LXXXIV. Reply to Mr. Barlow's article on floating bodies

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cumstance, which makes known *à priori* one of the elements of the orbit, introducing a new equation, it follows from it that the determination of parabolic orbits of comets conduces to more equations than unknown quantities, which gives room for various methods of calculating them. After having ascertained that method which ought to give the greatest precision, the author enters upon the subject at full length, and divides it into two parts: in the first he determines nearly the perihelion distance of the comet, and the time of its passage by the perihelion: in the second he gives the method of correcting these two elements by means of three observations taken at a distance from each other, and he deduces all the others from them. There exists a peculiar case in which the orbit of the comet may be rigorously determined: it is that case wherein the comet has been observed in its two nodes: after having examined it, the author gives the corrections necessary to be made in the elements calculated in the parabola to obtain the corresponding elements in the ellipsis: these inquiries, applied to comets, furnish the method of determining nearly the duration of their revolutions, when we have a great number of very exact observations, both before and after the passage by the perihelion. The method explained has the double advantage of correcting, by the number of observations, the influence of their errors, and of giving the elements by a rigorous analysis, simply by making the approximations to fall upon those data which are given by observation.

[To be continued.]

LXXXIV. *Reply to Mr. BARLOW's Article on Floating Bodies.* By G. ORR, Esq., of Buckingham Place, Fitzroy Square.

TO MR. TILLOCH,—SIR,

IN sending for your Magazine of March last a short essay on the subject of barges, timber, &c., floating down rivers, streams, or currents, it was not my intention to court a paper war. But Mr. Barlow * having asserted that I did not

* Philosophical Magazine for April 1809, p. 300.

under-

understand the subject, I beg to be allowed to trespass again on your indulgence.

I am persuaded that no person who has investigated the subject, will deny that all water in motion descends an inclined plane, and that bodies floating in it are actually descending an inclined plane also, being influenced by two causes in their progress; first, by the motion communicated to them by the fluid in which they float; and secondly, by their own weight arising from the inherent property of gravity, which, whether the body be more or less specifically heavy, is immutable, and peculiar to all matter.—*In vacuo*, as every one knows, a feather and a piece of gold will descend with equal velocity, and pass through equal spaces in equal times; but in air or water, the progress of bodies specifically different, will vary according to their specific gravity; the lighter body, possessing less power to overcome opposition, must of course be slower in its progress.—If the wood and metal balls, which I mentioned, were let fall *in vacuo*, or if they were mathematically polished, and passed down an inclined plane so polished and placed *in vacuo*, they would both descend with the same velocity; but in open air, and on a rough surface, the heaviest body being possessed of greater power, arising from a greater quantity of matter, viz. from greater specific gravity, it will have the greater power in overcoming opposition, and will pass on with the more rapid motion; but still in both bodies the principle of gravity is the same.

Mr. B. says that I am mistaken in making a comparison between balls of different weights rolling down an inclined plane, and barges or beams of different weights floating down a running stream: that is, as I understand him, he does not like the comparison, and he says the balls move through a *medium* perfectly at rest, but the barges, &c., through a *medium* in motion.—I beg leave to observe to Mr. B., that the air or atmosphere is never perfectly at rest, except when all its particles are *in equilibrio*, which is seldom the case, and never generally so. Balls may meet currents of air, or may overtake air moving slower than themselves: in either case, their motion must be retarded more or less,

478 *Reply to Mr. Barlow's Article on Floating Bodies.*

less, the same as beams floating in running water may be retarded by encountering irregular or slower motions in water.

Mr. B. illustrates his opinion by supposing a beam of timber loaded at one end, placed in running water, and *moving parallel to itself*, or, in other words, having an equal velocity at both ends. But this is absolutely impossible in the nature of things. The beam thus loaded cannot preserve its parallelism for an instant. It must obey the laws of gravity, and instantaneously begin to change its situation, the heavy end getting foremost. It would be just as impossible that such a loaded beam could preserve its parallelism, as that a ruler loaded at one end, and placed parallel on an inclined plane, should rest in that position, or that a cone should keep in such a situation without force.—Mr. B. says again, “If a beam should meet any resistance, that end which is heaviest will oppose it with the greatest effect.” Certainly, because it contains the greatest quantity of matter: But will not the heavier end always go foremost without any resistance? In considering this subject, allowance must be made for currents, eddies, &c.; but to understand it the more clearly, it would be best to consider the floating bodies as passing down a regular stream.

Mr. B. seems to me to confound weight, which is only the result of gravity, and of a greater quantity of matter, with gravity itself; for though one end of a beam be heavier than the other, and the beam consequently will float with the heavier end foremost, yet the inherent and inseparable property of gravity is the same in both ends of the beam.

I am, sir, your obedient servant,

G. ORR.

P. S. I do conceive that all bodies floating with the stream, and which have a heavy and light end, will become depressed at their heavier end, and be borne parallel to the plane on which the water moves,—in all such cases adapting themselves to the inclination of the plane or bed on which the water runs.