Preliminary Note on the Density of the Tonk Meteorite.

BY

PROF. E. P. HARRISON, PH.D., I.E.S.,

AND

BABU SAILENDRANATH GHOSE.

FOR obvious reasons it was not advisable to weigh the material in water or other liquids, at any rate before the chemical analysis had been completed; consequently it was decided to find the density by a volumenometer method.

The instrument available at Presidency College was of the original Regnault pattern, with a bulb "A" of about 250 c.c. capacity. The small bulb "B" was of about 50 c.c. capacity.

Since the specimen only occupied a vol. of about 1 c.c. the instrument was unsuitably large; nevertheless a careful examination has led to an estimate of a probable error of 8 % on the density found, and it was thought worth while publishing the result pending the construction of a smaller apparatus.

Theory.

If V is the volume of the bulb A and capillary tube up to scratch a, and v is the volume of bulb B between the scratches a and b.

b the vol. of the specimen.

P the atmospheric pressure.

p the change of pressure expressed in *cms.* of mercury required to change the vol. from a to b at atmospheric pressure when the flask is empty.

p_1 the change of pressure required to change the volume from a to b when the flask contains the specimen.

We have, assuming Boyle's law—$b = Pv\left(\frac{1}{p} - \frac{1}{p_1}\right)$

Experiment.

The volume v was measured by running out the required vol. of mercury from the bulb B into a weighed beaker. From the weight of this mercury its volume (the vol. between a and b) was found assuming the density of mercury. (Fig. 1.)

The differences in level of the mercury columns giving p and p_1 were determined by means of a Cathetometer reading to 1/100th of a mm..

Care was taken to exclude moisture from the bulb.

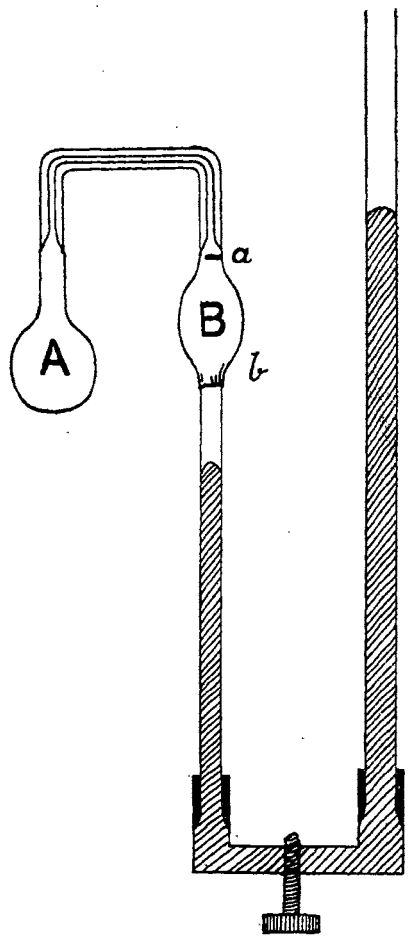

FIG. 1.

Results.

Barometer corrected (=P)	...	75·92 cms.
Mean value of p	...	12·735 cms.
,, value of p_1	...	13·157 cms.
,, value of v	...	54·04 c.c.
whence b = vol. of the specimen = 1·02 c.c.		
Mass of the specimen	...	4·23 grams.

Whence its Density $= \frac{4 \cdot 23}{1 \cdot 02} = 4 \cdot 1$ grams per c.c.

Examination of the Errors.

Probable error in measurement of p and p_1 = ·002 cm.
,, ,, ,, ,, ,, v = ·02 c.c.
Error on b due to error ·002 on p = — ·05 c.c.
,, ,, ,, ·002 on p_1 = + ·05 c.c.
,, ,, ,, ·02 on v = + ·005 c.c.
Probable total error on b
$= \sqrt{2\,(\cdot 05)^2 + (\cdot 005)^2} = \cdot 07$ c.c.

∴ Probable error on the density = —·3 grams per c.c. on a volume of about 1 c.c. that is, about 8%.

So limits of the density are from 3·8 to 4·4

Remarks.

Various elementary substances and minerals possess densities within the range just indicated.

Elements.

Barium	... 3·75 to 4·00
Selenium	... 4·2
Zirconium	... 4·14.

Minerals.

Iron Carbonate ($Fe\ Co_3$) (Spateisenstein) ...	... 3·80
Iron Sulphide ($Fe_2\ S_3$) ...	... 4·33
Iron Fluoride ($Fe\ F_2$) ...	... 4·09
Corundum	... 3·90
Garnet	... 3·80
Black Manganese ore ...	... 3·90 to 4·1

It was suspected originally that the meteorite contained an unusually large percentage of carbon. Here it may be noted that the density of graphite (2·3) is considerably lower than that found for the present specimen.

In view of the fact that a qualitative test showed the specimen to be slightly magnetic it is likely that a certain amount of some iron, manganese or nickel compound, enters into its constitution.

It remains for the chemical analysis to reveal this in detail.

PHYSICAL LABORATORY,
PRESIDENCY COLLEGE.
October the 29th, 1912.