The theory and laws of the pendulum will be easily understood. When the ball of a pendulum that has been freely suspended from a point is raised from the perpendicular, and is allowed to fall by its own weight, it begins a series of vibrations, which would be infinite, if the motion were not retarded by the friction upon the point of suspension, and the resistance of the air. It falls to the perpendicular position from which it was drawn, by virtue of the same power that causes a body to fall to the earth; the force of gravitation. But when it comes to this position, it has acquired a certain velocity, sufficient to urge it upward on the opposite side, and to cause it to describe as large an arc as in falling. The pendulum, therefore, is in theory capable of a perpetual motion.

Galileo discovered that the oscillations of a pendulum are isochronous, or performed in equal times, whether the arc be large or small, within a certain limit. He was led to this discovery by observing in the church of Pisa the vibrations of the large chandelier which had been left swinging when the candles were lighted for the evening service. But the law that is most important for us to notice is, that the times required to perform an oscillation are as the square root of the length of the pendulum.—If, for instance, there be three pendulums, whose lengths are as one, four, and nine respectively, the oscillations of the second will require twice the time of the first, and the third three times, because one, two, and three, are the square roots of one, four, and nine. As the oscillations of the pendulum vary with its length, a certain length will be required that it may beat seconds, or, in other words, vibrate sixty times in a minute. For the latitude of London it must be thirty-nine one fifth inches long; but a pendulum that will beat seconds in one latitude will not do so in another.

The attraction of gravitation is a force with which all matter is endowed, and belongs to particles as well as to masses, all bodies universally attracting each other, directly as their masses, and inversely as the squares of the distance. But when a body is made to revolve on its axis, a new force is called into action, which in some measure resists the attraction of gravitation. In the case of our earth, for instance, gravitation would cause it to fall towards, or into the body of the sun, but the centrifugal force solicits it to fly away