NOTE

Abietic Acid.—Steele,[1] according to a recent paper, crystallized rosin from 98% acetic acid, and supports the view of Knecht and Hibbert[2] that rosin consists mainly of abietic anhydride. It is true that rosin does not crystallize well from solvents immiscible with water, but this is no justification for assuming that the crystallization of rosin is the result of hydration. Knecht and Hibbert state that it is probable that in every case where rosin is distilled in a vacuum it is abietic anhydride that passes over; furthermore, that there is no case on record in which the crystallization of rosin or its distillate has been effected throughout by means of anhydrous solvents.

Our past experience with rosin and abietic acid does not confirm these statements. If rosin consists mainly of abietic anhydride it is obvious that further heating should remove more water and retard crystallization. The solvent employed by us was petroleum naphtha that had been treated with anhydrous calcium chloride to remove any water present. Some light colored "gum" rosin was heated at a temperature of 220–225° (the thermometer bulb in the rosin) under a vacuum of 25 mm. for 30 minutes. The residue was then dissolved in petroleum naphtha, inoculated with a crystal of abietic acid and allowed to stand in a cool place. In a week the walls of the vessel were covered with crystals.

In another experiment 100 g. of rosin was distilled under reduced pressure, the receiving flask being only air-cooled to facilitate the removal of any water vapor by the suction. The first 10% of the distillate was rejected in order to prevent contamination of the main distillate by the small amount of water and turpentine invariably present in rosin. Fifty g. of the distilled rosin was then dissolved in 50 cc. of petroleum naphtha with the aid of gentle heat, cooled, inoculated and allowed to stand in a cold place. The rosin formed large spherical masses of crystals made up of well defined needles. After 3 weeks the crystals were removed and centrifuged; yield of crude crystals, 31.5 g. The abietic acid was again recrystallized from the same solvent, crushed to a fine powder in a mortar, placed on a suction filter, washed rapidly with cold, light petroleum ether, dried and titrated.

Analysis. Subs., 1.0199. Calc. for $C_{20}H_{30}O_2$: 33.76 cc. of 0.1 N KOH. Found: 33.40.

Knecht and Hibbert consider the turning white of rosin varnishes in the presence of water to be due to the passing of abietic anhydride into crystalline abietic acid. We have placed clear lumps of rosin in stoppered bottles containing distilled water, 5% sulfuric, and 20% sulfuric acid. The rosin in the water soon became opaque on the surface, while that in

[1] Steele, This Journal, **44**, 1333 (1922).

[2] Knecht and Hibbert, *J. Soc. Dyers Colour.*, **35**, 149 (1919).

the sulfuric acid remained perfectly transparent over a period of 7 months. If rosin consists of abietic anhydride, hydration to abietic acid would certainly be expected to take place more rapidly in the sulfuric acid than in pure water.

The loss in weight obtained by Knecht and Hibbert in heating abietic acid to 180° in a current of carbon dioxide, while corresponding with the theoretical loss on conversion to abietic anhydride, has not been shown to consist entirely of water. Cases where 2 molecules of a monocarboxylic acid combine, in the absence of a dehydrating agent, to form an anhydride are rare in the chemical literature, and still rarer, are those giving a theoretical yield.

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NEW BOOKS

The Origin and Development of the Quantum Theory. By Max Planck. Translated by H. T. Clarke and L. Silberstein. The Nobel Prize Address delivered before the Royal Swedish Academy of Sciences, Stockholm, June 2, 1920. Oxford University Press, American Branch, 29–35 West 32nd Street, New York City, 1922. 23 pp. 16.5 × 24.5 cm. Price $1.20.

Planck's Nobel Prize Address, which is primarily an explanation of how he was led to introduce the quantum of action into physics, is not only of interest as a valuable summary, free from technicalities, of progress in one of the most important branches of modern physics, but is also an inspiring autobiographical account of the effort and *modus operandi* by which a fundamental scientific discovery was achieved.

An insight into the quantum theory may be gained either by examining the distribution of energy in the continuous spectrum emitted by a black body or by considering the phenomena of line spectra and photo-electricity. These two modes of approach are exemplified by the investigations of Planck and Bohr, respectively, both of whom have been awarded the Nobel Prize for their researches in the quantum theory. Although Planck's method of investigation based on thermal radiation is probably the more complex of the two because of the necessity of considering a large aggregate of molecules rather than a single atom, this type of research nevertheless furnished the means by which the fundamental unit of action was first introduced into physics and is, therefore, the aspect of the quantum theory particularly emphasized in the author's address.

Planck first sought to explain the distribution of energy in the spectrum of a black body by employing the classical electrodynamics and statistical mechanics. This investigation yielded a formula which agreed with experimental data only at long wave lengths; at high frequencies an equation