RUBE GOLDBERG MACHINES

INDEPENDENT INVENTOR ACTIVITY 2: SIMPLE MACHINES

Today I Will…

Today you will learn about the six simple machines and how they function. Through hands-on activities, you will explore how these tools are the base for almost any machine or more complex device that we use in real life. Tools make our lives easier, and these activities will demonstrate how.

Good Things To Know Before I Begin…

This activity involves several "stations" as you examine each of the six simple machines. You may need more than just one session to complete the stations. Do one or a few at a time, but you do not have to do it all in one day. You should spend about 10 minutes exploring each simple machine and how it works. We recommend that you use our Google Slides for this activity as they will also help you learn how these machines work.

I Will Need…

- Google Slides: YIP RGM Lesson 2: Simple Machines **(optional)**
- **VIDEO** (included in Google Slides): **Open A Refrigerator RGM**
  LINK: https://www.youtube.com/watch?v=wp2EY2wifn8
- **Simple Machine Station Supplies**

Lever

- ___Ruler
- ___Soup can or paper towel roll
- ___Objects to lift (bar of soap in its wrapper, a wooden block, etc.)

Inclined Plane

- 2 boards (varying length)
- String
- Rubber bands (several)
- Books (several)

Wheel & Axel

- Ruler
- Matchbox cars
- Tape

Screw

- ___Cut out paper right-triangles of various sizes (color the diagonal edge with marker)
- ___Tape
- ___Pencil

Wedge

- ___Playdough or modeling clay
- ___Plastic knife
- ___Scissors

Pulley

- ___Small bucket (or make a bucket using a cup with a string attached for a handle)
- ___Sewing spool
- ___String
- ___Pencil
- ___Object to lift (small weight, pennies or beans, etc.)

Inventor Activities

What happens if you try to lift a heavy box? It's hard and you may not be able to lift it far off the ground or even at all. What could you use to help you? Maybe a cart or a dolly?

Carts and Dollies are examples of devices that help us move heavy loads using simple machines. There are 6 types of simple machines.

Inclined Plane	**Wedge**
Lever	**Wheel & Axle**
Pulley	**Screw**

The Google Slides for RGM Lesson 2 also show good examples of the six different simple machines, so you may want to look at them.

Watch this video of a Rube Goldberg Machine and see if you can point out some of the simple machines that it includes. (Examples: garage door, file cabinet, hammer = lever, binder = incline plane, dolly = wheel & axle, punching glove = screw, bucket = pulleys, refrigerator opening = wedge, etc). Notice the everyday objects used to create the machine (alarm clock, skateboard, bicycle, drum, etc.). Rewatch as necessary since the video is only 15 seconds in length.

Video: Open A Refrigerator RGM (Video is included in Google Slides RGM Lesson 2)
Link: https://www.youtube.com/watch?v=wp2EY2wifn8

Activity: Simple Machines Stations

Set up the simple machine activities described below. You can do them in any order, and you do not have to do them all at once. Play around with each machine and see how you can adjust the materials to make your work harder or easier. You should spend about 10 minutes playing with each activity.

Set up the simple machine stations as you go.

LEVER
Task: Use a lever to move/lift a load. You will make a lever out of the given materials and explore the relationship of the fulcrum to the load. You will discover that it is easier to move an object when the fulcrum is closer to the load.
Set Up: Lay the soup can or toilet paper roll on its side (this is the fulcrum). Place a ruler or other long plank across the top so that it acts as a "see-saw". Place the object to lift on one side of the plank. Press down on the open side of the plank (the side without the object).
Lever Hint: What happens if you move the object closer to the fulcrum (so it's not on the edge but closer to the middle of the plank)? What happens if you move the fulcrum? Move the fulcrum closer to the load. Move the fulcrum away from the load and experiment.

INCLINED PLANE
Task: Use an inclined plane to move a heavy load. You will make inclined planes with boards varying the slope of the board. There will be rubber bands around the books. Tie the string to the rubber bands and pull the books up the different inclined planes. You can also pull the books straight up without using the inclined planes.
Set Up: Use more books or a box or other larger object (your base) to use to create a "slide" using a board which rests on the object and then slopes down to a surface- this creates an inclined plane. Try to find several bases so that you can make inclined planes of different slopes (inclines) and lengths. Place a rubber band around a heavy book and tie a string around the rubber band so that you can use the string to pull the book up the inclined plane.
Inclined Plane Hint: What happens if you just try to lift the book straight up using string attached to the rubber band? Then try to pull the book up the inclined plane. Make a steeper inclined plane and try to pull the book up again. Look at the stretch of the rubber bands straight up compared to different inclined planes. You will discover that it takes more work to move an object up an inclined plane with the steepest slope, but the most work is required to lift the book straight up.

WHEEL & AXLE

Task: Explore how a wheel & axel reduce friction to make moving an object easier. Starting a car at the starting line, push one car on its side and the other on its wheels. Note the difference in distance traveled and the speed of travel.

Set up: Place several matchbox cars on the table along with a ruler. Use a piece of tape to mark a "starting line" on the table. Then push the cars, some on their sides or tops, and others using their wheels, and measure the distance traveled using a ruler and observe any differences in speed of travel.

Wheel & Axle Hint: What happens when you try to push the car when it's upside down or on its side? What happens when you push it so that it uses the wheels to roll? Try cars of various sizes and try to push them on their side, upside down and using their wheels as normal. Which cars go the farthest distance? Which ones move more smoothly? (Note: It is important that you try to push each car with the same amount of force. A stronger push will affect the distance the car goes no matter if its on its side, top or wheels.)

SCREW

Task: Make a screw using an inclined plane around a cylinder. You will see the inclined plane as part of the screw. Experiment with different size triangles. Count the number of "ridges" (the colored stripes of the diagonals). What do you notice when using larger or smaller triangles?

Set Up: Take the cut-out right-triangles (the long edge should be colored with a marker). Turn the triangles so the colored edge is face down. Tape one of the short edges of the triangle to a pencil. Wrap the triangle around the pencil.

Screw Hint: When the triangle is more gradual (the diagonal of the triangle is less steep), there are more "ridges" on the screw- it will take more turns to screw it in, but it takes less effort to turn it each time. When the triangle is steeper, there are less "ridges" on the screw- it will take less turns to screw it in, but it takes more effort for each turn.

WEDGE

Task: Explore how different wedges are used to split or move things. You will cut through playdough/modeling clay using various objects (plastic knife, scissors, fingers) to observe how wedges are used to cut and split things apart.

Set Up: Place several lumps of playdough/clay on a work surface. Use a plastic knife to cut a lump in half. Then use a finger to cut a lump. Finally use the scissors (scissors are not a wedge, but they use wedges, the blades, to do work) to cut the lump.

Wedge Hint: How are the cuts different? Which tool cuts the easiest? How does the shape of the wedge affect the cutting?

PULLEY
Objective: Use a pully to move a load.
Set Up: You will make a pulley by attaching a piece of string to the handle of a small bucket and run the string over the spool attached to a pencil. Fill the bucket with a small, weighted object. Pull the string to lift the bucket. Then try to lift the bucket without the pulley. If necessary, you can make a bucket using string and a plastic or paper cup. Punch two small holes just under the rim of the cup facing opposite each other. Then, using a piece of string (about 4-5 inches long), loop each end of the string through one of the holes and tie a knot to create a handle.
Pulley Hint: Compare how it feels to lift the heavy bucket using the pulley and not using the pulley.

Did anything about your simple machine surprise you?