Two Pyrex tubes were evacuated and filled simultaneously from a reservoir containing a deuterium–hydrogen mixture. The first tube was fitted with a magnetic break at the lower end and, after filling, was sealed off at the upper end. The second tube was equipped with a stopcock and was coated on the inside with a layer of "Lubriseal." At the end of twenty-two days mass spectrographic analysis showed the gas in the first tube to contain 2.07% deuterium and that in the second 2.09%. It is evident, therefore, that an apparatus containing stopcocks may be used in the study of deuterium–hydrogen mixtures without fear of interchange between deuterium and hydrogen from the stopcock grease.

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RECEIVED DECEMBER 22, 1933

THE SYNTHESIS OF POLYNUCLEAR HYDROCARBONS BY THE CYCLODEHYDRATION OF AROMATIC ALCOHOLS

Sir:

Since our preliminary publications in this field,[1] a number of articles have been published abroad[2] which show that these communications of ours have escaped notice there and which make it seem desirable to us to report the following additional results which have been obtained in our laboratories. This is done in the hope that it will save our fellow investigators the time and money which might otherwise be spent in the duplication of experiments.

Our studies in the tetralin field, for example, already have shown that 1-methyltetralin can be obtained by the action of sulfuric acid upon any one of the following: $PhCH_2CH_2CH_2CH(OH)Me$, $PhCH_2CH_2CH_2CH{=}CH_2$, $PhCH_2CH_2CH(OH)CH_2Me$, or $PhCH_2CH{=}CHCH_2Me$.

1-Ethyltetralin has been prepared similarly from both $Ph(CH_2)_4CH(OH)Me$ and $Ph(CH_2)_4CH{=}CH_2$.

In two of the above compounds, a shift in the location of the double bond is indicated in connection with the cyclization.

In the case of $Ph(CH_2)_2CMe(OH)CH_2Me$, both 1,2-dimethyltetralin and 1-methyl-1-ethylindane appear to be formed.

As stated in our initial announcements,[1] these studies are being pursued in various directions, especially with the object in view of preparing synthetically compounds of biological interest.

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RECEIVED DECEMBER 21, 1933

(1) (a) Bogert, *Science*, [N. S.] **76**, 475 (1932); (b) **77**, 197 (1933); (c) **77**, 289 (1933).

(2) (a) Schlenk and Bergmann, *Chemistry & Industry*, **52**, 207 (1933); (b) Cook, Hewett, Haslewood, *et al.*, *ibid.*, **52**, 949 (1933); (c) Ruzicka, Ehmann, Goldberg and Hösli, *Helv. Chim. Acta*, **16**, 833 (1933); (d) Kon, *J. Chem. Soc.*, 1081 (1933); (e) Cook and Hewett, *ibid.*, 1098 (1933); (f) Fulton and Robinson, *ibid.*, 1463 (1933).

FREEZING POINTS OF MIXTURES OF THE WATERS, H^1_2O AND H^2_2O

Sir:

We have determined the freezing points and specific gravities at 25° on 15-cc. portions of mixtures of H^2_2O and H^1_2O using a Beckmann thermometer calibrated by the Bureau of Standards, and standard technique. The samples were prepared by electrolysis of potash solutions using nickel electrodes, followed by repeated distillations from alkaline permanganate to remove carbon dioxide and other impurities which would lower the freezing point. The freezing points were independent of the supercooling (1 to 2.8°) and were constant to within 0.001° for periods of at least ten minutes. The zero point of the thermometer was determined repeatedly against the freezing point of ordinary distilled water using precisely the same technique. Slow freezing of the 39.9% sample over a period of three hours with continuous stirring, until one-third had separated as ice, produced no change in equilibrium temperature greater than the experimental error of 0.002°. The specific gravities of the melted ice and unfrozen liquid, using a 1.3-cc. pycnometer, checked to 0.02%.

These observations indicate that the solid

Approx. % heavy component 100% = sp. g. 1.11165	F. p., °C.	Sp. gr. 25/25°	F. P. / (sp. g. −1)	Observer
1.23	0.053	1.001376	38.5	Washburn, Smith and Frandsen, *B. S. J. Res.*, **11**, 453 (1933)
14.7	.632	1.01644	38.5	This investigation
19.1	.824	1.02135	38.6	This investigation
39.9	1.679	1.04456	37.7	This investigation
39.5	1.670	1.04411	37.9	This investigation; redistilled *in vacuo*
94.6?	3.8	1.1056[a]	36.	Lewis and Macdonald

[a] The terms specific gravity and density are used interchangeably for this value [Lewis and Macdonald, THIS JOURNAL, **55**, 3058 (1933)].

phase is a solid solution of the two components and that on freezing the mixtures behave as though they were pure substances. The values in column 4 of the table show that the freezing point is a linear function of the specific gravity to 20% (H^2_2O) but a deviation outside our experimental error is perceptible at 40%. The experiments are being extended to more concentrated mixtures.

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RECEIVED DECEMBER 26, 1933

NEW BOOKS

Great Men of Science. A History of Scientific Progress. By PHILIPP LENARD. Translated from the German by H. Stafford Hatfield. The Macmillan Company, 60 Fifth Avenue, New York. 389 pp. Price, $3.00.

This volume presents brief and sympathetic accounts of the lives and contributions of sixty-six great figures in the history of Science. It starts with Pythagoras, Euclid, Archimedes and Hipparchus, and concludes with Stefan, Boltzmann, Hertz and Hasenöhrl. As Professor Andrade points out in the Introduction—"It is not often that one who, like Professor Lenard, has won for himself an assured place in the history of science, undertakes a systematic appreciation of the work of his predecessors, of the kind which we have before us in this book.... In these studies of great men by Professor Lenard the reader will find a vivid sympathy, a generous enthusiasm and an illuminating criticism which bring out in lively fashion both the personality and the secret of the scientific greatness of the subject."

Out of the sixty-six scientists there are fourteen who can be reasonably classified as chemists—namely, Boyle, Black, Scheele, Priestley, Cavendish, Klaproth, Dalton, Gay-Lussac, Davy, Berzelius, Faraday, Bunsen, Hittorf and Crookes. It is of particular interest to the chemists of today to have the achievements of these men measured against the background of Science as a whole.

The portraits that accompany the biographies are arresting. The author's remark in the Preface is no overstatement—"Let anyone who has a sense for portraits examine the plates of this volume... he will find from this examination a spiritual profit, an introduction to a world of clearer and more natural thinking."

We must be grateful to the translator for making this inspiring book more easily accessible to English readers. Unfortunately, while the meaning is in general clear, the diction is frequently awkward and laborious.

ARTHUR B. LAMB

Modern Alchemy. By WILLIAM ALBERT NOYES, University of Illinois, and W. ALBERT NOYES, JR., Brown University. Charles C. Thomas, 220 East Monroe Street, Springfield, Illinois, 1932. ix + 207 pp. 15 × 23 cm. Price, $3.00.

Under the picturesque title of Modern Alchemy the authors, father and son, have given us an excellent philosophical survey of the more important modern theories of the structures of atoms and their relations to chemical activity. Modern transmutations of elements and typical instances of advances in industry and medicine under the influence of chemistry are presented in an interesting way. The latter are the modern equivalents of the twin objectives of the alchemist of old, wealth and health.

In the chapter on valence the reviewer believes that a valuable opportunity has been missed by the insistence on "potential polar" valences as opposed to actual polarity. Two different electrical systems of different positive kernel charge and different space relations can have the same attraction for pairs of negative electrons holding them in chemical union only in the rare cases where the sizes of charges and distances compensate each other. For the majority of combinations, this is not so. Surely, the structures $:\ddot{N}:(\ddot{Cl}:)_3$ and $:P(:\ddot{Cl}:)_3$ for the trichlorides of nitrogen and phosphorus give a summary of the striking chemical differences between these two substances, which neither the old structures NCl_3 and PCl_3, nor those used on pages 107 and 108 of the present text, do. In the opinion of the reviewer, the general application of this rational type of partial polarity as distinguished from ionic polarity, will ultimately play the same leading role in elucidating the chemical behavior of non-electrolytes in the organic and the inorganic fields, as the theory of ionization has accomplished for electrolytes.

The chapter on the effect of radiation on chemical systems is particularly timely and is an excellent presentation of a subject that has become of such moment in the intimate study of atoms and molecules.

The volume should prove of great value to advanced students in the sciences. General readers with a thoroughly good foundation in physics and chemistry would find it extremely interesting.

JULIUS STIEGLITZ

Physico-Chemical Methods. By JOSEPH REILLY, Professor of Chemistry, National University of Ireland, and WILLIAM NORMAN RAE, Professor of Chemistry, University College, Colombo; with a foreword by F. G. Donnan. Second edition, revised. D. van Nostrand Company, Inc., 250 Fourth Ave., New York, 1933. xv + 822 pp. 586 figs. 16.5 × 23.5 cm. Price, $8.00.

The second edition of this well-known standard work on physico-chemical methods seems to the reviewer a very