allied problems—*e.g.* the chemical constants of substances and the change in the ratio of the specific heats of hydrogen at low temperatures—the kinetic theory is admirably treated. Even the kinetic theory of electrons in metals is developed, though it is to be regretted that the essential fallacy of treating these as a perfect gas is not emphasised, and the uninitiated

reader is left to believe that there are $2 \cdot 10^{24}$ free electrons per unit volume, when such a number would involve a specific heat about fifteen times as great as is actually observed.

In spite of these omissions, however, the book is certainly to be recommended, especially to those who are interested in free path phenomena, although these alone are scarcely able to throw light on the process of molecular interaction until the quantum problem has been solved.

A Monograph on Margarine.

Margarine. By W. Clayton. (Monographs on Industrial Chemistry.) Pp. xi+187. (London: Longmans, Green, and Co., 1920.) Price 14s. net.

CURIOSLY enough, the introduction of artificial butter dates from the early days of the Franco-Prussian War, and, while the butter and lard substitute industry has been carried on on a small scale since then, margarine, as an industry, became of prime importance to the nation only during the Great War. Many important improvements have been made, and these are set forth in the book under review.

In the first part a brief account of the oils employed in the manufacture of margarine is given, and some less known oils, such as Cohune oil, tea-seed oil, and Babassu kernel oil, are mentioned. Later chapters deal with hydrogenised oils, and for the present writer's views on this subject reference may be made to the notice of Dr. G. Martin's book on "Animal and Vegetable Oils, Fats, and Waxes" in NATURE of September 9 last.

Interesting chapters treating bacteriologically of the pasteurisation of milk and of the production of "starters" for the ripening of the milk follow. A brief description of the actual manufacturing operations of forming an emulsion between the mixed oils and the milk is then given. The theory of emulsification is, of course, very well stated, as Mr. Clayton is an authority on colloid chemistry. His opinions are therefore of great interest, and when they have been digested by technical chemists, very valuable results should arise in their industrial application.

In regard to the causes of rancidity in fats, Mr. Clayton seems inclined to accept the view that they result from bacterial actions on the glycerides. We believe that rancidity is due, in the first instance, to the formation of super-oxides of the unsaturated glycerides and their subsequent decomposition with the production of aldehydes and aldo-acids by the action of moisture, aided, per-