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.*

ANCHORING PHENOMENON

## The Loaded Shopping Cart

A shopping cart on a smooth tile floor. Empty, a gentle push sends it gliding across the aisle. Now load it up: gallons of milk, a watermelon, a couple of bags of dog food. The same gentle push barely moves it. Same arms, same shove, same floor, different cart. Students will keep circling back to this all week.

> **DRIVING QUESTION**
> *"Why does the same push move an empty cart so much further than a loaded one?"*

INVESTIGATIVE 1

### The Stuck Tug-of-War

Two teams pulling on a rope, neither side gaining ground. The flag in the middle doesn't move an inch, even though everyone is pulling hard. Then one team adds a player. The flag jerks toward them and the rope goes flying. Use this to sharpen the lens the anchor is pushing on: motion changes when the forces stop cancelling out.

> **DRIVING QUESTION**
> *"Why didn't the flag move at all when both teams were pulling hard, but jumped right away when one team added a person?"*

INVESTIGATIVE 2

### Two Carts, Same Ramp

Two toy cars at the top of the same ramp, released at the same time. One is empty, one has a stack of pennies taped to the roof. They both roll down, but the loaded car keeps going much further past the bottom of the ramp before friction stops it. Same ramp, same release, different load, different finish. Same kind of change as the anchor, only this time the heavier object goes further instead of less far.

> **DRIVING QUESTION**
> *"Why does the heavier cart roll further past the ramp, even though both started in the same spot?"*