Like Galileo's hypothesis, any hypothesis must be tested in a **controlled experiment.** In an experiment to test a hypothesis, you must change one variable at a time to determine what influences the phenomenon you are observing. Galileo performed a series of experiments using balls of different weights on one ramp before determining the time they took to roll down a steeper ramp.

controlled experiment

an experiment that tests only one factor at a time by using a comparison of a control group with an experimental group

The best physics models can make predictions in new situations

Until the invention of the air pump, it was not possible to perform direct tests of Galileo's model by observing objects falling in the absence of air resistance. But even though it was not completely testable, Galileo's model was used to make reasonably accurate predictions about the motion of many objects, from raindrops to boulders (even though they all experience air resistance).

Even if some experiments produce results that support a certain model, at any time another experiment may produce results that do not support the model. When this occurs, scientists repeat the experiment until they are sure that the results are not in error. If the unexpected results are confirmed, the model must be abandoned or revised. That is why the last step of the scientific method is so important. A conclusion is valid only if it can be verified by other people.

Did you know?

In addition to conducting experiments to test their hypotheses, scientists also research the work of other scientists. The steps of this type of research include

- identifying reliable sources
- searching the sources to find references
- checking for opposing views
- documenting sources
- presenting findings to other scientists for review and discussion

SECTION REVIEW

1. Name the major areas of physics.
2. Identify the area of physics that is most relevant to each of the following situations. Explain your reasoning.
   - **a.** a high school football game
   - **b.** food preparation for the prom
   - **c.** playing in the school band
   - **d.** lightning in a thunderstorm
   - **e.** wearing a pair of sunglasses outside in the sun
3. What are the activities involved in the scientific method?
4. Give two examples of ways that physicists model the physical world.
5. **Critical Thinking** Identify the area of physics involved in each of the following tests of a lightweight metal alloy proposed for use in sailboat hulls:
   - **a.** testing the effects of a collision on the alloy
   - **b.** testing the effects of extreme heat and cold on the alloy
   - **c.** testing whether the alloy can affect a magnetic compass needle