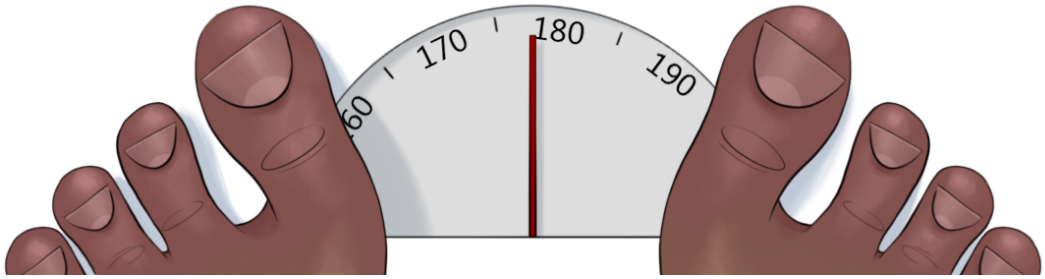

2.1: Newton’s First Law

Explain the motion of objects using Newton’s first law.

Sir Isaac Newton studied forces and motion scientifically. He performed numerous experiments and published his work. Today we often refer to Newton’s ideas as the three laws of motion. Newton’s first law built upon the work of Galileo, who also studied the motion of objects.

Fig. 2.1: Sir Isaac Newton, 1643–1727

Prior to Galileo’s time, the accepted idea was that a force was required to keep an object moving. Galileo worked to show that this idea was erroneous. Newton built upon Galileo’s work and correctly realized that once moving, objects will continue to move at the same speed and in the same direction unless some force changes their movement. But this can’t be true, can it? If you place a book on the floor and give it a push it will eventually stop on its own. If Galileo is correct, the book will keep sliding until it hits a wall or some other obstruction. You know the book will not keep sliding, yet I have claimed that Galileo is correct. What force is slowing the book down, then?

Galileo found that where friction is present, it acts to slow the motion of objects. Even though it seemed like nothing was pushing on that book, friction was pushing on it, applying a force that slowed it down. This is why people believed that a force was required to keep something moving.

Fig.2.2: Galileo Galileo, 1564–1642

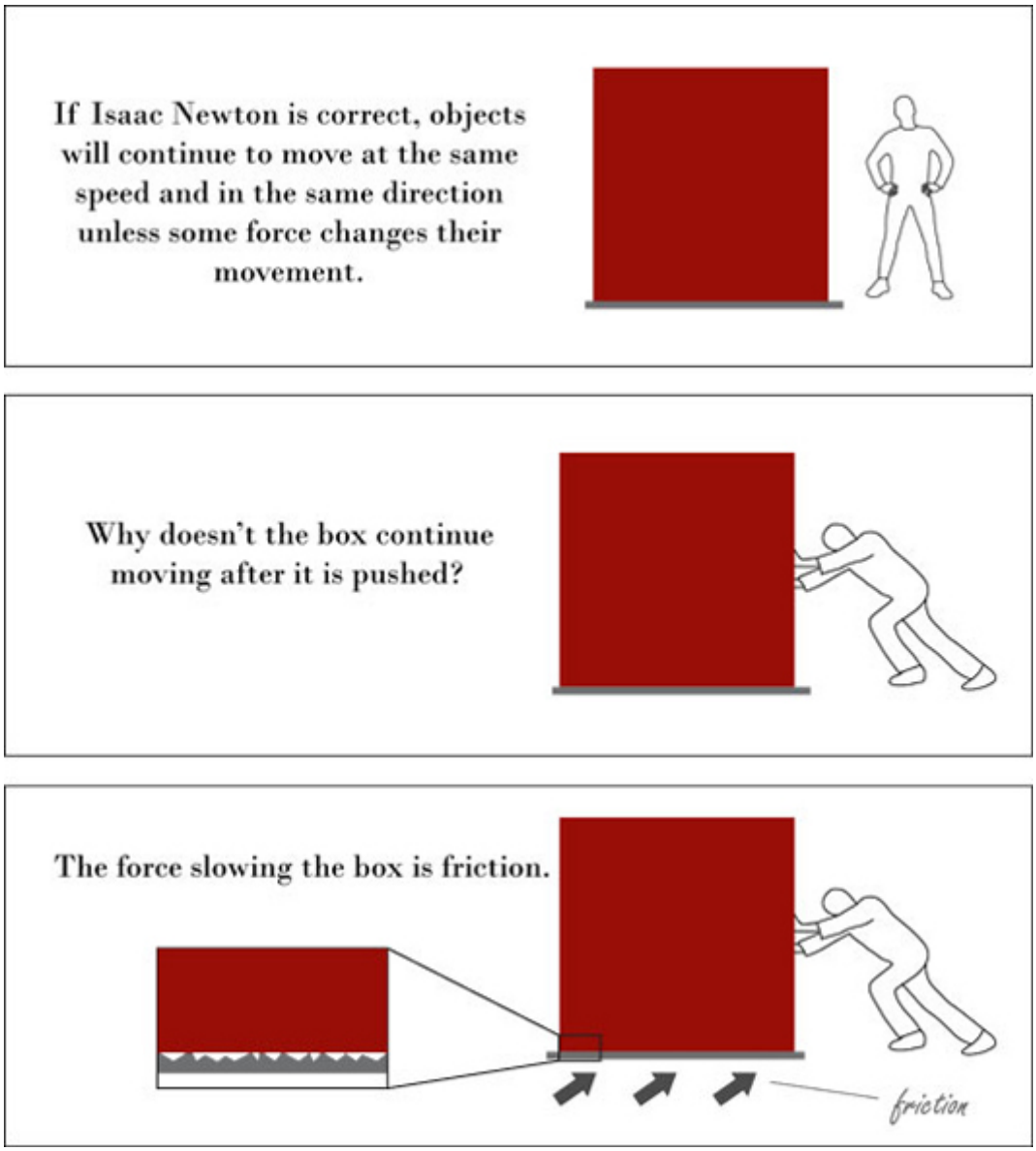

Fig. 2.3: An illustration of Newton's first law

Newton set out to find the relationship between forces and motion. He concluded that *forces can produce changes in motion.* If forces acting on an object are balanced, then there should be no changes in the motion. Therefore, changes in motion occur only when forces are not balanced. Just what do we mean by "balanced"? Well, forces are balanced if the *up* forces equal the *down* forces and the left forces equal the *right* forces.

Let's look at the example of the sliding book. When you push it, the book moves because your force is greater than the force of friction. However, as soon as you stop pushing the book, the force of friction becomes greater and the book slows down and eventually stops. Once the book has stopped, all forces acting on it are equal and it will not move until a new force is applied.

Newton's first law of motion states that an object in motion will remain in motion (with constant velocity) unless acted upon by an unbalanced force. This has often been referred to as the law of inertia.

Inertia is the tendency of matter to resist change in motion. Thus, all objects will resist any change in their motion, including objects that have a motion of zero. A stationary object will not move unless an unbalanced force acts upon it. Mass is how we measure an object's inertia. The more mass an object has, the more it resists change in its motion. Since inertia is a measure of the characteristics of matter, it is measured in kilograms. The SI unit for measuring force is the newton (N), named after Isaac Newton for his groundbreaking work in the study of forces.