hypothesis

an explanation that is based on prior scientific research or observations and that can be tested

Models can help build hypotheses

A scientific **hypothesis** is a reasonable explanation for observations—one that can be tested with additional experiments. The process of simplifying and modeling a situation can help you determine the relevant variables and identify a hypothesis for testing.

Consider the example of Galileo's "thought experiment," in which he modeled the behavior of falling objects in order to develop a hypothesis about how objects fell. At the time Galileo published his work on falling objects, in 1638, scientists believed that a heavy object would fall faster than a lighter object.

Galileo imagined two objects of different masses tied together and released at the same time from the same height, such as the two bricks of different masses shown in **Figure 6.** Suppose that the heavier brick falls faster than the lighter brick when they are separate, as in **(a).** When tied together, the heavier brick will speed up the fall of the lighter brick somewhat, and the lighter brick will slow the fall of the heavier brick somewhat. Thus, the tied bricks should fall at a rate *in between* that of either brick alone, as in **(b).**

However, the two bricks together have a greater mass than the heavier brick alone. For this reason, the tied bricks should fall *faster* than the heavier brick, as in **(c).** Galileo used this logical contradiction to refute the idea that different masses fall at different rates. He hypothesized instead that all objects fall at the same rate in the absence of air resistance, as in **(d).**

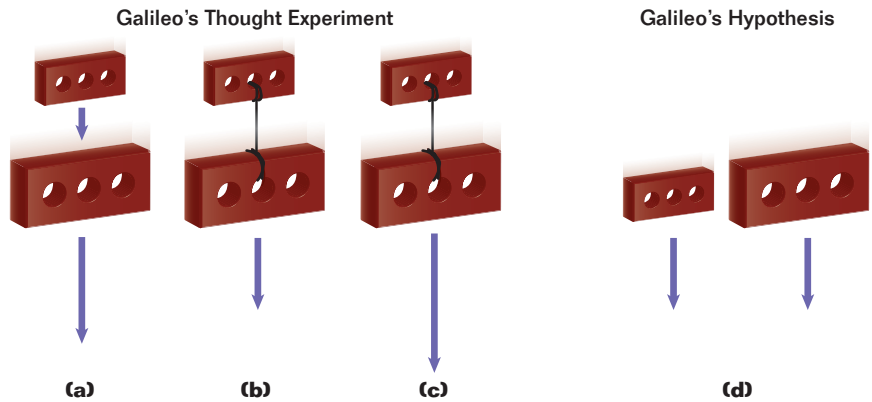

Figure 6
If heavier objects fell faster than slower ones, would two bricks of different masses tied together fall slower **(b)** or faster **(c)** than the heavy brick alone **(a)**? Because of this contradiction, Galileo hypothesized instead that all objects fall at the same rate, as in **(d).**

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Models help guide experimental design

Galileo performed many experiments to test his hypothesis. To be certain he was observing differences due to weight, he kept all other variables the same: the objects he tested had the same size (but different weights) and were measured falling from the same point.

The measuring devices at that time were not precise enough to measure the motion of objects falling in air. So, Galileo used the motion of a ball rolling down a ramp as a model of the motion of a falling ball. The steeper the ramp, the closer the model came to representing a falling object. These ramp experiments provided data that matched the predictions Galileo made in his hypothesis.