Integral Atomic Weights, Part 2. — By Frank William Dodd, Assoc. Mem. I. C. E., Weymouth, England.

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Since reading the short paper on this subject in November, 1912, at a meeting of the Nova Scotian Institute of Science, the author has given further consideration to the subject, and has also received and considered numerous criticisms.

The most important of these criticisms and one which, being fairly obvious, was advanced from several quarters, was based on the fact that the specific gravity of an element is not a definite and inherent quantity, but is dependent upon temperature and other conditions, physical and mechanical, and may vary widely for the same element.

The author's first paper may be summarized in a sentence. It suggested that if the specific gravity of the elements of a group multiplied by a suitable factor be added to the atomic weights of those elements, a series of numbers is obtained which very strongly suggests a system of Integral Atomic Weights, and the building up of the heavier elements from the lighter.

The question arises,—which specific gravity, seeing that an element may have a great range of specific gravity?

In the present paper I have to suggest that each element has what may be termed a Natural Specific Gravity, any departure from which may be regarded as more or less accidental. This Natural Specific Gravity results from the combination of certain volumes in a definite manner, analagous to the mode of combination of gases; producing a resultant compound with a specific volume having a definite

and simple relation to the specific volumes of the constituents.

To illustrate this suggestion the following table, Fig. 1, is arranged showing the actual specific gravities of the elements in Group I in comparison with what I suggest are the Natural Specific Gravities. Gold is omitted as it seems to belong to another group as far as this system is concerned. The agreement between the observed specific gravities and the Natural Specific Gravities based on the Atomic Multiples, affords a confirmation of the real connection of the Multiples with the actual physical properties of the elements.

With this new suggestion in view the author invites attention to the accompanying table, Fig. 2, relating to Group V, in which the Atomic Multiples are worked out from the Natural Specific Gravities. In other words—one assumption is made and one only—namely that the Natural Volumes of this Group are as shown on diagram Fig. 3. This shows only three Natural Volumes for the eight elements. It is thought that the diagram will show that the assumption is not a rash one.

The Atomic Multiples arrived at, show very close approximation to multiples of 5, so close that it is at least 1,000,000 to one against this being a mere chance result.

As I foresaw in reading my first paper, some of the Multiples have had to be slightly modified on further consideration, and as the subject develops.

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FIG. 1

	ATOMIC MULTIPLE	NATURAL VOLUME	NATURAL SPECIFIC GRAVITY	NAT SPEC. GR REDUCED TO WATER BASIS	OBSERVED SPECIFIC GRAVITY FOR COMPARISON
Li. 7	8	$\frac{24}{2}$	$\frac{2}{3}$	.5883	·534
Na.23	24	24	1	.8825	·9735
K.39·1	40	40	1	.8825	·896
Cu.6357	80	8	10	8.8250	8·925
Rb.8595	88	44	2	1.7750	1·532
Ag107·88	120	10	12	10·5900	10·530
Cs.132·81	136	68	2	1.7750	1·870

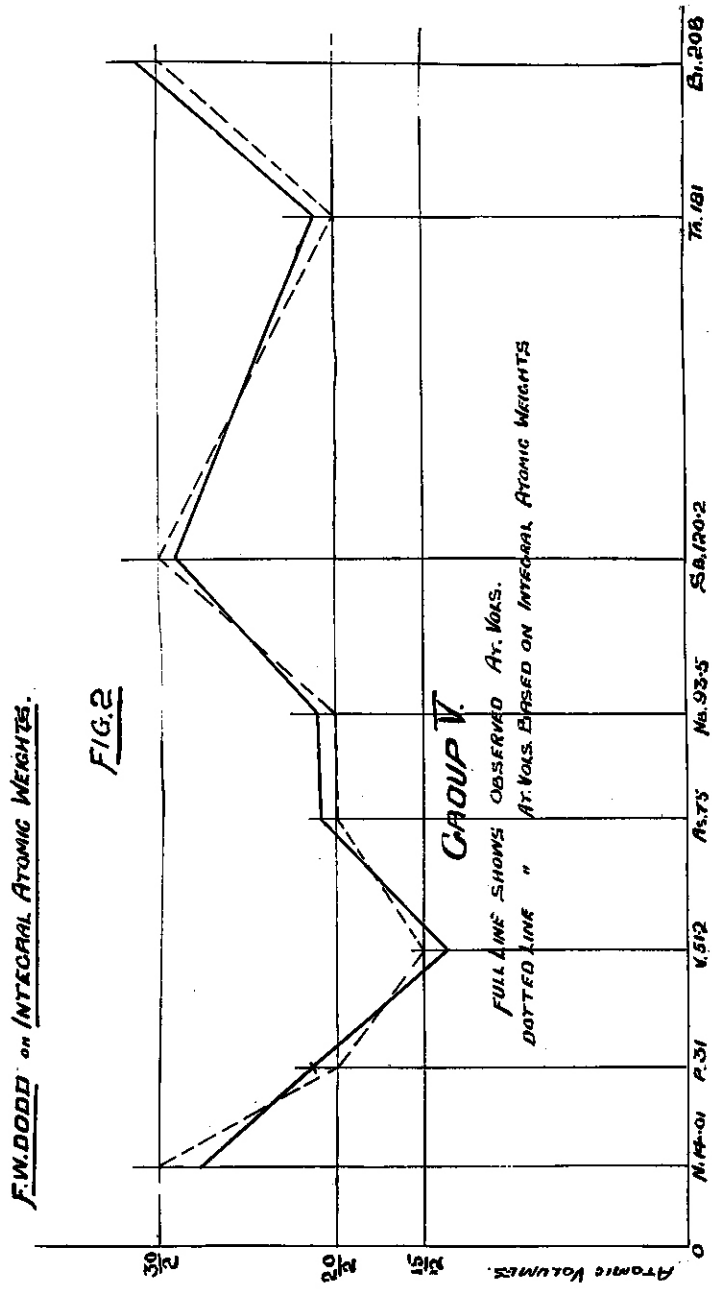
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FIG.2
GROUP V.
FULL LINE SHOWS OBSERVED AT. VOLS.
DOTTED LINE " AT. VOLS. BASED ON INTEGRAL ATOMIC WEIGHTS
ATOMIC VOLUMES.
ATOMIC WEIGHTS
N.14.01
P.31
V.51.2
As.75
Nb.93.5
Sb.120.2
Ta.181
Bi.208
0
10
20
30

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FIG. 3

ELEMENT	SUGGESTED ATOMIC MULTIPLE	NATURAL VOLUME	NATURAL SP. GRAVITY	ATOMIC WEIGHT PLUS NAT. SP. GR. × 1·1325	ERRORS i.e. DEPARTURE FROM SUGGESTED MULS.	
N. 14.01	15	$\frac{30}{2}$	1·0	15·1425	·1425	
P. 31	35	$\frac{20}{2}$	3·5	34·96375	·03625	
V. 51·2	60	$\frac{15}{2}$	8·0	60·26	·26	
As. 75	85	$\frac{20}{2}$	8·5	84·62625	·37375	
Cb. 93	105	$\frac{20}{2}$	10·5	105·39125	·39125	
Se. 1202	130	$\frac{30}{2}$	8·66	130·01500	·01500	
Ta. 181	205	$\frac{20}{2}$	20·5	204·1625	·8375	
Bi. 208	225	$\frac{30}{2}$	15·0	224·9875	·0125	

MEAN ERROR IN A CHANCE COMBINATION WOULD BE 1·25