TM/412

Diss Norfolk.
Sunday Morning

Dear Sir

Your letter reached me just as I was about to leave Cambridge, where I had been detained by illness. I am much better now, but not well. I have been so uncomfortable as to render it impossible for me to turn my mind to Mathematics. There is a great difficulty opposed to the solution of your question, which consists in our not knowing what, in fact, is the law of the resistance with respect to the velocity, when bodies move in fluids. If we make ~~the~~ hypothesis of a law, we come at a solution, but is our supposed law the one which obtains in nature? All I can say at present is that from experiments & from very plausible reasoning it appears that the resistance varies as the square of the velocity; moreover that the resistance, which a ~~fluid~~ uniform fluid opposes to a sphere moving in it, is equal to the weight of a cylindrical column of the fluid, whose ~~base is a~~ circumference is a great circle

of the sphere & whose length is half the space thro which a body must fall by gravity in order to acquire the velocity ~~of the~~ with which the ~~globe~~ sphere moves. You understand what cylinder I mean. A cylinder, whose base is the area of a great circle of the sphere (instead of the word sphere use Globe if you please)

This being supposed, the limit of the velocity which a globe could acquire by falling towards the earth either from a state of rest, or with a certain velocity of projection, is easily determined. it is as follows

Let d = the diameter of the globe

s = its specific gravity, that of the air about the earth being 1.

m = the space a body descends thro from rest by the force of gravity in 1"
i.e. $m = 16\frac{1}{12}$ ~~feet~~ nearly

Then the limiting velocity = the square root of the fraction $\frac{16 \cdot s-1 \times m \times d}{3}$ ~~ft~~ per second

Note. the body never would acquire this velocity if it continued falling in such a fluid for ever, but it approaches to it sine limite.

The cases you give involve the absolute weight of the bodies & their specific gravities; my expression requires the diameter of the the body; now from the weight & sp. gravity I cannot find the diameter unless I knew the weight of some given bulk of air, as for instance of a cubic foot. now I have no books about me to tell me that. & I have quite forgotten the numbers. tho I fancy a cubic foot of water weighs 1000 ounces avoirdupois. which would not help me, because I forget the specific gravity of water. ———

Monday

I meant to have sent you this letter yesterday, but the mathematics made me so nervous, that I could not go on. If in the course of my meditations & researches I discover any thing, that may throw light on this subject I'll put it by for you. As soon as I think my health fitting, I shall come to Town, & shall have a real pleasure in coming to see you. If you like to send me down the weight of a cubic foot of air, I'll send you the answers to the cases (according to the above expression) for the offer of a mere mechanical piece of service, which I make upon the supposition of your not being in the habit of calculating things from letters. perhaps you can do it ten times faster than I. Farewell. believe me

Yr most sincerely
Thomas Manning

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MAR 26
1803

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