3. The existence of compounds in multiple proportions raises the question, "Which multiple shall be written on the card?"

On page 22 it was pointed out that the composition of the black oxide of mercury can be represented by using two mercury cards and one oxygen card, three in all, while two suffice for the red oxide. A little consideration shews that if 3.97 be written on the oxygen card[1] instead of 7.94, the red oxide will be represented by three cards and the black by two; the same result would be reached if 99.24 on the mercury card were replaced by 198.48, leaving the oxygen with 7.94.

Which shall be adopted—7.94 or 3.97, 99.24 or 198.48?

4. This has been answered by making the cards express more than the composition of the chemical compounds.

Of the four substances involved in the reaction

Merc	Ox	and	Hy	Chl	giving	Merc	Chl	and	Hy	Ox
99.24	7.94		1	35.18		99.24	35.18		1	7.94

three are gases at high temperatures; at 500°*C* and one atmosphere pressure, for instance, the 8.94 g steam occupy 31.5 litres, the 36.18 g hydrogen chloride occupy 62.9 litres, and the 134.42 g corrosive sublimate occupy 30 litres. The volume of hydrogen chloride represented by the second group of tickets is thus about twice that of the sublimate represented by the third group, or that of the steam represented by the last.

If the 36.18 g of hydrogen chloride could be represented by two groups, leaving the others as before, the volumes of each of the three gases represented by a group of tickets would obviously be the same. This result might be accomplished, for instance, by writing ½ instead of 1 on the hydrogen ticket, and 17.59 instead of 35.18 on the chlorine card, thus

Merc	Ox	Hy	Chl	Hy	Chl	give	Merc	Chl	Chl	Hy	Hy	Ox
99.24	7.94	0.5	17.59	0.5	17.59		99.24	17.59	17.59	0.5	0.5	7.94

Or if it be decided to stick to 1 on the hydrogen card[2]

Merc	Ox	Hy	Chl	Hy	Chl	give	Merc	Chl	Chl	Hy	Hy	Ox
198.48	15.88	1	35.18	1	35.18		198.48	35.18	35.18	1	1	15.88

In all three methods of representation, the proportions between the weights of the chemicals are the same; but in the second and third each group of tickets stands for the same volume of gas, and in every case the number of tickets has been kept as small as possible.

[1] Third pack.

[2] Fourth pack.