



Skateboards Have Levers & Fulcrums – Simple Machines

Teacher Pre-Activity Introduction and Preparation

Texas Essential Knowledge and Skills (TEKS) Alignment within this Activity

Sixth Grade

(6) Science concepts. The student knows that there is a relationship between force and motion. The student is expected to: (A) identify and describe the changes in position, direction of motion, and speed of an object when acted upon by force.

Seventh Grade

(6) Science concepts. The student knows that there is a relationship between force and motion. The student is expected to: (A) demonstrate basic relationships between force and motion using simple machines including pulleys and levers;

Eighth Grade

(7) Science concepts. The student knows that there is a relationship between force and motion. The student is expected to: (A) demonstrate how unbalanced forces cause changes in the speed or direction of an object's motion.

Teacher Notes

Simple machines are devices that make work easier with a single motion and consist of a few or no moving parts. A machine is a device that does work and simple machines make work easier. Simple machines do not allow you to do less work, but they do make the work easier in three main ways: 1) by lessening the force exerted, 2) by changing the distance over which a force is exerted, or 3) by changing the direction of the force exerted. Classic examples of simple machines are the screw, the wheel and axle, the wedge, the pulley, the inclined plane, and the lever. A lever is a straight rod or board that pivots on a point known as a fulcrum. Pushing down on one end of a lever results in the upward motion of the opposite end of the lever.

The modern skateboard has an upturned area on the nose (or front) of the board, as well as on the tail (or back) of the board. The upturned kick acts as a lever for the rider and helps to lessen the force exerted by the rider while performing tricks on ramps, in the street or on the flat ground. The lever action of a skateboard allows a rider to have greater control of the board and to make tricks easier to do. The lever on a skateboard allows the rider to perform ollies, nollies, tail slides and blunts to name a few choice tricks. The skateboard deck is an example of a lever with a fixed fulcrum or pivot point, which is the point where the trucks and wheels are attached to the desk.



Teacher Post-Activity Materials

Answers to Questions

1. What is a simple machine? How do they make work easier? Simple machines are devices that make work easier with a single motion. Simple machines do not allow you to do less work, but they do make the work easier in three main ways: 1) by lessening the force exerted, 2) by changing the distance over which a force is exerted, or 3) by changing the direction of the force exerted.
2. What is a lever? A lever is a straight rod or board that pivots on a point known as a fulcrum. Pushing down on one end of a lever results in the upward motion of the opposite end of the lever.
3. What kind of objects do you think of when you hear the word lever? List two levers that people use all the time. Answers can vary, but will probably include objects like see-saws, skateboards, or common tools like a crowbar or a hammer.
4. What is a fulcrum? A fulcrum is a fixed point around which a rigid lever moves. The place where the trucks of the skateboard and the deck come together is an example of a fulcrum. The fulcrum action allows the rider to control the movement of a trick by applying or releasing pressure to the fulcrum point.
5. What is force? A force is any push or pull, and can be a helpful force, as in the way the wind will push a sailboat forward on the water. It can also be a hindering force, such as when a salmon is trying to swim against the current in a river.

Extensions

Math can be integrated into the lesson by having the students measure the distance that the objects are catapulted. Participants may want to vary the objects that are catapulted. Be sure that they will not injure other students as the objects are released. Marshmallows (used in this lab) are the safest objects to use for this activity. From this, participants may make a connection between mass of the object and the distance it is catapulted.

1. Identify some levers that are used in society.
2. What different classes of levers are found in the real world?
3. What is the relationship between force and distance?
4. How can force be measured?

Simple machines are devices that make work easier in a single motion. Although not all simple machines are used in skateboarding and BMX, a number are present. If you take two or more simple machines and put them together, you will get a complex machine. Both skateboards and BMX are examples of complex machines. Can you identify all the simple machines that are in a skateboard? Can you identify all the simple machines that are in a BMX bike? How do you think the lever action of the skateboard helps riders make tricks easier to do?



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Student Laboratory Activity



Introduction

Beginning in the 1950s, skateboarding started all across California. Surfers took to the streets to practice the moves they were doing in the ocean. The first boards were merely flat pieces of solid wood that took their shapes and styles from the surfboard. Modern skateboard decks consist of an upturned area on the nose (or front) of the board, as well as on the tail (or back) of the board. The upturned kicks act as a lever for the rider and helps to lessen the force exerted by the rider while performing tricks on ramps, in the street or on the flat ground.

The lever action of a skateboard allows a rider to have greater control of the board and to make tricks easier to do. The lever on a skateboard allows the rider to perform ollies, nollies, tail slides and blunts to name a few choice tricks. In skateboarding, the place where the trucks and the deck come together is an example of a fulcrum or a fixed point around which a lever moves. The fulcrum action allows the rider to control the movement of a trick by applying or releasing pressure on either side of the fulcrum.



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Purpose

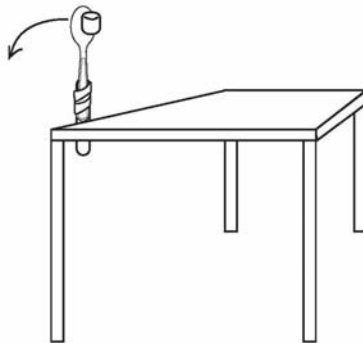
The student knows that there is a relationship between force and motion using simple machines including levers and fulcrums.

Things You Need

- Goggles
- Scissors
- Meter stick
- Tongue depressors
- Rubber bands
- Plastic spoons
- Plastic rulers
- Tops from Water bottles
- Duct tape
- Masking tape
- Marshmallows – small and large
- Modeling Clay
- Balance for weighing objects

What to Do

1. Using duct tape, secure one of the Tongue depressors to a plastic spoon lever so that it extends the arm of the spoon. Be sure to secure it tightly to the spoon. This will support the catapult arm and form the primary lever.
2. Using duct tape, tape another Tongue depressors to the lever so that it adds to the arm of the lever. This will extend the arm of your catapult.
3. Put your level (catapult) on the edge of the table and hold the end of it (the Tongue depressors) tightly down on the table. It is a good idea for one partner to hold the catapult and another to actually fire the objects.
4. Your catapult is ready for use! When you are using the catapult, always make sure to hold down the base.





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5. Set a beginning reference point with masking tape, this will be your starting point to see how far your object will fly.
6. Select a small marshmallow, weigh it and record its weight in grams (g) on your data sheet.
7. With the catapult ready to use, place a small marshmallow into the spoon and prepare to launch it.
8. When you have released the catapult, mark the final distance that the object flew. Record this distance in centimeters on your data chart. Remember to calculate the actual distance of the object from its beginning to its final landing spot. A third member of the team should be marking the distance it travels and measuring the distance flown by the object.
9. Repeat the experiment two more times to get a total of three trials for your experiment. Calculate the average flight of your object and compare this with classmates.
10. Try another object like a large marshmallow or a piece of modeling clay and see what results you can obtain. You can also make objects out of the modeling clay that can be of unique sizes and shapes. Be sure to record all your data and look for similarities and differences within your catapults and those of your classmates.
11. As an extension, see if you can create a better catapult using the materials that are provided, including the plastic rulers and tops from water bottles.





Student Laboratory Data Sheet

Data Table 1

Trial	Name of Object	Weight of Object (g)	Distance traveled (cm)
1			
2			
3			
Average			

Data Table 2

Trial	Name of Object	Weight of Object (g)	Distance traveled (cm)
1			
2			
3			
Average			

Data Table 3

Trial	Name of Object	Weight of Object (g)	Distance traveled (cm)
1			
2			
3			
Average			

Questions to Answer

Once your experiment is done, answer these questions and draw some conclusions.

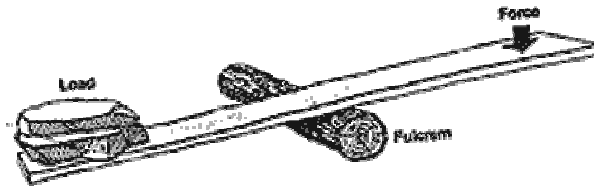
1. What is a simple machine? How do they make work easier?
2. What is a lever?
3. What kind of objects do you think of when you hear the word lever? List two levers that people use all the time.
4. What is a fulcrum?
5. What is force?



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What Is Going On?

Simple machines are devices that make work easier with a single motion and that also consist of a few or no moving parts. A machine is a device that does work and simple machines make work easier. Simple machines do not allow you to do less work, but they do make the work easier in three main ways: 1) by lessening the force exerted, 2) by changing the distance over which a force is exerted, or 3) by changing the direction of the force exerted. Classic examples of simple machines are the screw, the wheel and axle, the wedge, the pulley, the inclined plane, and the lever. A lever is a straight rod or board that pivots on a point known as a fulcrum. Pushing down on one end of a lever results in the upward motion of the opposite end of the fulcrum.



One common use of levers is to use a small force to overcome a large force. The lever is used for prying, as in the case of the crowbar, or for lifting. For example, the fulcrum is the point upon which a crowbar rests when used to lift or to pry loose some object; the effort is applied at the end farther from the fulcrum and is relatively small. The distance from the operator's hands to the fulcrum is known as the lever arm, or effort arm; the object being pried loose is the resisting force, or resistance; the object's distance from the fulcrum is the resistance arm.

Where Does This Happen in Real Life?

The modern skateboard has an upturned area on the nose (or front) of the board, as well as on the tail (or back) of the board. The upturned kick acts as a lever for the rider and helps to lessen the force exerted by the rider while performing tricks on ramps, in the street or on the flat ground. The lever action of a skateboard allows a rider to have greater control of the board and to make tricks easier to do. The lever on a skateboard allows the rider to perform ollies, nollies, tail slides and blunts to name a few choice tricks. In skateboarding, the place where the trucks and the deck come together is an example of a fulcrum or a fixed point around which a lever moves. The fulcrum action allows the rider to control the movement of a trick by applying or releasing pressure on either side of the fulcrum.

Many other common tools, instruments, and appliances use the principle of the lever. Levers in which the fulcrum is located between the effort and the resistance, as in the crowbar and a double pan balance, are known as first-class levers. The fulcrum may also be located at one end of the lever, with the effort applied at the other end and the resistance in between. This type of lever, illustrated by the wheelbarrow and a nutcracker, is known as a second-class lever. The final possibility, known as a third-class lever, has the effort applied between the fulcrum and the resistance such as tongs, brooms, fishing poles or golf clubs.