physico-chemical methods, the name indicates the method of calculation used. All the results are derived from Morley's values for the densities (except, of course, the results of the chemical methods which are independent of these results):

THE ATOMIC WEIGHT OF HYDROGEN.

Chemical methods:	
Morley	1.00762
Noyes	1.00787
Mean of chemical methods	1.00775
Method of limiting density:	
Leduc and Sacerdote	1.00775
Rayleigh	1.00775
Jacquerod and Scheuer	1.00777
Berthelot	1.00773
Mean	1.00775
Method of critical constants:	
Guye (Dewar)	1.00765
Guye (Olszewski)	1.0078
Berthelot (Wroblewski, Olszewski)	1.0076
Method of molecular volumes:	
Leduc	1.00765

All of the physico-chemical results fall within the limits of the best chemical data. The wonderful agreement of the results obtained by the method of limiting density shows that the compressibility data are probably very accurate, and that the largest source of error in these results is probably Morley's density of hydrogen.

The conclusion drawn by Noyes from the chemical methods that 1.00775 is the most probable value for the atomic weight of hydrogen, is confirmed in a very striking manner by the method of limiting densities, which, as has been pointed out, is the most reliable of the physico-chemical methods.

URBANA, ILL., February 2, 1910.

THULIUM.

(PRELIMINARY ANNOUNCEMENT.)

BY C. JAMES.

Received February 26, 1910.

The writer has obtained about 250 grams of the bromate of Cleve's thulium by the continued fractionation of the rare earth bromates more soluble than erbium.

This earth, discovered in 1879, has hitherto never been obtained in a pure condition. It is very rare, and comparatively large amounts of the ytterbiums are obtained during its preparation.

To obtain this quantity of material about 200 kilos of euxenite, ytterspar, gadolinite, fergusonite and yttrotitanite were employed; and in addition the yttrium earths derived from large quantities of monazite, supplied by the Welsbach Light Company through the courtesy of Dr. H. S. Miner, to whom many thanks are due.

Thulium bromate is more soluble than erbium bromate, but less soluble than the corresponding compound of ytterbium.

Thulium salts are of a pale bluish green color, best seen in artificial light. However, this tint is very readily destroyed by minute amounts of erbium, the solution becoming first yellowish green, then yellow, colorless, and lastly pink as the erbium content increases.

The material is still undergoing fractionation so as to make sure of the non-complexity of this element.

In addition to the above, it may be as well to state that the more soluble portions are being carefully studied, since the most soluble fractions are colored pale yellowish green when in solution while the intermediate fractions between these and thulium are colorless.

It is expected that early in May the determination of the atomic weight will have been completed and a study of the compounds commenced. All these fractions are being examined by means of a quartz spectrograph and Sir William Crookes has kindly offered to investigate the spark spectra of thulium and erbium with the unequaled instruments at his disposal. This latter element has also been obtained in a high state of purity.

NEW HAMPSHIRE COLLEGE, DURHAM, N. H.,
February 15, 1910.

THE MARSH TEST AND EXCESS POTENTIAL.

(FIRST PAPER.[1])

THE QUANTITATIVE DETERMINATION OF ARSENIC.

BY W. D. HARKINS.

Received May 14, 1909.

Introductory.

The most widely used method for the determination of small quantities of arsenic is the separation as arsine suggested by Marsh,[2] together with the decomposition of this gas in a heated glass tube as recommended by Liebig.[3] An excellent review of the history of the development of this method has been given by Lockemann.[4]

[1] Presented at the New York meeting of the American Chemical Society, December 28, 1906, and in part at the December, 1905, meeting of the Stanford Chemical Society.

[2] *Ann.*, **23**, 207 (1837).

[3] *Ibid.*, p. 217.

[4] *Z. angew. Chem.*, **18**, 416 (1905).