XXI.—*On a Simple Method of Assaying Iron.*

By WALTER NOEL HARTLEY, King's College, London.

IT once happened that being desirous of estimating the amount of iron in an ore, the only apparatus at my disposal was a common pair of apothecary's scales without weights, and one burette.

The following method was at once designed as a rough and ready one, but further consideration and much experience has shown it to be remarkably accurate, and as an example for students beginning quantitative work it is most instructive, placing before them all ordinary methods of analysis in a new light. Without entering into full details, it will suffice if I state the principles on which the method depends; these are, 1st: The abolition* of weights by exactly balancing a quantity of the ore against pure iron wire. 2nd: The reduction of inaccuracies in weighing by making the solutions of the iron and the ore up to the same volume, and taking a fraction (about $\frac{1}{50}$) of the liquid for experiment, whereby the error of the balance is diminished $\frac{1}{50}$. 3rd: The reduction of all other experimental errors to a minimum by putting comparable quantities of both ore and pure iron under precisely the same conditions.

The quantity of iron wire taken should be at least about 5 yards (4 to 5 grams), of such a thickness as that of an ordinary sewing needle or small pin. It is a matter of some importance that the quantity should not be too small, otherwise the accuracy of the experiment is affected. Of course for making the liquids up to the same bulk any flask or bottle with a mark upon it, will answer the purpose,

* This is not new; it has been proposed, in the case of soda-ash, to weigh it against pure carbonate of soda. See Sutton's "Volumetric Analysis," p. 4.

and for taking off a fraction of the solutions any sufficiently small pipette or drawn out glass tube marked with a file.

The reduction of the ferric to ferrous solution is accomplished in five minutes by gently warming with pieces of granulated zinc, sufficient in quantity to prevent the pipetteful of the ore solution completely covering it.

The liquid may be poured off, the zinc washed, and the washings added to the solution, without the trouble of filtering until their total bulk is about half a litre. Permanganate is used for titration, because by its colour alone the strength of solution proper for the purpose may be determined. When examined by transmitted light in a half-inch tube, it should be of a full red colour, but exhibit no shade of blue.

The iron wire when titrated, should consume about 500 to 1,000 of the small division on the burette.

All the calculation necessary to find the percentage of iron in the ore is—

$$\frac{m \times 100}{n} = x,$$

m and n being the quantities of permanganate used for the ore and wire respectively, and x the quantity sought.

The following numbers were all obtained by beginners in quantitative work, each number being the work of a different experimenter.

Hæmatite containing	69·23	per cent. Fe.
No. 1 A	69·15	„
2 B	69·45	„
Spanish ore	50·54 to 50·56	
No. 1 C	50·72	
2 D	50·50	
3 E	50·50	
4 F	50·24	
5 G	50·20	
Titanic iron sand. . . .	47·12	per cent. iron.
No. 1 H	46·50	

The numbers 4 and 5 were analyses of a different sample of the same ore, which furnished the foregoing numbers.