

Soccer, like many sports, is all about motion. As players dribble, pass, block shots, and score goals, they're using the motion of their bodies to control the motion of the ball. And wherever you have moving objects, you have physics! The difference between tapping the perfect back-heal pass and driving home a penalty kick lies in understanding the forces at work on the ball: friction and momentum, angle and trajectory.

In these activities, learners become soccer scientists as they use tabletop models to explore how the physics of force and motion impact different aspects of the game, from ball control to equipment design!

Activity 1: Use the Force!

To move a soccer ball, you need a force—a push or a pull—and every force has two aspects: strength and direction. Different combinations of strength and direction create different kinds of ball movement. Experiment with forces on a mini soccer field to find the right strength and direction for different game scenarios. What kinds of force do you need for a short sideways pass versus a long forward ball? What do you need to weave through a crowd of players or loft the ball over a wall of defenders?

Activity 2: On the Field

Players aren't the only forces in a soccer game! The field surface and even the air act on the ball, too, and since most soccer is played outdoors, players have to adapt their play to account for changing conditions. Using a small-scale model, test how wind conditions and different playing surfaces affect the ball's movement and decide how players should adjust their kicks to counteract these forces.

Activity 3: Think Fast!

Before every move a player makes to control a ball's movement, there's a split second of reaction time—the time it takes their brain to process information about how the ball is moving and send messages to their body to respond. Especially for goalkeepers, that reaction time can be the difference between making a save and letting in a goal. Use a mini soccer goal to test the effects of various factors like preparation, distraction, and movement changes. What makes it easier—or harder—to keep the ball out of the goal?

Activity 4: Foot Friction

Forces affect not just the ball, but the players as well. The force of friction between players' feet and the field surface changes how they stop, start, or turn. Soccer players are known for wearing shoes with cleats on the bottom to keep them from slipping. Why do cleats work? And does the shape, number, or arrangement of cleats affect how well the shoe grips? Explore and test a variety of materials to engineer the perfect prototype for a soccer cleat sole.