

e-LAB

A LEGOLAND® California Educational Resource Guide Grades 2-6



Table of Contents

Welcome	Page 1
Background Information	Page 2
Before and After Visit: Minds-On Activities	Page 3
LEGOLAND Activities: Discovery Worksheet	Page 4
Hands-On Activities	Page 5
About Energy in Motion: Objectives and Standards	Page 6

Welcome to LEGOLAND California!

Education Programs

"e-LAB" was developed by LEGO® Education and 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 scheduled program. Teachers must be present during the 45-minute program. Materials provided.

Lunches

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

Safety

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

Background Information

Energy comes from many sources.

Most of our energy supply comes from fossil fuels, such as oil, coal, and gas. Since fossil fuels take millions of years to form, they are effectively non-renewable. Every time we use oil, coal, and gas, there is less for future use. Also, burning fossil fuels produces waste products that pollute the atmosphere.

Energy also occurs naturally in wind, flowing water, and sunlight. Using these renewable energy sources may offer an alternative power source.

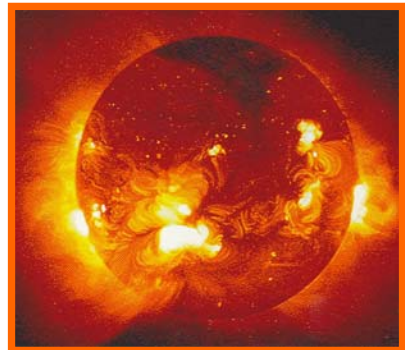


Collecting and Storing Energy

Energy that is naturally available needs to be collected to be useful. Sometimes energy can be used at the place where it is collected, and sometimes it must be stored and transferred. Potential energy is energy stored up and ready to be used. Kinetic energy is the energy of motion.

When energy is transferred from where it is stored to where it is used, some energy escapes as heat.

Power is a measure of how fast you transfer energy. You can lift an object slowly and work at a low power. Lift it quickly and you work at a high power.



Renewable Resources: Wind, Water, and Solar Power

Windmills, grouped into windfarms, can generate electricity. Large rotors have pitched blades to collect wind energy. Windmills convert about 30% of the wind's energy into electricity.

Turbines are powerful waterwheels used in hydroelectric power stations. Water is stored behind a dam. As the water is released, it drives the turbines and generates electricity. Worldwide, water power is the major source of energy, after fossil fuels.

Solar panels collect energy from the sun. One type of solar panel contains a liquid that absorbs the heat energy. Hot liquid passes to a heat exchanger to heat the water in a swimming pool or a home's water heater.

Another type of solar panel converts the sun's rays into electricity. The voltage and power is low, so several cells are connected in each panel.

Before and After the Visit: Minds-On Activities

Balloon Power!

Use renewable energy—air!
Store potential energy, and change it to kinetic energy.
Find out how weight affects how fast and far the balloon travels.

Remember:

Potential energy is energy stored and ready to be used.
Kinetic energy is the energy of motion.



Materials

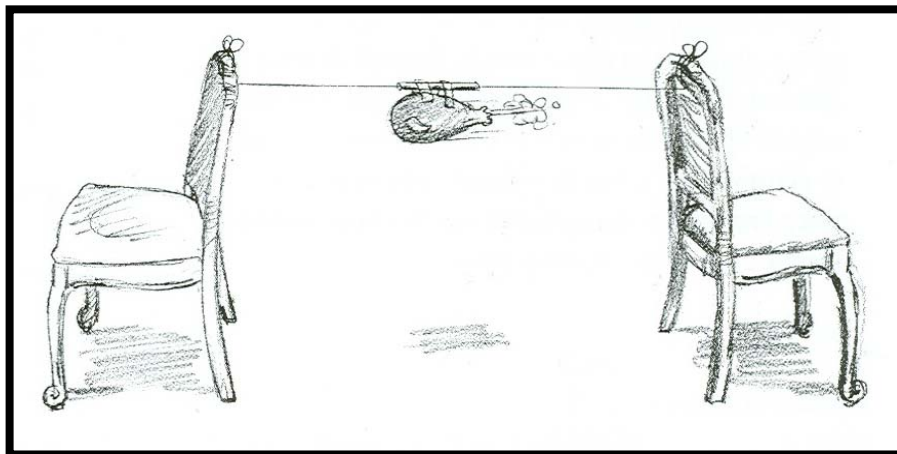
Long balloons
Pennies

Drinking straw
String or fishing line, 6 ft. long

Masking tape
2 chairs

Procedure

1. Thread the drinking straw on the string. Tie each end of the string to the back of a chair.
2. Move chairs apart until the string is taut. Slide the straw to one end.
3. Inflate the balloon, but do not tie it.
4. Hold the balloon with the opening facing the chair. Tape the balloon to the straw.
5. Let the balloon go!



Discussion

1. How far did the balloon go?
2. What renewable energy source powers the balloon?
3. Where is potential energy stored? When is kinetic energy released?
4. Is any energy wasted? If so, how?

Now try this!

1. Tape a penny to the balloon or straw. How does weight affect the speed and distance the balloon travels? Try it with two pennies.
2. Use a different size or shape of balloon. Can you increase the potential energy stored and the kinetic energy released?

Discovery Worksheet

TECHNIC® Coaster

Ride the TECHNIC Coaster!

Think about how the TECHNIC Coaster makes the most of potential energy, kinetic energy, and gravity, to speed up and slow down.

Potential energy
is energy stored up and ready to be used.

Kinetic energy
is the energy of motion.



1. Where does TECHNIC Coaster have the most potential energy, at the lowest or highest point of the track?

2. How does TECHNIC Coaster gain more and more potential energy—by going up or down the track?

3. How does the height of the track affect the amount of potential energy that can be stored?

4. When is potential energy changed to kinetic energy?

5. How does the dip at the end of the ride help the TECHNIC Coaster slow down? How does this help the brakes?

-4-

Answer Key: 1. Highest point. 2. Up the hill. 3. The higher the track, the more potential energy. 4. Changes to kinetic energy as gravity pulls the coaster down the hill. 5. Climbing the dip against gravity takes more power. Since the coaster naturally slows down, the brakes do not have to work as hard, and do not wear out as quickly.

Hands-On Activities



Discover energy and where we find it.

Energy is the capacity to do work or the ability to make things move.

Think about where energy comes from.

What is the difference between renewable and non-renewable energy?

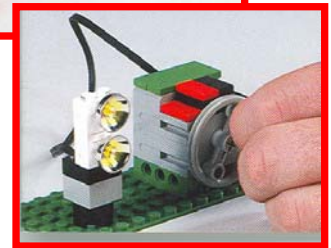
Can you give several examples of each?



Generate energy.

Use the windmill, hand crank, and solar panel to compare the power generated from wind, solar, and mechanical energy sources.

Discover how to use the LEGO capacitor to collect, store and transfer energy. When energy is stored in the capacitor, it is called potential energy. When the energy is released, it changes to kinetic energy, the energy of motion.



Build a model, then collect and store the energy to power up!

1. Build a model of a theme park ride or a car, with a motor attached.
2. Explore the power of two different energy sources: Mechanical and solar.
3. Collect mechanical energy, then solar energy, in the capacitor.
4. Transfer the power to the motor to make the ride run.
5. Which energy source gives the most power?

About e-LAB

Educational Objectives

- Learn about renewable resources, such as solar and wind energy.
- Experiment with production, storage, and transfer of mechanical, solar, and wind energy.
- Test and compare energy sources.
- Define and experience potential and kinetic energy.
- Relate Hands-On activity to LEGOLAND attractions.



California Content Standards

GRADE TWO

Science: Physical Science

1. The motion of objects can be observed and measured. ...Students know:
 - a. The position of an object can be described by locating it in relation to another in the background.
 - b. An object's motion can be described by recording the change in position of the object over time.
 - c. Tools and machines are used to apply pushes and pulls (forces) to make things move.

Science: Investigation and Experimentation

4. Students will:
 - a. Make predictions based on observed patterns and not random guessing.
 - g. Follow oral instructions for a scientific investigation.

GRADE THREE

Science: Physical Science

1. Energy and matter have multiple forms and can be changed from one form to another.
 - a. Energy comes from the sun to the Earth in the form of light.
 - b. Sources of stored energy take many forms, such as food, fuel, and batteries.
 - c. Machines and living things convert stored energy to motion and heat.

Science: Investigation and Experimentation

5. ...Students should develop their own questions and perform investigations. Students will:
 - a. Repeat observations to improve accuracy, and know that the results of similar scientific investigations seldom turn out exactly the same because of unexpected differences in things being investigated, methods, or areas of uncertainty in the observation.
 - e. Predict the outcome of a simple investigation, and compare the result to the prediction.

Math: Measurement and Geometry

- 2.6. Identify common solid objects that are the components needed to make a more complex solid object.

GRADE FOUR

Science: Investigation and Experimentation

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

GRADE FIVE

Science: Investigation and Experimentation

- 6b. Students will develop a testable question.
- 6c. Plan and conduct a simple investigation based on a student-developed question....

GRADE SIX

Science: Focus on Earth Science: Energy in the Earth System

- 3a. Students know that solar energy reaches Earth through radiation, mostly in the form of visible light.

Science: Focus on Earth Science: Resources

6. Sources of energy and materials differ in amounts, distribution, usefulness, and the time required for formation.
 - a. Students know the utility of energy sources is determined by factors that are involved in converting these sources to useful forms and the consequences of the conversion process.
 - b. Students know different natural energy...resources... and classify them as renewable or non-renewable.

Science: Investigation and Experimentation

- 7a. Students will develop a hypothesis.
- 7b. Select and use appropriate tools and technology ...to perform tests....
- 7e. Students will recognize whether evidence is consistent with a proposed explanation.