of the change of velocity which they produce. One of the great difficulties which stood in the way of the fixing of these very simple mathematical relations and definitions was the fact that all matter with which we can experiment is under the influence of a constant but unknown force, that which makes it fall if not supported. It was only by freeing themselves from the effect of this constant force, or by balancing it, that philosophers gradually arrived at the conception and definition of mass, or quantity of matter, as something independent of its weight. It was reserved for Newton to show and define the exact relation which weight bears to the other properties of matter defined and measured by his predecessors. By doing so he added a new definition, a new means of measuring the quantity of matter or its mass, showing at the same time to what extent the popular measure of matter—*i.e.*, its weight—could be accurately used for scientific purposes. Again, to express it in the language of our day, Newton showed that matter is not only that which offers resistance to change of motion, but also that which causes change of motion in other portions of matter: it is not only the object on which force spends itself, it is the seat of this force, and the degree in which it can change motion in other portions of matter is proportional to the degree in which it resists the change of its own motion—in other words, the gravity or weight of matter is proportional to its mass or inertia, and is not dependent on any other difference, whether of size or of quality. This second universal property of matter, which brought out more clearly the reciprocity of all mechanical, and subsequently of all

21. Weight and mass.