THE STANDARD

Newton's Third Law & Collisions

Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.

DCI
DISCIPLINARY CORE IDEA

PS2.A · Forces and Motion

> *For any pair of interacting objects, the force exerted by the first object on the second object is equal in strength to the force that the second object exerts on the first, but in the opposite direction (Newton's third law).*

When two objects interact, they push on each other with equal force in opposite directions. Always. The car pushes the wall, the wall pushes back just as hard. The forces in the pair are simultaneous, equal in size, opposite in direction, and they act on different objects. That last part is the one students miss. **The two forces aren't on the same thing.**

SEP
SCIENCE & ENGINEERING PRACTICE

Constructing Explanations and Designing Solutions

> *Apply scientific ideas or principles to design an object, tool, process or system.*

Students aren't just learning a law. They're using it to design a solution. The standard pairs the physics with engineering: pick a collision problem (a fragile cargo, a passenger, a phone), then design a device that reduces the force during impact. The science idea drives the design choice. **If the design doesn't connect back to force pairs, it's craft time.**

CCC
CROSSCUTTING CONCEPT

Systems and System Models

> *Models can be used to represent systems and their interactions, such as inputs, processes and outputs, and energy and matter flows within systems.*

A collision is a system with two objects, the force pair between them, and whatever you build to sit between them. Students model that system with a sketch or diagram showing the force arrows, the objects, and where the design feature lives. The model is the thinking tool. **It shows where energy and force flow during the moment of impact.**