

Simple Machines Playground

Grade: 1-2
Time: 1.5hr

Activity Overview :

Today we will be learning about different kinds of simple machines, how they work, and how we can build our own playground using these machines! You might be surprised to find that many pieces of playground equipment are simple machines such as levers, pulleys, inclined planes and wheels and axles.

Before we begin, think about the following questions:

- Can you think of examples of simple machines you use in your own life?
- What is your favourite part of the playground?

Materials:

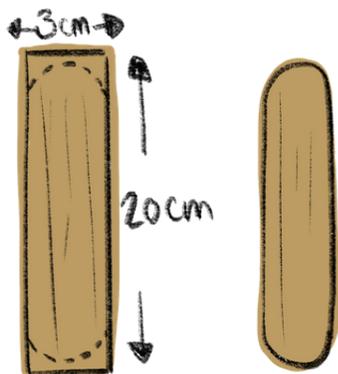
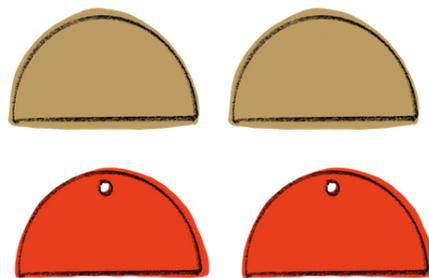
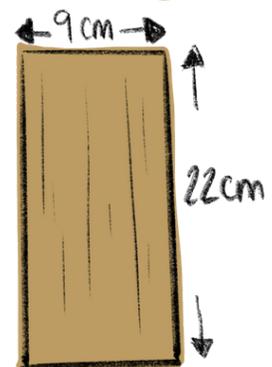
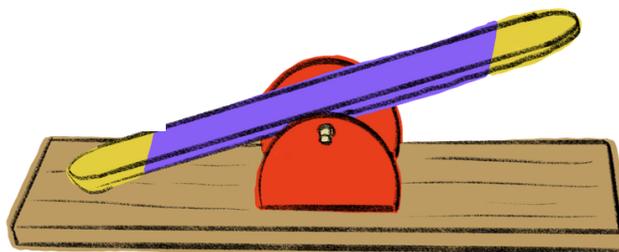
- cardboard
- white glue, hot glue, or tape
- scissors
- colourful paper or paint
- toothpick (1)
- straws (3)
- skewers (3)
- balloon (optional)
- string (optional)
- plastic bottle
- bottle cap (1)



Don't worry if you don't have all these supplies. Experiment with other everyday items and see what you can build!

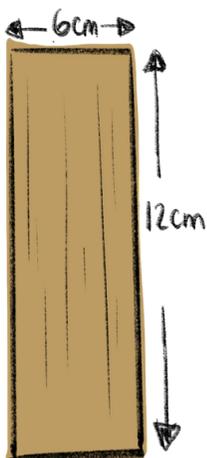
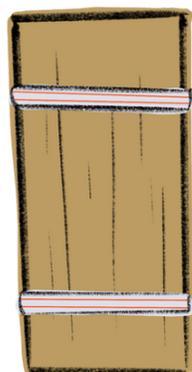
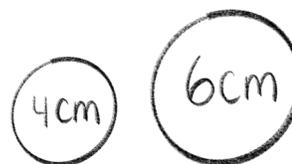
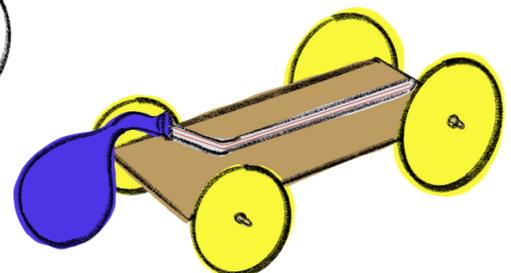
Activity (Seesaw - Lever):

- 1** Cut a 20 cm long and 3 cm wide rectangle out of cardboard. Round each corner of the rectangle. This will be the beam of your seesaw.
- 2** Cut two semi circles of equal size, out of cardboard, these will hold the beam in place. Decorate your base, semi circles, and beam with colourful paper or paint.
- 3** Cut out a 22 cm long and 9 cm wide rectangle of cardboard. This will be the base.
- 4** With help of a parent or guardian, pierce a hole near the top of each semi circle.
- 5** Tape or glue the toothpick to the center of the beam (perpendicular to the beam with the ends of the toothpicks sticking out), this will be the hinge or fulcrum.
- 6** Put the toothpick through the holes in the semicircles, have one semi-circle on either side of the beam. Tape or glue the semicircles down to the base
- 7** Move the beam in an upward and downward motion (press on one side of the beam) and you've got a seesaw!

Step 1**Step 2****Step 3****Step 5-7**

Activity (Go-Car - Wheel and Axle):

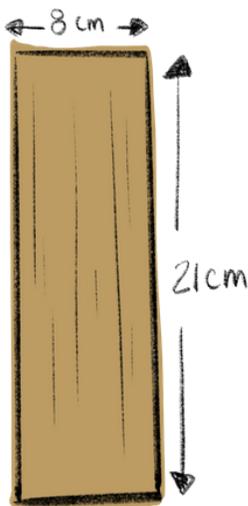
- 1 Cut out a rectangular piece of cardboard that is 12 cm long and 6 cm wide, this will be the base of your car.
- 2 Cut two straws to a length of 6 cm, these pieces will hold the axles of your car in place.
- 3 Attach the 6 cm straws to the rectangular piece of cardboard using glue or tape
 - Attach the first straw 2 cm from the top of the piece of cardboard
 - Attach the second straw 2 cm from the bottom of the piece of cardboard
- 4 Cut out four wheels for your car out of cardboard, the two back wheels will have a 6 cm diameter and the two front wheels will have a 4 cm diameter.
- 5 Using your skewers, poke holes in the middle of each wheel.
- 6 Glue or tape one end of a skewer into the hole made in the wheel, the skewer will be the axle of your car.
- 7 Thread the skewer attached to the wheel through the straw on the base of the car
- 8 Glue or tape the wheel of the same size to the other end of the skewer after it is in the straw.
- 9 Repeat steps 6-8 for the other set of wheels, now you have two axles and four wheels on your car, give it a push and watch it roll!

Step 1**Step 2-3****Step 4****Step 5-9**

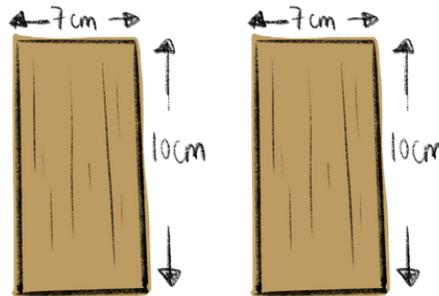
Activity (Ramp- Inclined Plane):

- 1 Cut one 21 cm long and 8 cm wide rectangle out of cardboard.
- 2 Cut two 10 cm long and two 7 cm wide rectangles out of cardboard.
- 3 Cut one 25 cm long and 12 cm wide rectangle out of cardboard. This will be the base. Decorate all the rectangles with colourful paper or paint.
- 4 Glue or tape the top two edges of the 10X7 cm rectangle at an angle as if you are building the base of a house of cards, then glue or tape it down to the base.
- 5 Glue or tape the 21X8 cm rectangle at an angle to the top of the two 10X5 cm rectangles. Add some construction paper to the end of the ramp to make the ramp curve and for a smooth landing!

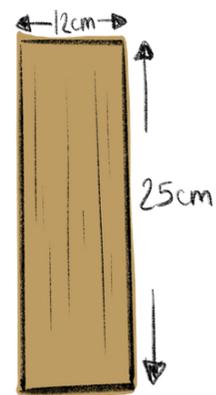
Step 1



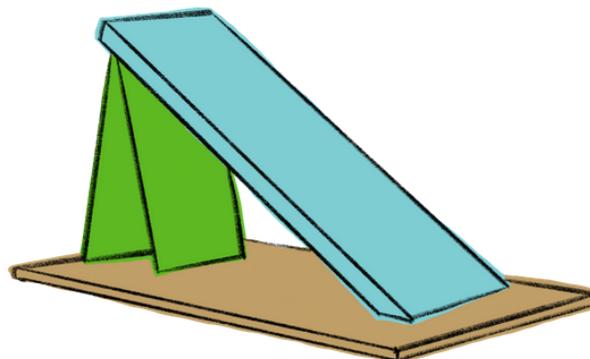
Step 2



Step 3



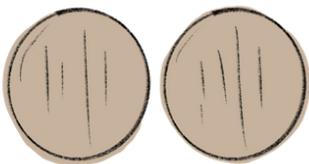
Step 4-5



Activity (Lift- Pulley)

- 1 Trace a cup to make two circles on a piece of cardboard and cut them out.
- 2 With the help of a parent or guardian, pierce a hole through the center of the two cardboard cut out circles and through a bottle cap. Make sure the bottle cap is smaller than the two cardboard circles.
- 3 Put a skewer through the circles and bottle cap in the following order: cardboard circle, bottle cap, cardboard circle. This will be the pulley.
- 4 Cut out the bottom half of a plastic bottle and pierce a hole near the top of both sides of the bottles using a skewer.
- 5 Thread a piece of string through both holes tying a knot on either side to make a handle on the bottle.
- 6 Tie one end of a string to the handle and loop the other end around the pulley. Pull the string down or release it upwards to watch your pulley in action!
- 7 You can balance your pulley against the back of two chairs or make columns for it by using two paper towel rolls.
 - Pierce a hole near the top of either side of the two rolls and put the skewer through the holes.
 - Cut a 30 cm long and 12 cm wide rectangle out of cardboard. This will be the base.
 - Glue or tape the two paper towel rolls to the base.

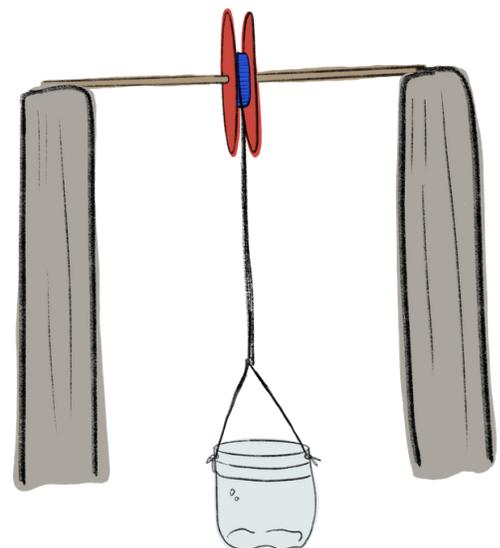
Step 1



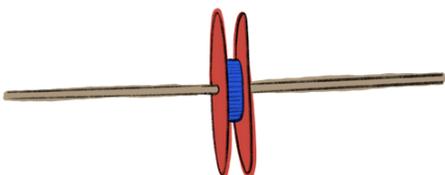
Step 4-5



Step 6-7



Step 2-3



Engineering and Science Connections

A **simple machine** is a mechanical device that has only a few or no moving parts to it. Simple machines make our lives easier by helping us do work without exerting as much force. For example, a pulley lets us lift more weight than we would be able to normally with just our arms. What we built today are examples of simple machines: levers, wheels and axles, inclined planes, and pulleys.

A **lever** is a simple machine made of a **beam** which rests on a **hinge** or **fulcrum**. The beam is fixed to the fulcrum and moves about this point. The seesaw we made has its fulcrum in the middle of the beam. When you apply a **force** (press down) on one end of the beam, the other end lifts up.

A **wheel and axle** is a mechanism that allows wheels to spin. An **axle** is a rod that passes through the centre of wheels and when it is twisted, causes the wheels to spin.

An **inclined plane** is a flat surface that has been tilted up or down at an angle, also known as a ramp. Objects can be pushed or pulled either up or down an inclined plane.

A **pulley** is a wheel with a groove running along the centre and a rim where a rope, cord, or cable can rest in. Pulleys change the direction a force acts in. When you pull down on the rope in a pulley, it lifts the object that is attached to the other end of the rope up off the ground. Pulleys are used to lift very heavy objects.

Extensions

Make your car move on its own! If you have access to a balloon, you can make your car move on its own!

- Glue or tape your third straw on the top of your car, One end of the straw should be sticking off the back of the car. The other end of the straw should be bent upwards
- Attach the balloon to the end of the straw that is bent upwards, tie it with a string to hold it securely Blow into the end of the straw to blow up the balloon
- Place the car on the ground and watch it roll away!

Make your car go up the ramp! If you do not have access to a balloon:

- Attach a string to one end of your car
- Place the car at the bottom of the ramp
- Hold the string taut at the top of the ramp and pull downwards, watch your car move up the ramp!

If you have access to a balloon:

- First follow the first extension and make your car move on its own using a balloon
- Blow up the balloon on your car
- Place the car at the bottom of the ramp with the balloon facing the top of the ramp
- Watch your car roll up the ramp!

Add a handle to your pulley! To help lift the load on your pulley, tape or glue the end of the string to the pulley. Add a handle using a piece of cardboard or a toothpick to one end of the skewer. As you rotate the handle, the string will wind around the pulley lifting the load. Rotate the handle in the opposite direction and the string will unwind, lowering the load.

Share your creations!

Don't forget to share your experiments and creations with us! We would love to see what you've made. You can Email us at: esqinfo@uwaterloo.ca or send us a message/tag us on our social media!

Facebook: @uwengoutreach

Twitter: @UWEngOutreach

Instagram: @uwengoutreach

Thanks for exploring, discovering, and learning with us!

3, 2, 1 Done!

3 - Write or draw 3 things you learned from this activity

2 - Write or draw 2 things you found super interesting or cool and want to learn more about

1 - Do you have any questions about the activity? Did something make you wonder...what if? how? or why?