3. **The Law of Gas Density***.—It is clear, too, that if some systematic way can be found for choosing the combining weights of compounds, the problem will at the same time be solved for elements. For, let there be taken as the combining weight of any element the *smallest* weight of it found in the combining weight of any of its compounds. Now, it has been found that a very simple law connects the physical and chemical properties of gaseous substances. The following table will make clear the nature of this law :—

	I. Specific Weights. (Air = 1.)	II.	III. Combining Weights.
Hydrochloric Acid (gas)	1·265	36·5	36·5
Water (in the gaseous state)	0·63	18	9 or 18
Ammonia	0·59	17	$5\frac{2}{3}$, $11\frac{1}{3}$ or 17
Carbon Dioxide	1·52	44	22 or 44
Carbon Monoxide	0·97	28	14 or 28
Methane	0·552	16	8 or 16
Ethane	1·04	30	15 or 30
Ethylene	0·97	28	14 or 28
Acetylene	0·90	26	13 or 26

In order to bring out the relation between these numbers, calculate the specific weights to the same scale as the combining weights. This can be done by taking 36·5 as the specific weight of hydrochloric acid and multiplying all the other numbers in the column by $\frac{36{\cdot}5}{1{\cdot}265}$. This, of course, preserves the ratio between the specific weights, but refers them to 36·5 of hydrochloric acid instead of 1 of air. These numbers have been placed in column II. of the table. Small fractions are neglected. It is at once evident that, if the right choice is made, *the specific*

* *Gas Density* is used as a general term for the specific weight of a substance in the gaseous state. It is convenient, if not quite correct.