



# TEACHER GUIDE

## PATTERNS OF MOTION AND FRICTION GRADES 3-5

### COMMON MISCONCEPTIONS

- **Students don't think friction is a force.**  
They think things slow down naturally unless a force is applied to keep it moving.
- **Friction is a force that slows moving objects to a stop.**  
The force of friction resists motion. Without friction, an object in motion would not stop unless some other kind of force acted upon it.

### MOTION AND FORCES AT THE ELEMENTARY LEVEL

According to the NGSS standards, in third grade students focus on balanced and unbalanced forces, as well as the idea that repeatable motion forms identifiable patterns. Although not explicitly stated in the standard, students are gathering evidence through observation of many examples that objects' motion can be explained the same way again and again. By predicting patterns of motion, they are applying laws of physics and observing evidence that these laws work every time. This not only reinforces the evidence for the ideas on which our conceptual understanding of the world is based, but also helps students gain hands-on experience as to how science works.

### FRICTION

As students start to explore forces and motion, they will encounter friction. Although not always intuitive for students due to the fact that it is largely unseen, the force of friction acts upon the objects they observe, and they will need to take it into consideration. Starting out with obvious examples may be useful (such as sand paper vs. ice or that rubbing your hands together shows sliding friction). At this level friction can be introduced as a force that resists motion and can remain qualitative rather than quantitative.

## PENDULUMS

The physics behind pendulums can be a bit tricky even for older students, so at this level they are intended to be used in a simplistic way. The focus on pendulums here is on their patterns of motion and how those change over time (slow down due to friction). Introducing mass, gravity, period, or frequency in addition to this focus is likely to confuse students.



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