THE STANDARD

Changes in an Object's Motion

Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.

DCI — Disciplinary Core Idea

PS2.A · Forces and Motion

> *The motion of an object is determined by the sum of the forces acting on it; if the total force on the object is not zero, its motion will change. The greater the mass of the object, the greater the force needed to achieve the same change in motion. For any given object, a larger force causes a larger change in motion. All positions of objects and the directions of forces and motions must be described in an arbitrarily chosen reference frame and arbitrarily chosen units of size.*

Whether an object's motion changes depends on two things: the total force pushing or pulling on it, and how much mass it has. Bigger total force in one direction means a bigger change in motion. Bigger mass means it takes more force to get the same change. **Balanced forces leave motion alone.**

SEP — Science & Engineering Practice

Planning and Carrying Out Investigations

> *Plan an investigation individually and collaboratively, and in the design: identify independent and dependent variables and controls, what tools are needed to do the gathering, how measurements will be recorded, and how many data are needed to support a claim.*

Students aren't running a teacher demo. They're designing the experiment. They pick the independent variable (force or mass), the dependent variable (the change in motion), the controls, the tools, and how many trials they need. The plan is the work. **If the plan can't be repeated by another group, it isn't done.**

CCC — Crosscutting Concept

Stability and Change

> *Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and forces at different scales.*

Motion that isn't changing is stability. Motion that is changing is change. This standard sits right on the seam. **Students look at what's keeping motion steady (balanced forces) and what's nudging it off course (unbalanced forces), then trace the cause back to force and mass.**