

GET MOVING!

A LEGOLAND® California Educational Resource Guide Grades 2-4



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Welcome to LEGOLAND California!

Education Programs: "Get Moving!" was developed by the LEGOLAND Education Department. For information on LEGOLAND Education programs, visit www.LEGOLAND.com/edu.

Directions: From Interstate 5, buses exit Palomar Airport Road East. Turn LEFT on Hidden Valley Road, and LEFT into LEGOLAND. Cars exit Cannon Road East and turn RIGHT on LEGOLAND Drive.

Arrival and Entry: Please arrive 30 minutes before your program. Teachers must be present during the 45-minute program.

Lunches: Lunches may be pre-ordered when you book your program, or purchased at LEGOLAND restaurants. School groups may bring lunches in disposable containers and use self-storage bins.

Safety: LEGOLAND Parks are built to the highest standards of quality and safety. Height restrictions apply on selected attractions throughout the Park.

Background Information

What is Force?

Force is any push or pull. Force is needed to provide motion, change direction or speed, and to stop.



Forces cause objects to move.

Gravity constantly pulls all things toward the center of the earth. TECHNIC® Coaster is gravity-powered.

Inertia makes an object resist a change of motion. When the TECHNIC Coaster speeds up, riders feel pinned to the back of the car. Inertia makes it a fun ride!

Riders also experience inertia when the car stops and they feel “pushed” forward against the lap bar. Inertia makes your body want to continue moving as it had been moving.

When inertia is at work, an object at rest tends to stay at rest, and an object in motion tends to stay in motion.



Centrifugal Force pulls objects away from the center of motion. AQUAZONE® riders hang on as centrifugal force pulls them to the side of the car, away from the center of the ride.

Wind resistance pushes the riders’ hair backwards. Riders on many different rides can feel wind resistance. Cars that are low and sleek face less wind resistance.

What forces act on a car going down a slope?

Friction is the amount of surface contact between a car and the slope: Less friction, faster car.

Friction can cause heat when two surfaces come in contact and rub together.

How do we reduce friction to make a car go faster?

- **Change the slope’s surface.** The smoother the surface, the faster the car.
- **Change the slope’s angle.** The steeper the slope, the faster the car.
- **Change the tires.** Usually the car will go faster with narrow and smooth tires.

Weight can also make a car go faster or slower. In theory, a heavy and lightweight object released at the same time from the same point on a ramp should reach the bottom at the same time.

In reality, a light object often travels faster, but not as far. A heavy object often travels slower, but farther. This is due to different amounts of friction in the wheels and axles.

Hands-On Activities

Get Moving in the Imagination Zone!

Plan Your Design

Think about forces that would make your car go faster or slower.
What design might make the fastest car?



Build and Test!

Work in pairs to build a fast car. Test your car on the Maniac Midway speed ramps.
Redesign and test your vehicles until you are ready to race.



Race on the Maniac Midway!

Race the cars on the speed ramp in heats until all cars have raced.
Which car went the fastest? Look at the design of the car. Why do you think it was the fastest?

Discovery Worksheet

How do forces act on these rides?

Think about inertia, centrifugal force, gravity, friction, and wind resistance.



Kid Power Towers

Riders pull the cable to go up, then slowly come down when they let go of the cable.

What force helps riders go down?

What force makes your hands feel hot as they rub against the cable?



BIONICLE® Blaster spins in a circle. Which force pushes riders away from the center?



TECHNIC Coaster speeds up suddenly. Which force makes riders feel pinned back, as if they haven't started moving?



AQUAZONE riders feel air pushing against them. Which force is at work?

Before and After the Visit: Minds-On Activities

Make your own Maniac Midway!

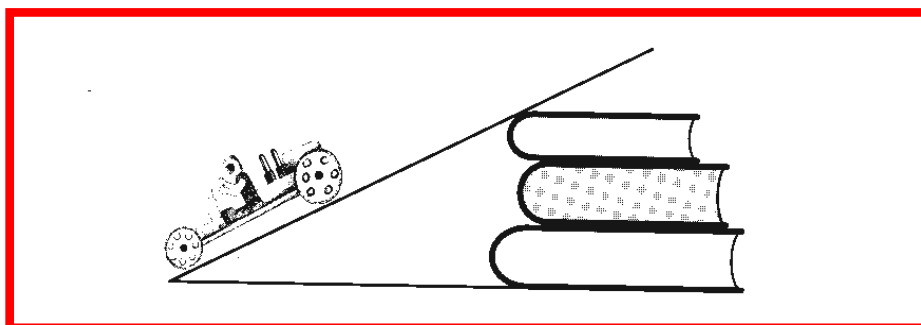
Set up a ramp in your classroom and test the effects of forces acting on the cars you race.

Materials and Set up

Cardboard or plank propped at an angle with books.
Toy cars or LEGO® cars
Carpet runner, to place on ramp.
Weights for cars (Coins, for example).
Tape measure to measure the distance traveled.
Bar graph to record distance traveled under different conditions.

See the changes when different forces are at work.

Change only one factor at a time to see how the car's performance changes under different conditions.
Use the same car for each trial.



Trial #1

Release a car from the top of the ramp. Record the distance traveled from the bottom of the ramp.

Trial #2

Put a carpet runner on top of the ramp. This will increase friction. Now release a car from the top of the ramp. Did the car travel slower or faster? Did it go farther or not as far?

Trial #3

Take the runner off the ramp. Tape a weight to the car. Release it from the top of the ramp. Did it affect the car's performance?

Trial #4

Take the weight off the car. Add books to the ramp to make it steeper. Release a car from the top of the ramp. Did the car go faster or farther? Now take books off the ramp to make it less steep. How does the car perform?

About Get Moving!

Educational Objectives

- Learn about forces, such as gravity, friction, and inertia.
- Build a vehicle.
- Explore how forces cause movement and change speed.
- Relate Hands-On activities to the experience of LEGOLAND attractions.



California Content Standards

Grade Two

Science: Physical Sciences

1. The motion of objects can be observed and measured...Students know:
 - a. The position of an object can be described by locating it relative to another object or the background.
 - b. An object's motion can be described by recording the change in its position over time.
 - c. The way to change how something is moving is to give it a push or a pull. The size of the change is related to the strength, or the amount of "force" of the push or pull.
 - d. Tools and machines are used to apply pushes and pulls (forces) to make things move.
 - e. Objects near the Earth fall to the ground unless something holds them up.

Science: Investigation and Experimentation

- 4a. Students will make predictions based on patterns of observation rather than random guessing.

Grade Three

Science: Investigation and Experimentation

- 5a. Students will repeat observations to improve accuracy, and know that the results of similar scientific investigations seldom turn out exactly the same because of differences in things being investigated, methods, or areas of uncertainty in the observation.
- 5e. Students will predict the outcome of a simple investigation, and compare the result with the prediction.

Math: Measurement and Geometry

- 2.4 Combine and take apart three-dimensional objects to construct new three dimensional objects.

Math: Problem Solving and Mathematical Reasoning

1. Students make decisions about how to approach problems.
 - 1.1 Analyze problems by...discriminating relevant from irrelevant information...and observing patterns.
2. Students use strategies, skills, and concepts in finding solutions.
 - 2.1 Predict outcomes and make reasonable estimates.
3. Students move beyond a particular problem by making general conclusions, summary statements and posing new, related questions and comments.
 - 3.3 Make connections between the solution and other mathematical solutions, concepts, other school subjects, and the real world.

Grade Four

Science: Investigation and Experimentation

- 6c. Students will formulate predictions based on cause and effect relationships.
- 6d. Students will conduct multiple trials to test a prediction draw conclusions about the relationships between predictions and results.