CLASS 5

CONTENTS

SIMPLE POWERED MACHINES

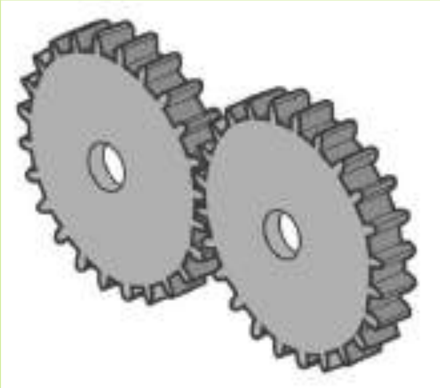
1. GEAR G1-G10

The gear is a simple machine that can be used to efficiently transfer force and motion.

Connect

Gears are wheels with teeth that mesh with each other. Because the teeth lock together, they can efficiently transfer force and motion.

Did you know?
Not all gears are round. Some gears are square, triangular, and even elliptical.



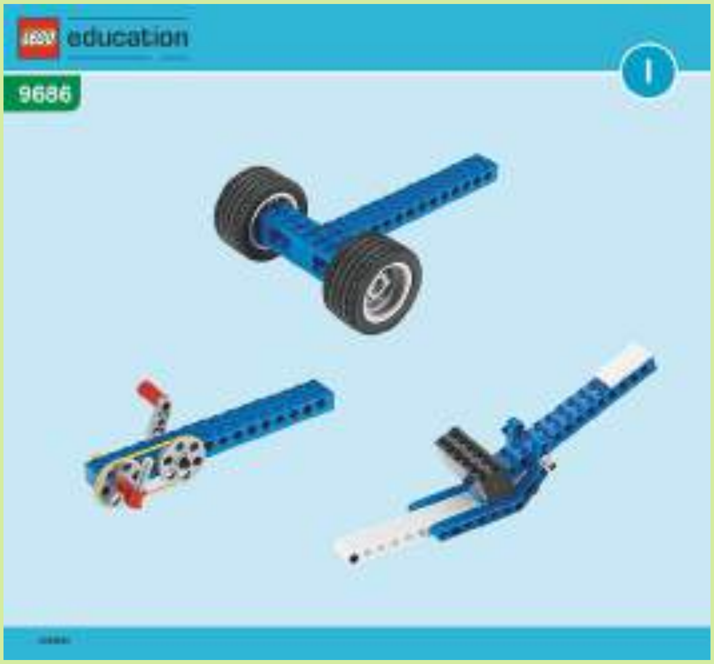
The drive gear is the gear that is turned by an outside effort, for instance your hand or an engine. Any gear that is turned by another gear is called a driven gear or follower. The drive gear provides the input force and the driven gear delivers the output force. Using a gear system can create change in speed, direction, and force. But there are always advantages and disadvantages. For example, you cannot have both more output force and an increase in speed at the same time.

To determine the ratio of which two meshed gears will move relative to each other, divide the number of teeth on the driven gear by the number of teeth on the drive gear. This is called the gear ratio. If a driven gear with 24 teeth is meshed with a drive gear with 48 teeth, there is a 1:2 gear ratio. That means the driven gear will turn twice as fast as the drive gear.

Gears are found in many machines where there is the need to control the speed of rotary movement and turning force. Common examples include power tools, cars, and egg beaters!

Construct

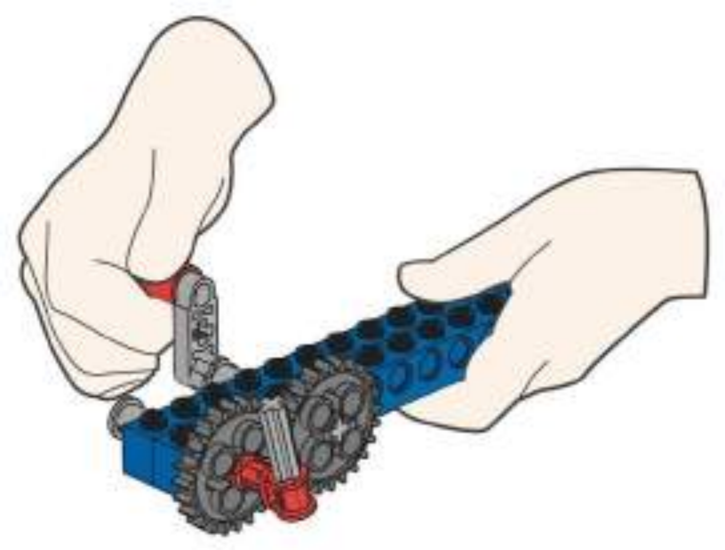
Build the following models. Use the Contemplate ideas below and on the Student Worksheet to learn about each model, one at a time.



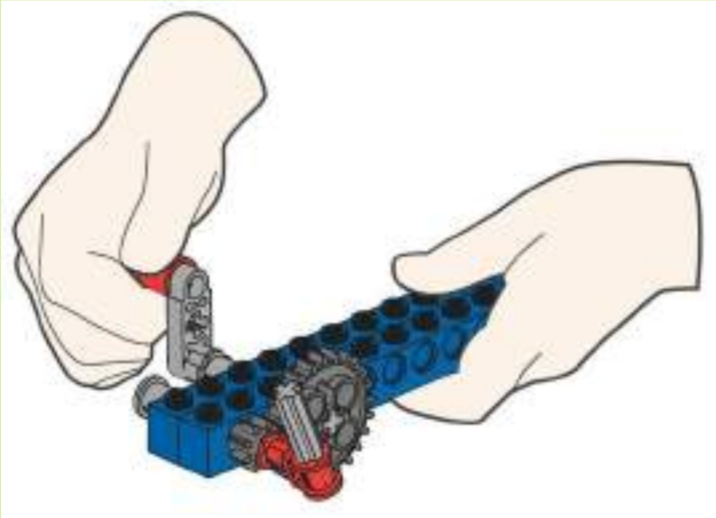
Contemplate

G1

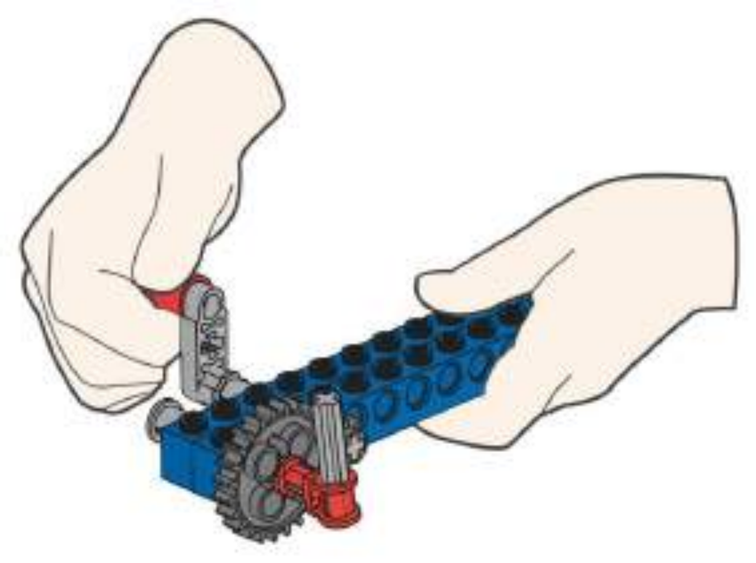
This model shows a 1:1 gear ratio. The speeds of the drive gear and the driven gears are the same, because they have the same number of teeth. The drive and driven gears turn in opposite directions.



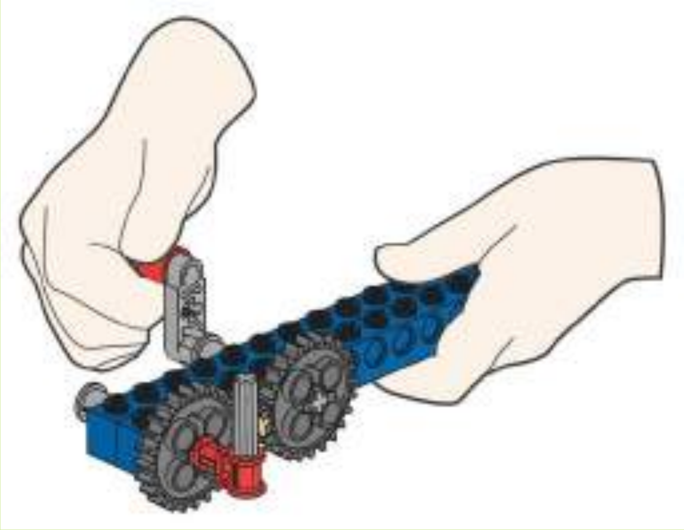
G2
This model has a 1:3 gear ratio. The larger drive gear turns the smaller driven gear, resulting in increased speed, but reduced output force. This is called gearing up.



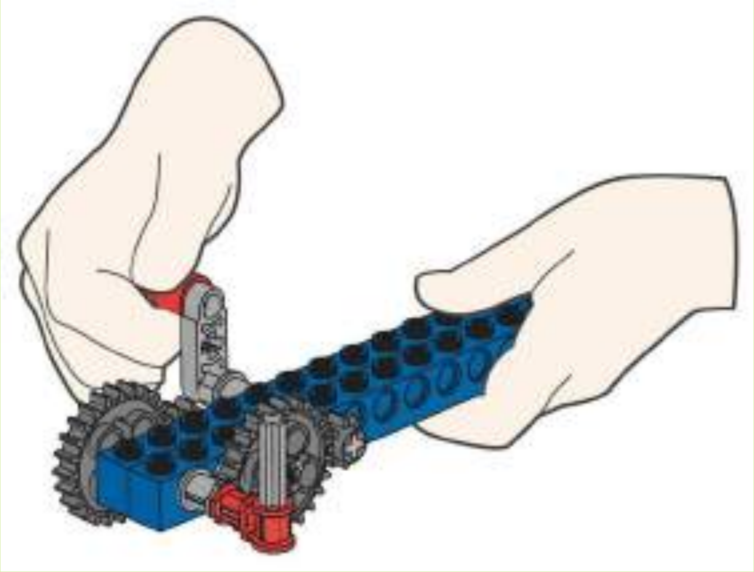
G3
This model has a 3:1 gear ratio. The smaller drive turns the larger driven gear, resulting in reduced speed, but increased output force. This is called gearing down.



G4
This model has a 1:1 gear ratio. The small middle gear is an idler gear. The idler gear does not affect the gear ratio, speed or output force of either the drive or the driven gears. The drive and the driven gears turn in the same direction and at the same speed.

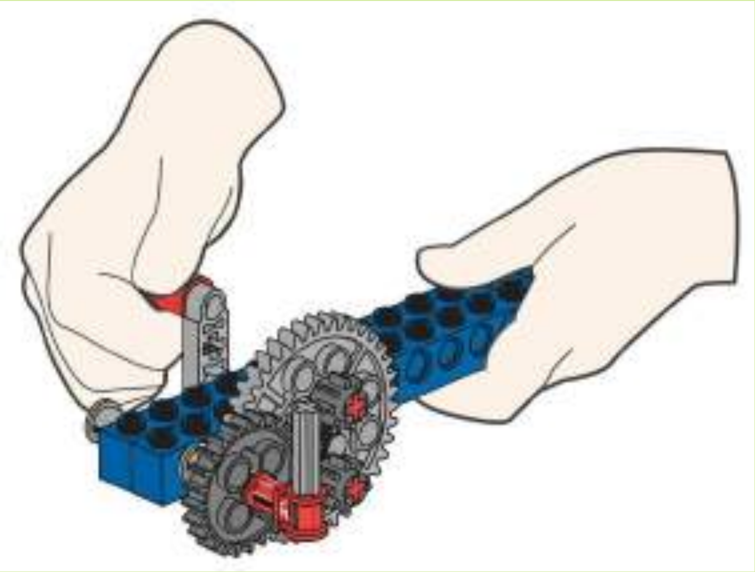


G5
This model shows a compound gearing with a 9:1 gear ratio. Because of this, the turning speed is significantly reduced and the output force is greatly increased. The smaller drive gear slowly turns the larger driven gear. The smaller gear on the same axle as the driven gear is now set in motion and is slowly turning the second large driven gear making it turn even more slowly.



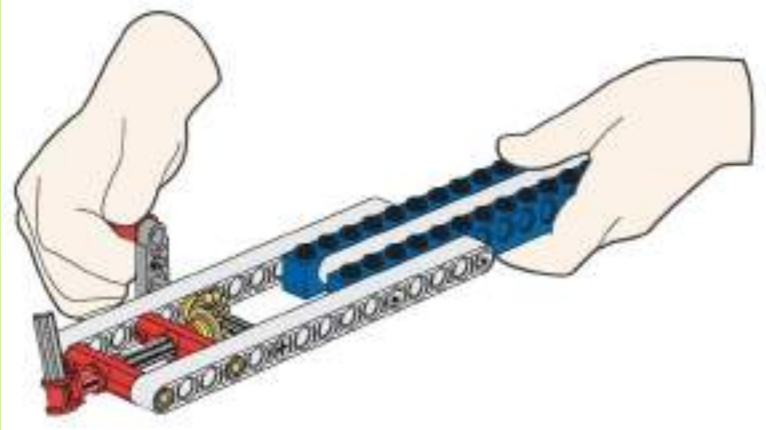
G6

This model shows a gearing set up for periodic movement e.g. the driven gear turns for a short while then stops for a moment. Speed is significantly reduced, as movement only occurs when the driven gear is meshed with one of the two drive gears.



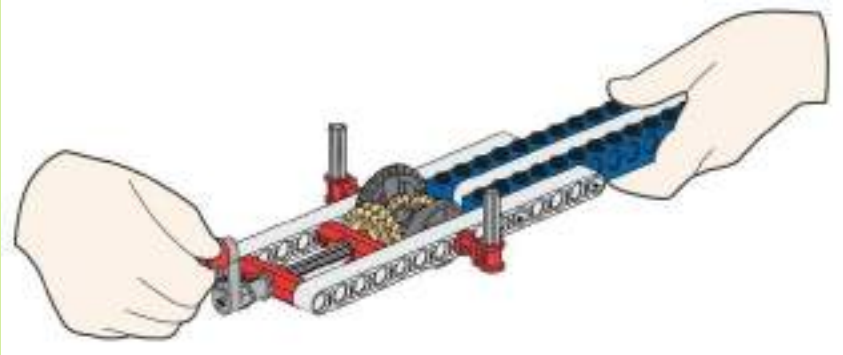
G7

This model shows an angle gearing with a 1:1 gear ratio. The two meshed bevel gears transfer the speed and force unchanged, but at an angle of 90º.



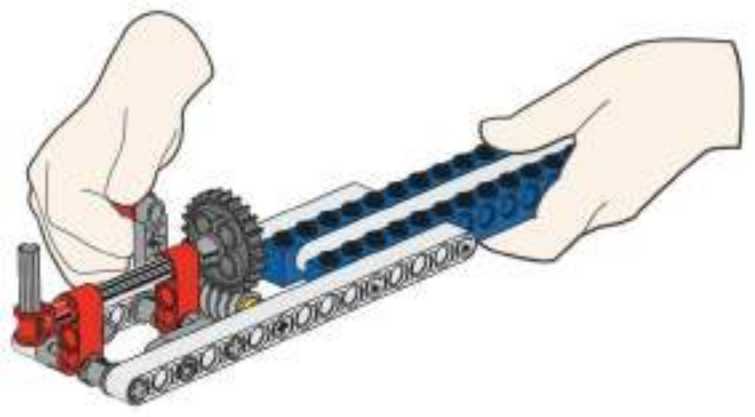
G8

This model shows a differential gearing with a gear ratio of either 28:20 or 7:10. The input force is transferred to two output forces at an angle of 90º. When one output pointer is stopped the other will double its original speed. When both output pointers are stopped the handle cannot be turned.



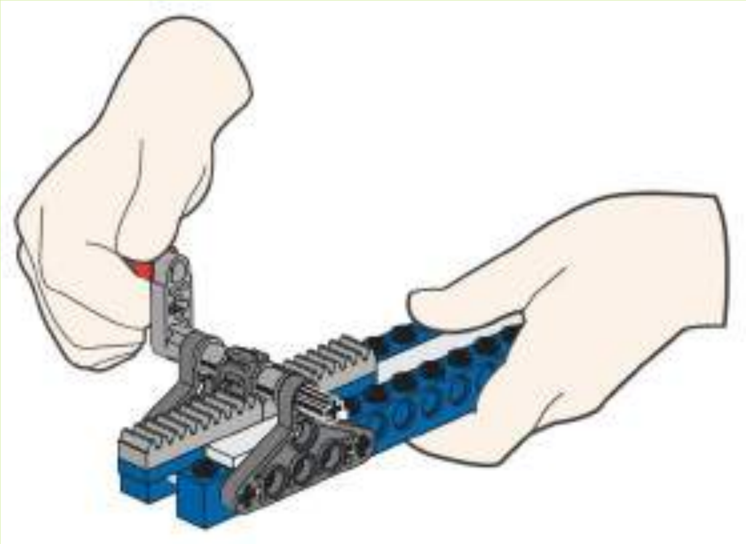
G9

This model shows a worm gear with a 24:1 gear ratio. It reduces speed significantly as it takes a complete turn of the worm gear to move the gear above by a single tooth. It changes direction by 90º. The output force is increased significantly. Worm gears can only be used as a drive gear.



G10

This model shows a rack and pinion gearing. Unlike the previous gears a rack and pinion gearing can only be used for linear motion, not rotary. When the handle is turned the gear rack moves forward or backwards depending on the rotational direction of the small gear (called a pinion).



2. Sweeper 1A+1B

Explore the scientific concepts of bevel gears, gearing up, pulleys, safety systems, distance and friction.

Connect

The path is covered in trash and leaves. It looks terrible and could be dangerous if someone slips on it! Now Jack and Jill have the job of cleaning it up, but they are not keen on their brooms and would much rather play on their cart.

Zog the Dog tries to help out but he’s not very good at it.

Suddenly they get an idea about combining the broom with the cart, but they are not sure exactly how to make it work.

How can you combine pushing a cart with cleaning a path?
Let’s find out!

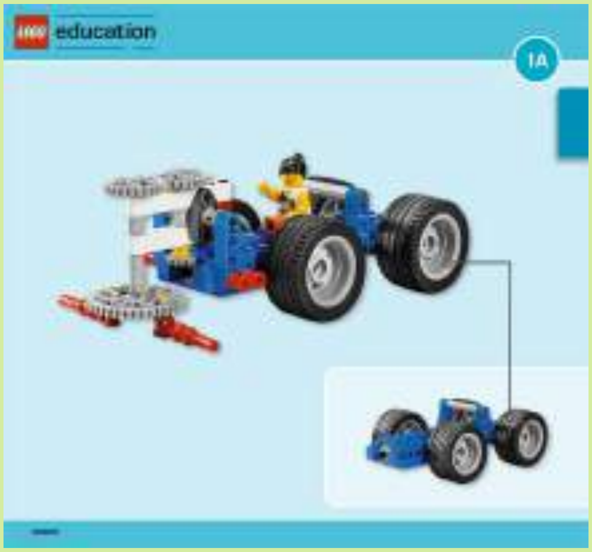
Construct

Make the Test Park
Use a smooth tabletop or floor, and place your crumb-proof wall or box on it.

Evenly spread out strips of crumpled paper scraps across a 10 cm (≈ 4 in) wide and 60 cm (≈ 24 in) long section of your park. This is the path covered in litter.

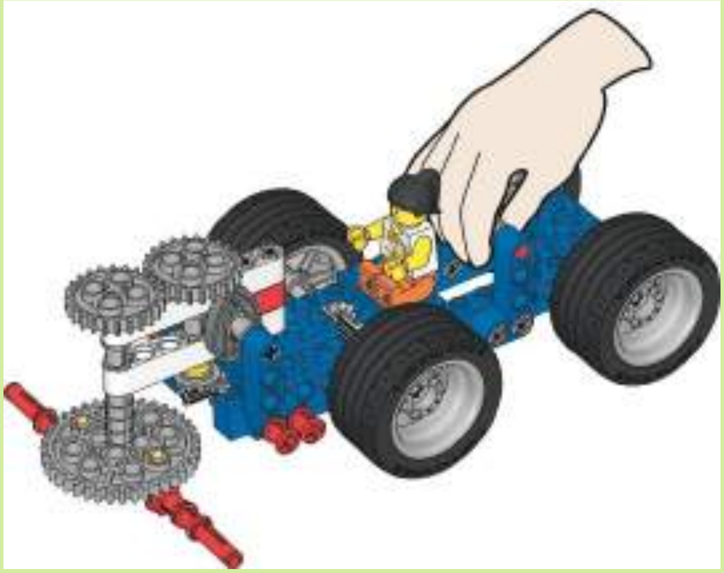
Leave plenty of room on either side of the path for the scraps to fly!

Build the Sweeper



Test That It Runs Smoothly

Push it gently across the table. The spinner should spin freely without hitting the frame of the cart and the sweeper 'blades' should open out and spin without touching the table.



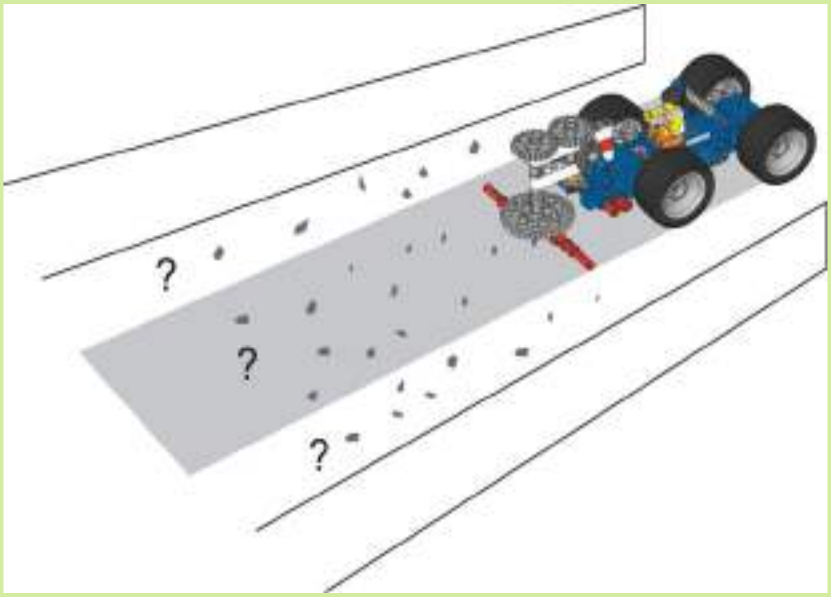
Contemplate

How well does it sweep?
Push it along the dirty path. How much of the scraps did you sweep aside? A quarter? Half?

What problems are there with this design? Estimate the amount swept aside compared to what is left on the strip.

It is not a fast sweeper and it doesn't actually pick up the scraps!

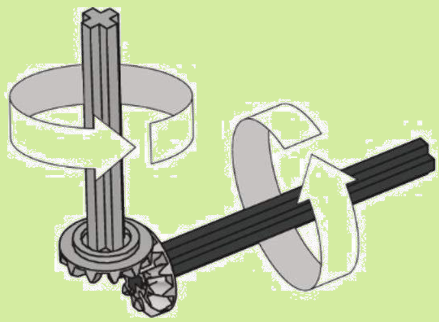
Did you know?
All the gears with regular teeth, like the big gear, are called spur gears.

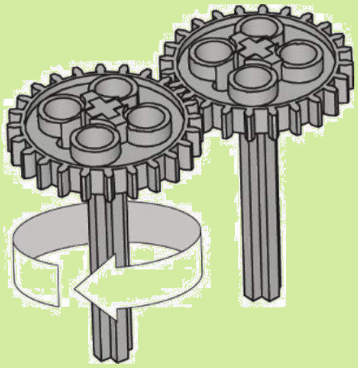


What is the gearing of the sweeper?
Push the sweeper along so the cart's wheels turn once. How many times does the sweeper head turn? Can you explain?

The sweeper head turns once. The gearing is 1:1. All the bevel and spur gears that mesh with each other are the same size. So there is no change in speed.

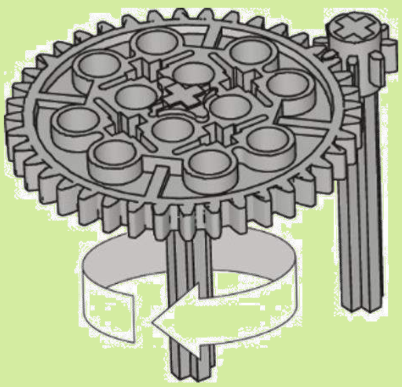
Tip:
What do the bevel gears do? They turn the direction of movement through 90°. They send moving energy around corners!

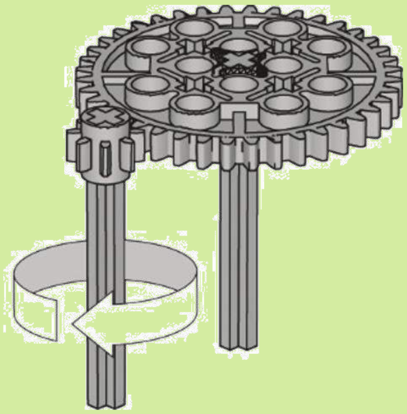




How can we make it sweep faster?
Try different combinations of drive gears (step 12, step 13).

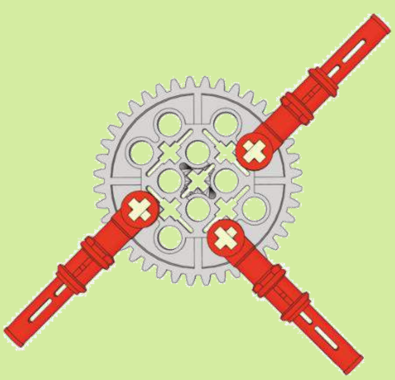
Step 12 makes the sweeper head far too slow, step 13 makes it 5 times as fast. Note the 40-tooth gear driving the 8-tooth gear!

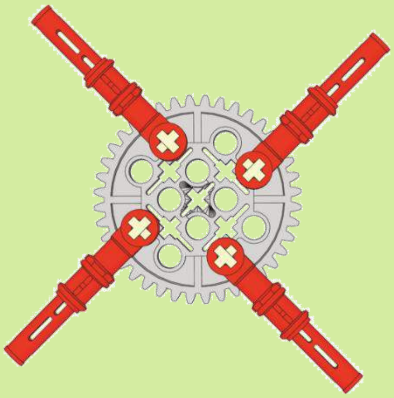




Jack and Jill would like to finish the job as quickly as possible so no one will fall over in the leaves and hurt themselves. To help them, try adding more blades to the sweeper head (step 14).

Three blades make it unbalanced and even worse than 2 blades. Four blades is better, and in balance.





Danger!
Push the sweeper and hold the sweeper head. What happens and what problems could this lead to?

The wheels may lock and the gears jump. Any items getting stuck in the sweeper may overload the machine or break the gears.

Continue

A Safer Sweeper
Rebuild the model to be driven by pulley belts. Try out different pulley systems. Predict and test how fast they will spin and how well they sweep.

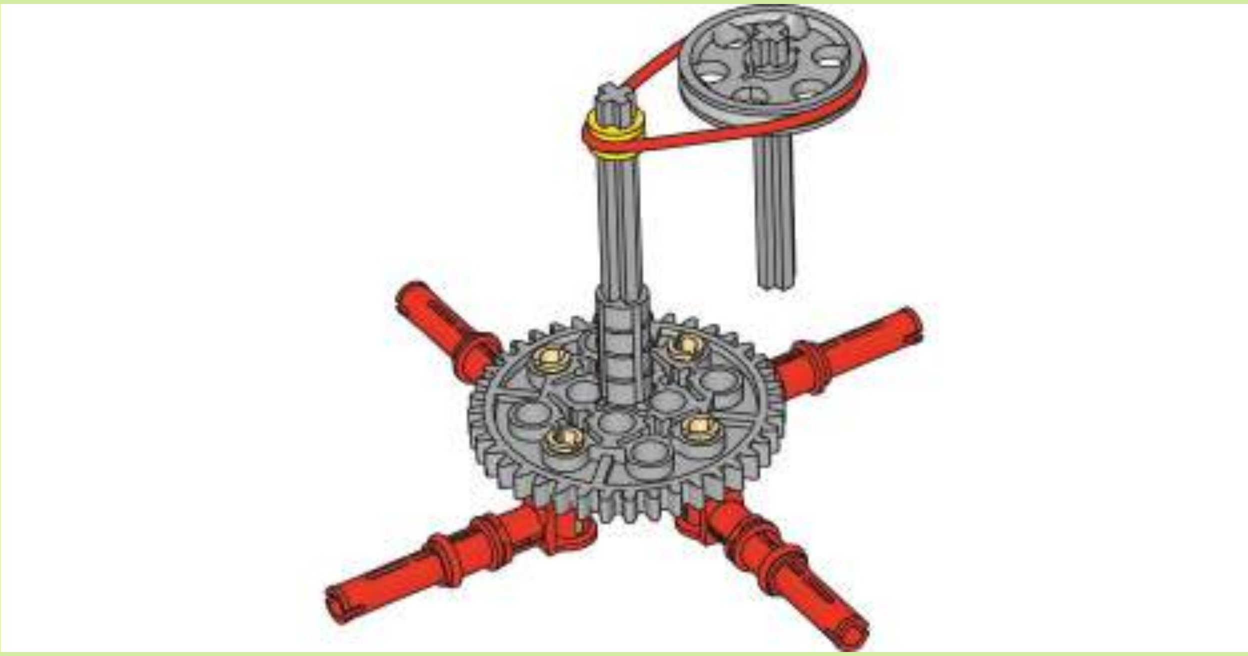
The sweeper head usually rotates more quickly. The bigger the driver pulley, the faster the rotation. It is harder to push though as there is more friction on the axles.

Push the sweeper and hold the sweeper head again. What happens? What are the pros and cons?

The driving band slips.

Good Points:
The sweeper will stop if something jams in it. It could be safer for the operator too.

Bad Points:
It takes more energy to push.



3. FISHING ROD

Explore the scientific concepts of pulleys, levers, pawl and ratchet, forces and properties of materials.

Connect

Jack and Jill are at a friend's birthday party with some other children. They are in the garden and they have been selected to catch fish in the new Fishing Pond.

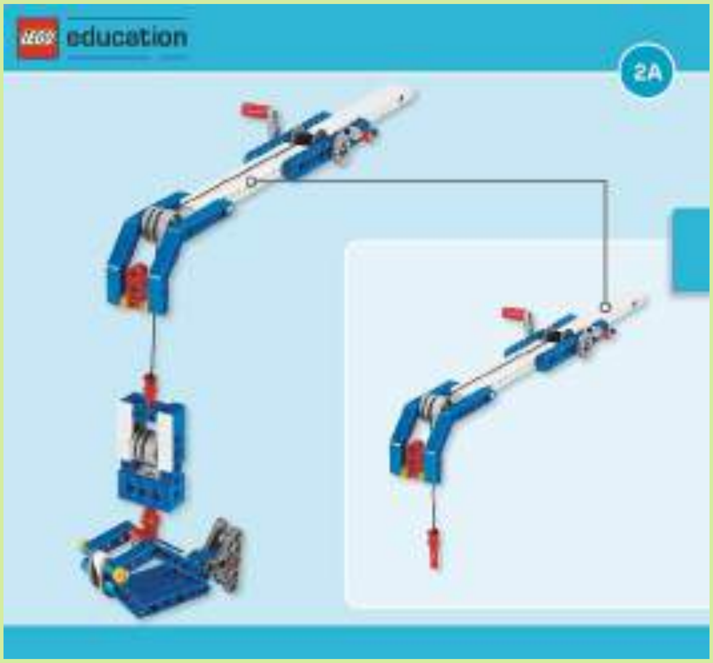
They have great fun, when suddenly Jack catches the largest and heaviest fish in the pond. Even using all his strength, he can't reel in the heavy fish.

Jill gets an idea as to how to reel in the fish. What do you think she plans on doing?

How can we make an exciting fishing device for Jack and Jill, and land the large fish?
Let's find out!

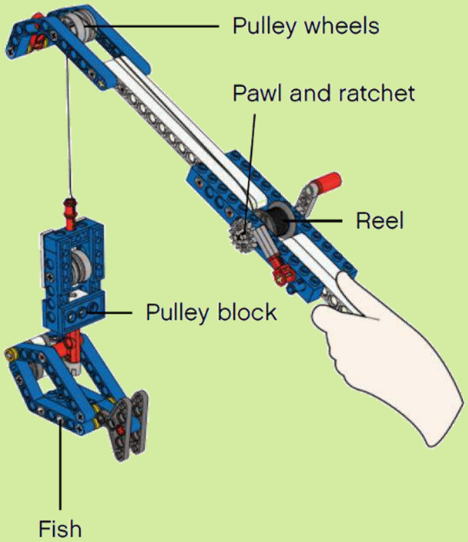
Construct

Build the Fishing Rod



Fine-Tune Your Fishing Rod
Loosen any overly tight bushings so that the reel and pulleys roll freely. If not, the tests will not work properly.

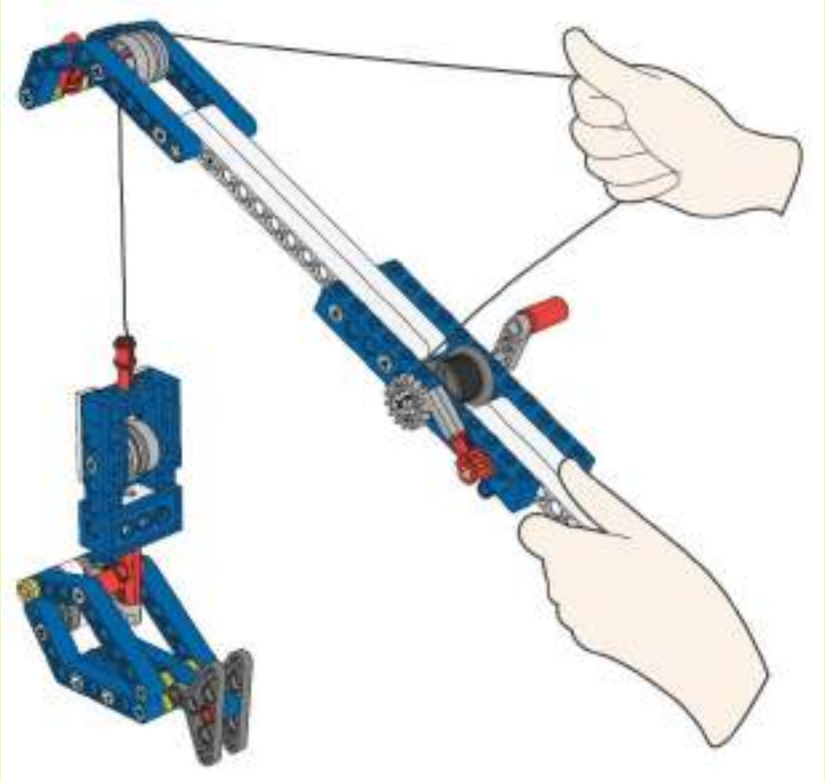
Test to See If You Can Catch the Fish
You may need more than one attempt. Try catching a fish and releasing it from the hook several times.



Contemplate

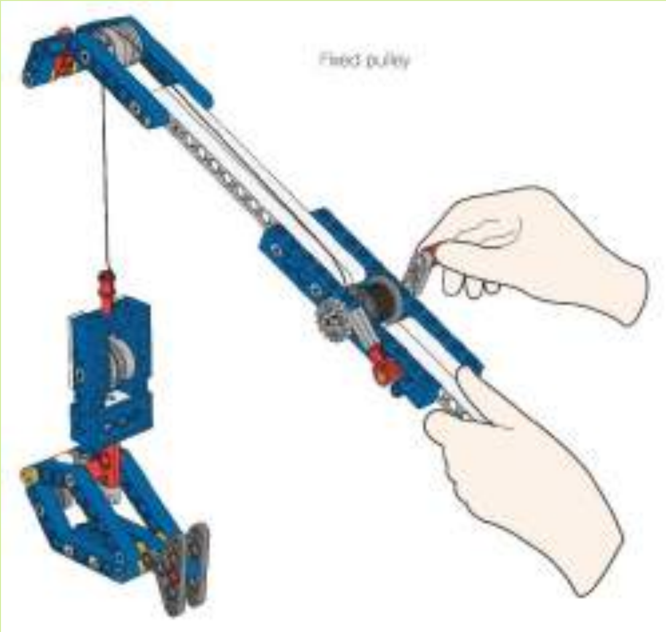
Why use a reel and ratchet?
Try first lifting the large fish by simply pulling on the line. Then, lift using the reel. What do you notice?

What are the advantages?
The reel makes it easier to lift the fish. But it is slower than pulling the line by hand. The ratchet locks the reel if you stop winding. This is a safety system.



What difference does an extra pulley make?
Set up the Fishing Rod as illustrated here. Predict and test which effects this might have when landing fish?

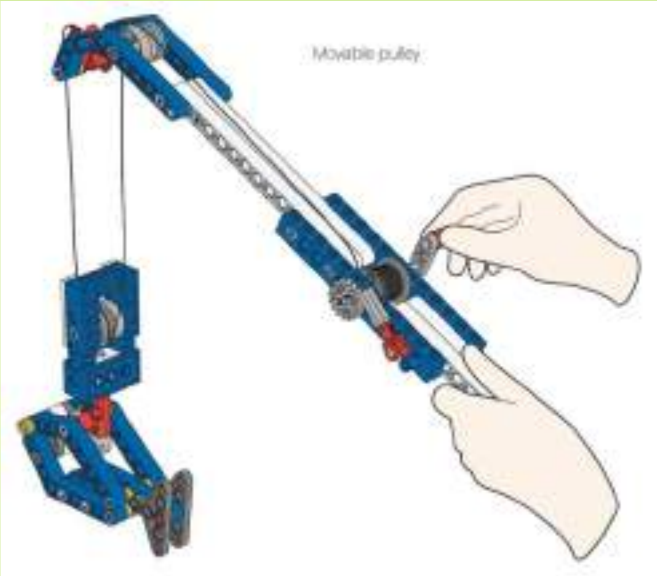
It actually feels heavy. This is because the second pulley is not being used – it is a fixed pulley. Pulleys are dead weight unless they are properly connected!



String up the pulley block as shown on page 11, step 20. Predict and test what effects this setup might have when landing the fish?

Even the heaviest fish is easier to lift. Using two pulleys – one fixed and one movable – means only half the effort is needed to lift the fish. But it is slower to reel in and you need to wind in twice as much line to reel in the fish.

Did you know?
Big cranes use this system to lift heavy loads with small motors. Some pulley systems, also called a block and tackle, use up to six or more pulley wheels!



Add a load (the weight element) to the fish and test again with your Fishing Rod. Find out which is the easier way to land the heavy fish.

4. Trundle Wheel 5A+5B

Design and make an accurate distance measuring device, measure, count, and calibrate scales for accuracy.

Connect

Jack and Jill are in the park preparing for the school sports day. Their favorite sport is the long jump. Jack has just made a huge jump. He is all excited and wants to know how long his jump is.

Jill has not got a ruler long enough to measure the distance so she is doing it in footsteps. Zog the Dog feels that he is much better at jumping so he is trying too.

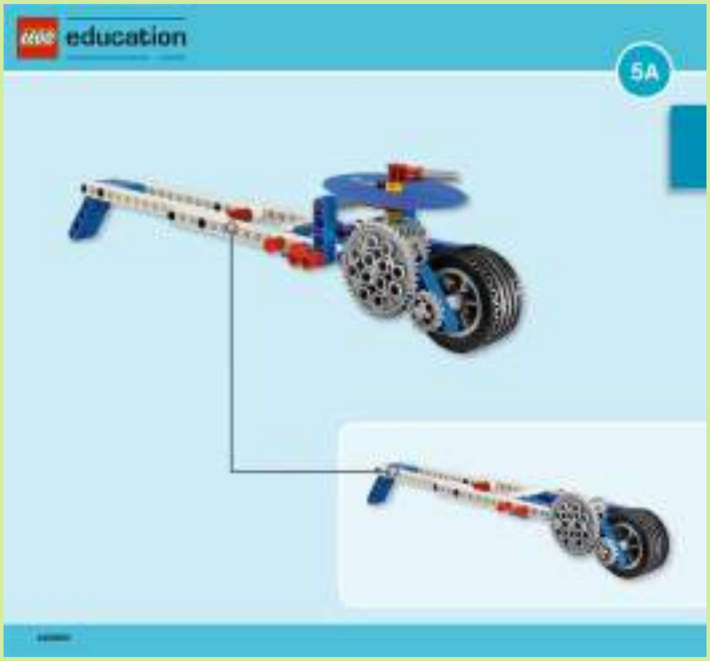
Jill says that Jack's jump was 58 cm (≈ 22.8 in).

Jill takes her turn on the long jump. She says her jump was 4 meters (≈ 4 yards), so Jack thinks she is just guessing ... and not very well, either!
They need some sort of device that can measure a long jump properly.

What sort of measuring machine can you invent that could measure a long jump?
Let's find out!

Construct

Build the Trundle Wheel

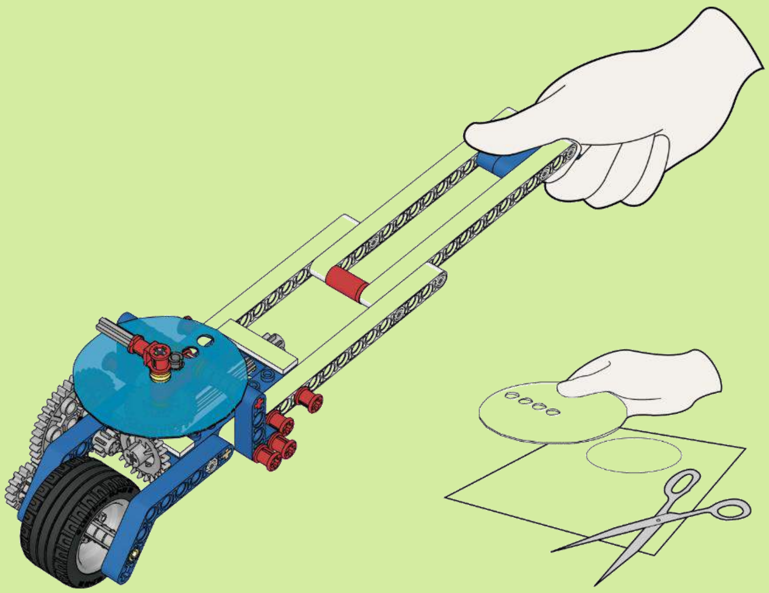


If using whiteboard markers, you can write directly on the blank plastic dial disc. Otherwise trace around the disc to create your own copy.

Make sure that the pointer moves smoothly as you push the trundle wheel. If it is stiff, loosen overly tight axle bushings and make sure all other elements are firmly pressed together.

What is this measuring device good at measuring? Ask the students for ideas and draw up a list.

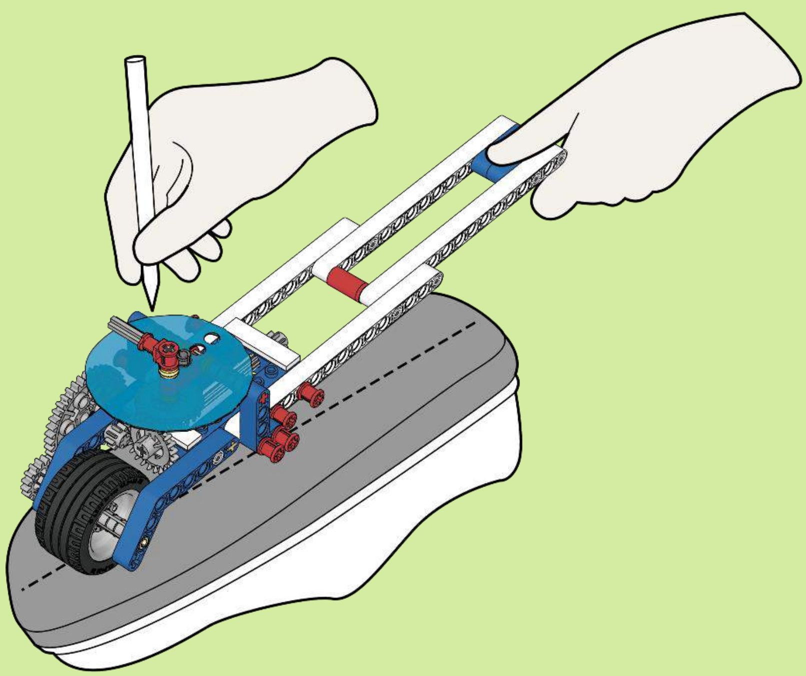
Measure all sort of lengths, such as your arm, hand, and leg to get a feel for measuring.



Contemplate

Stepping Out: Making a Foot Wheeler
How many “feet” fit on the scale?
Measure your shoe – several times! Mark zero and then add a new mark to the dial each time you reach the end of your shoe until you’ve been around the scale (you probably won’t get a whole number of shoes).

This is calibrating the scale in units of ‘shoe’.



Note
Learn how to reset the pointer after each measurement

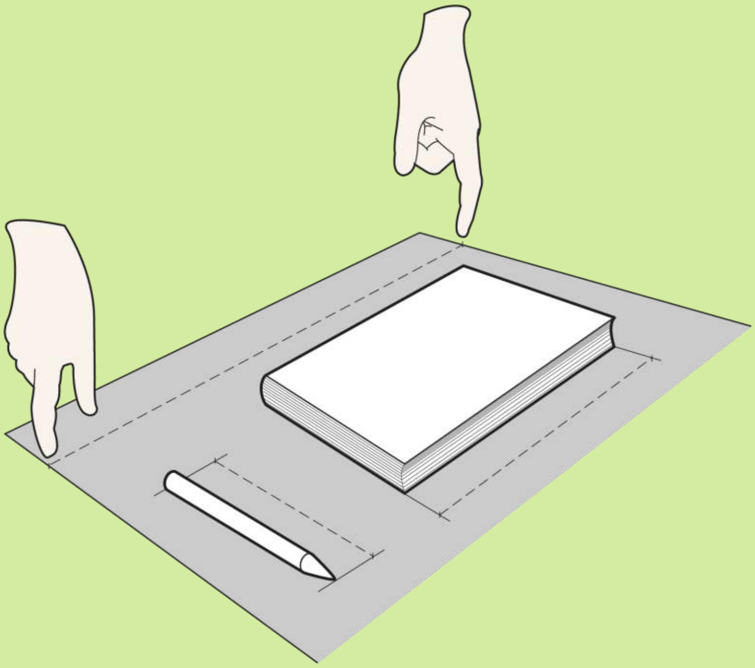
Predict
How many shoes wide is your desk! First use your foot wheeler to measure it! Then take off your shoe and measure it with your shoe. How accurate was your foot wheeler?

What are the problems of measuring in shoe lengths?

People's feet are not always the same size!
This is why we usually select a standard unit of measurements, such as the metric system or US customary system.

Note
The accuracy of our scale depends on how much pressure the children place on the tire.
Light pressure is ideal.
Try it and see.

Meter magic trundle: is it better than a ruler?
Collect three items that you believe are less than 1 meter (≈ 1 yard) long.
• Predict how long each is
• Measure with the trundle wheel
• Measure with a ruler
• What did you discover?



Rulers are the most accurate, usually followed closely by the trundle wheel, and then predictions. What trundle wheels are really good at is quickly measuring things that are longer than a normal ruler.

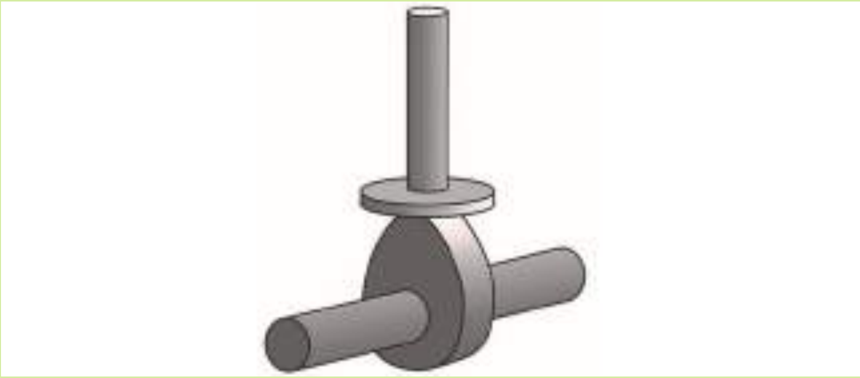
5. CAM H1

A cam is a shaped frame turning about an axis, like a rotating wheel. Cams can control the timing and degree of movement.

Connect

A cam is a shaped frame turning about an axis, like a rotating wheel.

Did you know?
Spring-loaded cams are used by rock climbers to tightly grip rock crevices so that they can then attach climbing ropes.



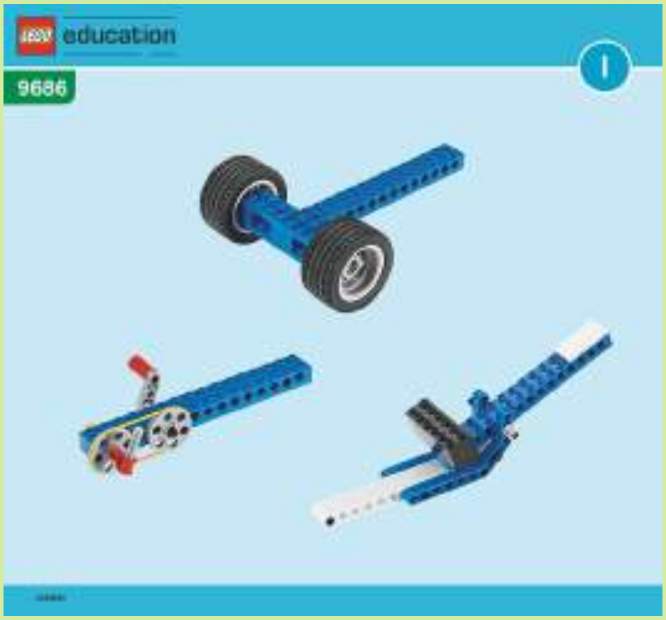
The profile of a cam allows it to control the timing and degree of movement of a follower. A cam can also be regarded as a continuous, variable inclined plane. Cams can be circular, pear shaped, or irregular.

Cams and cam followers are very prone to wear due to friction. Cam followers often have tiny rollers attached to them to reduce this friction.

Common applications with cam mechanisms include an electric toothbrush, an engine camshaft, and clamps.

Construct

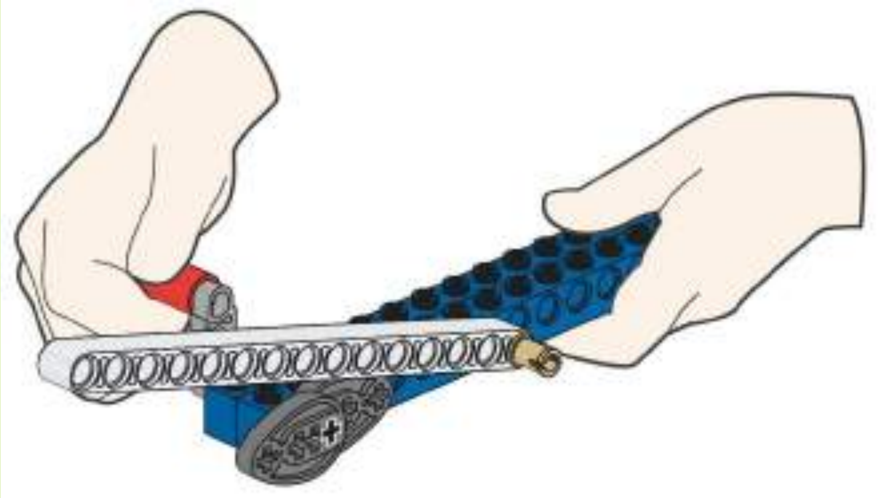
Build the following models. Use the Contemplate ideas below and on the Student Worksheet to learn about each model, one at a time.



Contemplate

H1

This model shows a double cam mechanism. As the two cams rotate, their shape and size dictate a sequence of upward and downward movements of the follower.



6. The Hammer 4A+4B

Explore the scientific concepts of levers, cams, inclined plane, mechanical programming, data recording, friction, force and momentum.

Connect

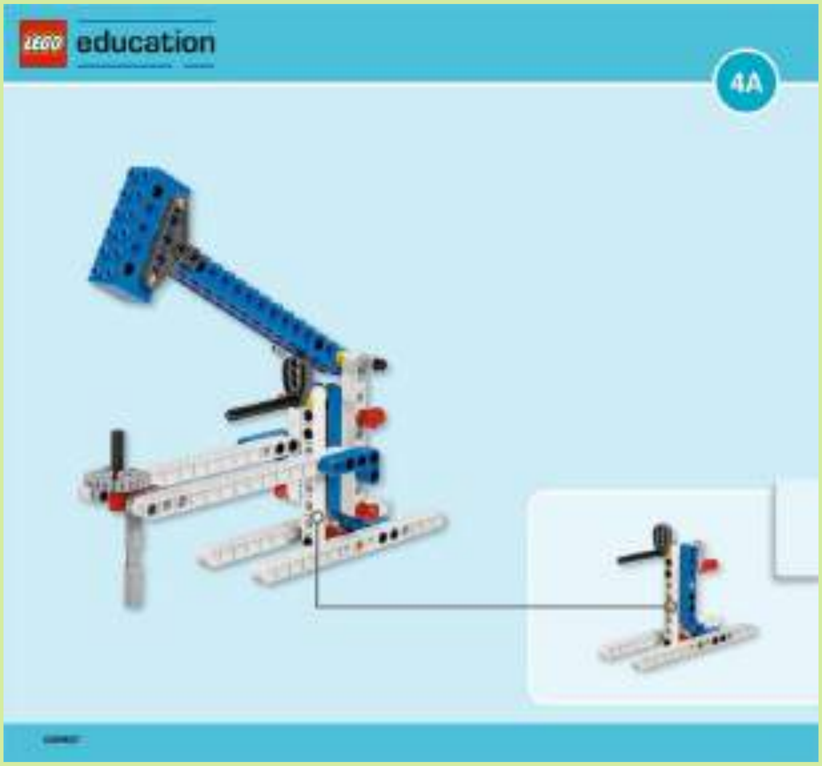
Jack and Jill are having fun hammering! They are trying to build a little shed for Zog the Dog, but the wood they are using is very hard and they need to use a lot of nails to make it hold.

After a while they are exhausted and try to think of simpler ways to hammer the nails into the wood. Two brains work better than one, they think, so together they try to solve the problem. Can you help them test a solution that will work and make the hammering much easier for them?

How can you make a hammer machine that will efficiently hammer nails into different surfaces?
Let’s find out!

Construct

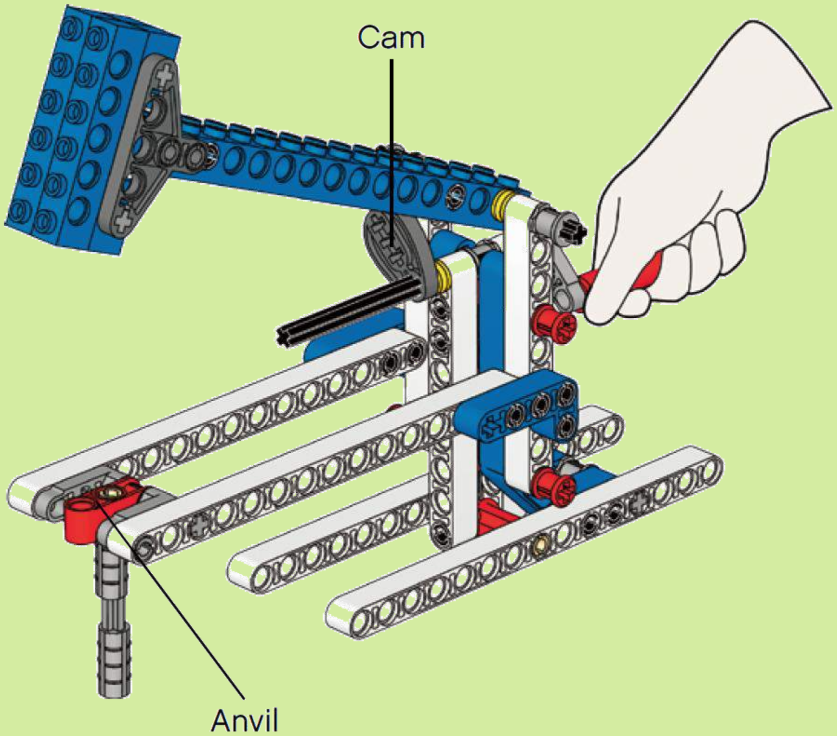
Build the Hammer



Testing
Turn the handle of the hammer by hand. Does it rise and fall smoothly?

If it feels stiff to turn, check that the axle bushings are not rubbing on the bricks and creating too much friction.

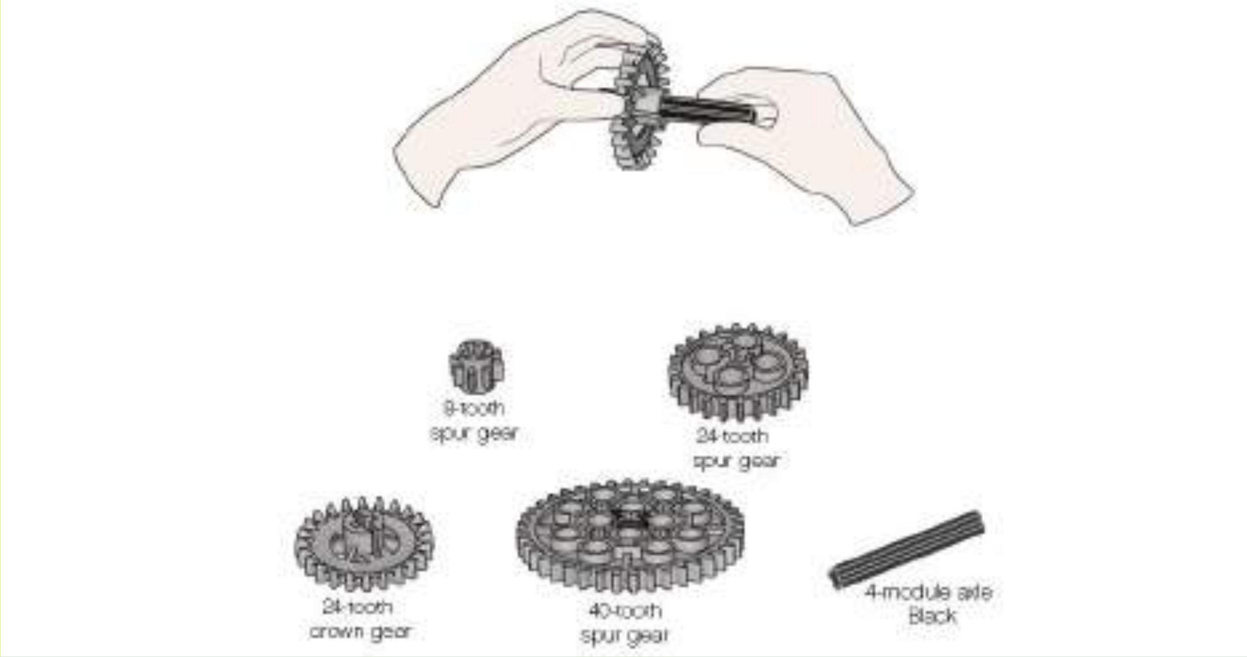
Did you know?
The LEGO research labs make sure every element has exactly the right amount of grip for the job it does and for safe handling by children. We call it 'clutch power' and it is measured very carefully!



Contemplate

Can you measure grip forces by hand?

Push the axle into each gear in turn – and pull it all the way through. Can you arrange them in order from most grip (most friction) to least grip?

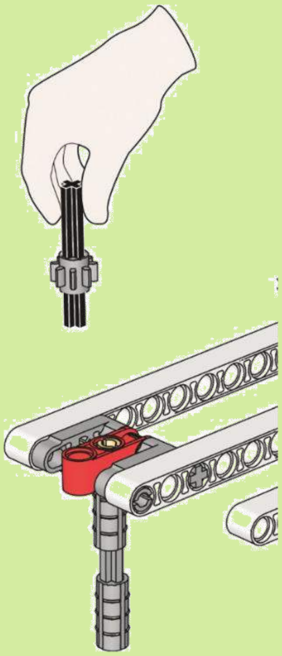


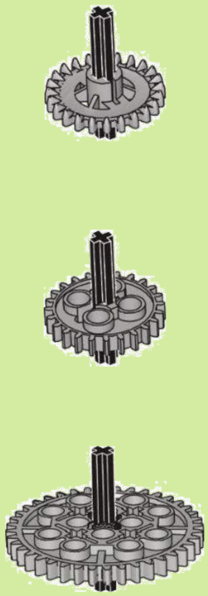
How can we measure the clutch power more accurately?

Use the same size axle to test each gear.

Turn the handle to hammer the axle down.
Count how many hits until the axle touches the tabletop for each gear.

In our tests, the 8-tooth gear has the least amount of friction. It is so small it is hard for fingers to grip. The crown gear is next. Even though it is big enough to grip, it also has pointy teeth. The 24- and 40-tooth spur gears have most friction as they have blunt teeth, are easy to grip, and transmit the most power in a model.





Is the hammer a better test of axle friction than testing by feel?
If you hammer each gear several times, you will find very similar results each time. This hammer is a real scientific instrument and much better than guessing. The LEGO® labs have huge machines that do the same job, but much more accurately.

What else can the cam do?
On page 14, step 18, the modification makes it so that the hammer hits twice for each turn of the handle. Also change the axle position through the cam to make different actions and timings. Try making a slow rise and a fast drop, or a fast rise and a slow drop.

Optional: Using a heavier hammer
It will drive the axles through more quickly. You need to put in more energy to lift the hammer, but it drops with more force. It has more momentum. The smooth cam edge is an inclined plane, which make it easier to lift heavier weights.

7. Letter Balance

Explore the scientific concepts of levers and gears, measuring weight and calibrating scales.

Connect

Jack and Jill have set up a post office and delivery service at their school. They have a plan to write letters and send them to all their friends at school.

To make everything as real as possible, Jill has designed some very spectacular stamps and she is having fun weighing all the letters and finding out what stamps to put on.

Jack is also thinking of using the new post office to send a big parcel to Granny – it is her birthday soon. He wraps it up and wants to find out about stamps for the parcel but ... it looks like the letter weight can't deal with such a heavy object.

How will Jack and Jill solve this problem so they can be sure what stamps to put on for Granny's birthday present to be sent off?

How can Jill work out a fair system that differentiates between the weight of the different letters and parcels her classmates are bringing to her?
Let's find out!

Construct

Build the Letter Balance

Fine-Tuning the Balance

The arm should swing freely and should return to the same spot each time. If it 'sticks' make sure the axle bushings are not too tight. Slide the counterweight up or down the axle so the pointer stops at zero on the scale.

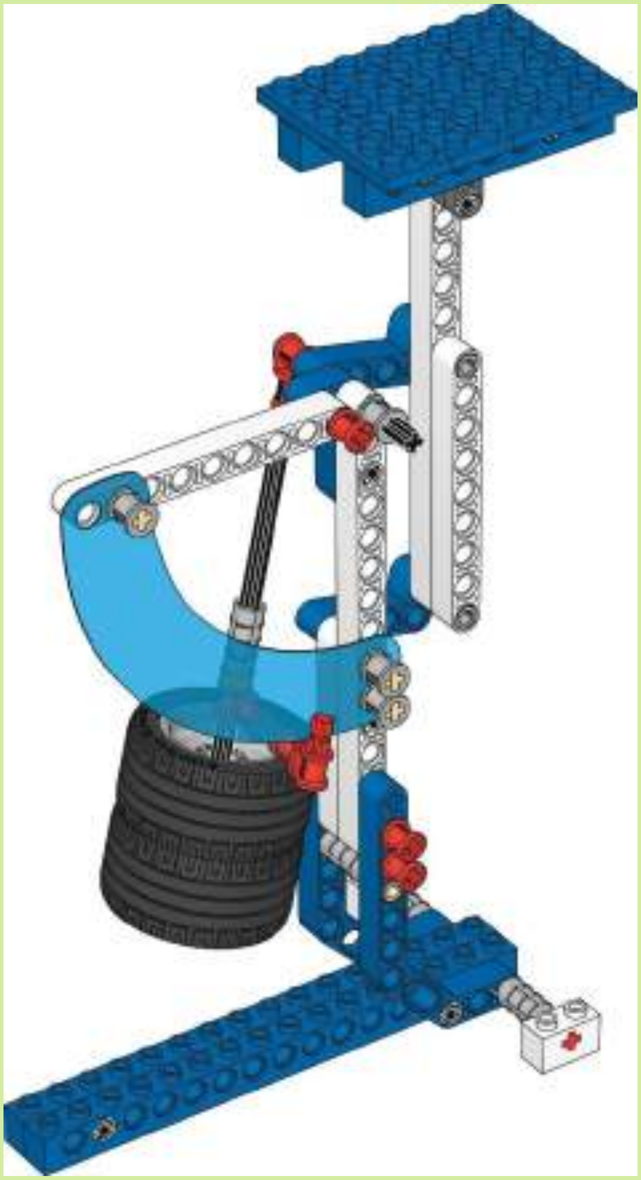
Tip:

To be accurate, letter balances require careful adjustment.
Make sure your LEGO® letter balance is always correctly adjusted.

Did you know?

Although it is a rather complicated one, the letter balance is in fact a first-class lever.

The letter becomes the effort trying to lift the load of the counterweight.
Can you locate the main fulcrum or pivot point?



Mark on the blue plastic disc with a white board marker or trace around it and cut out a paper copy. Put on scale markings and attach it on top of the blue plastic disc.

Contemplate

Hand versus Machine

Line up a collection of 5 objects in the order you think is from lightest to heaviest. Include the big wheel with tyre (16 g) and the weight brick (53 g). Record your estimated weights. Then weigh them. How close were your estimates? Did you get them in the right order?

Tip:

Usually we are better at estimating heavier weights.
The machine is nearly always more accurate than us.

School Post Office

A daily or weekly postal service in school run by children is a wonderful activity, so give it a try! Make your own envelopes, letters and packages. Design your own stamps and start weighing.

Tip:

Slide the counterweight high up the axle.
You may need to move the pointer too. This will make lighter objects such as letters move the arm to a greater extent across the scale. BUT you will need to calibrate a new blank scale in euro cents ... pence ... or ‘stamps’.

Heavyweights
How can we weigh packages over 150 g? Ask the class for ideas, and make a list.

Build model to page 11, step 21 by adding a second wheel to the counterweight axle.
Now you will need to calibrate another new blank scale or redo the blue plastic scale.

Find heavier things to weigh.
Can you find 2 different things/items that weigh approximately the same?

8. Click Clock

Explore the scientific concepts of gear mechanisms, measuring time, calibrating scales and investigating momentum.

Connect

Jack and Jill have been watching the Olympics on the TV and have become quite keen on finding out what it takes to beat Olympic records. They go out in the garden and decide to race 3 times around the old oak tree on the lawn.

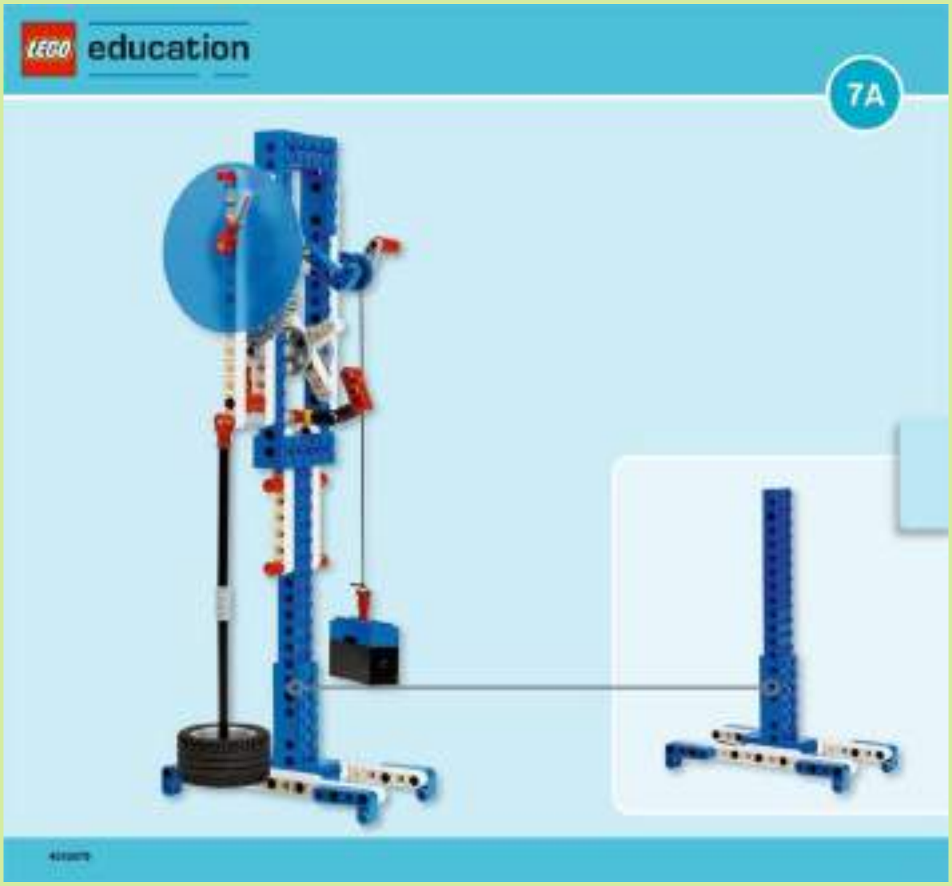
Jill is the first to go and Jack says: 'Ready, Set, Go!' He presses the stopwatch in his hand at the exact time of saying "Go"! Unfortunately, in his excitement, Jack presses too hard and the stopwatch breaks.

How are they now going to time the race around the oak tree?

How can we make a timer that can help us time races?
Let's find out!

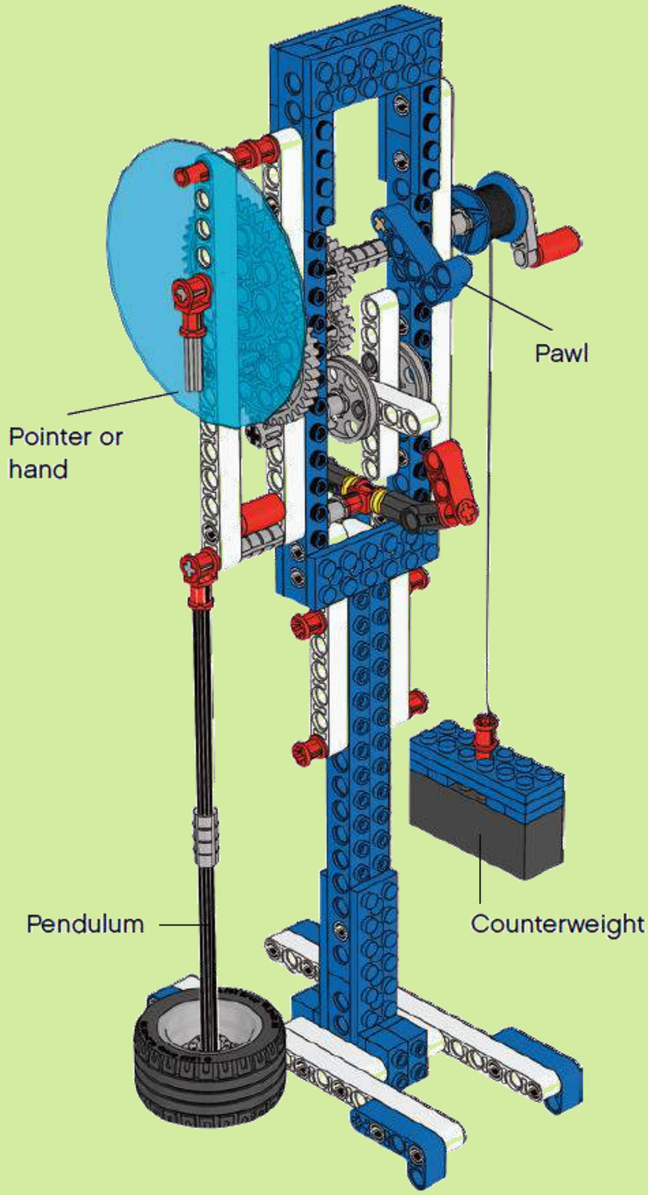
Construct

Build the Click-Clock



Release the pawl stopping the top axle, extend the gear wheels and use the handle to wind up the counterweight. Reposition the gear wheels, reset the pawl and start the pendulum swinging.

What happens?
The click-clock starts to tick.



Contemplate

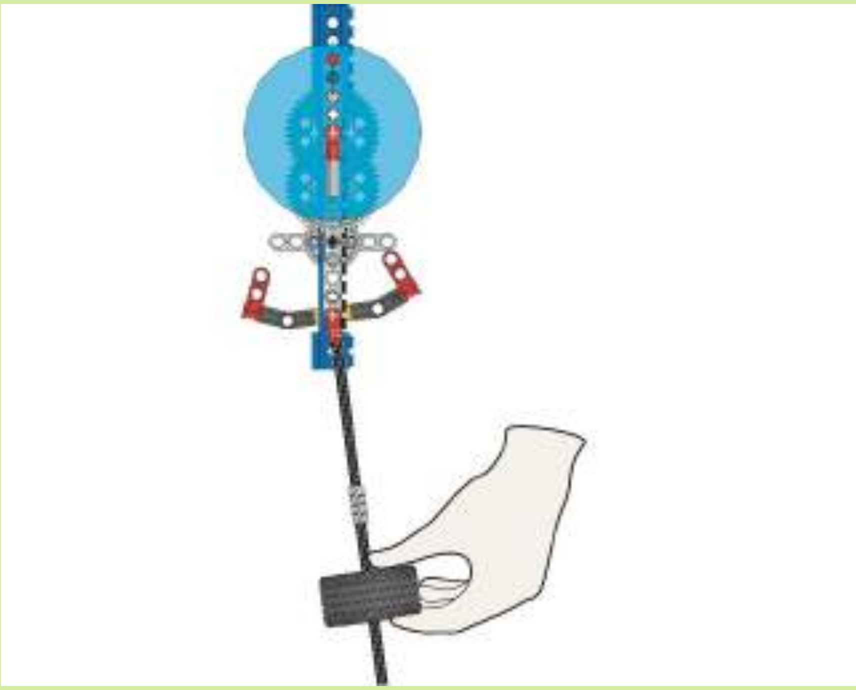
Making time go slower or faster!
First predict, then test.

A. Make sure the big wheel is at its lowest position. How many seconds does it take for the pointer to go around the dial once?

It takes approximately 70 seconds.

B. Slide the big wheel high up on the axle, set the pendulum swinging, and try timing it again.

The clock ticks even faster. The pointer rotates in approximately 55 seconds.



C. Change the pendulum to a small wheel as shown on page 18, step 27. How many seconds does it now take for the pointer to go around the dial once?

It takes approximately 56 seconds. It is faster than the same position with a big wheel because a small wheel weighs less and needs less energy to make the pendulum move back and forth.

Calibrating to 1 Minute

It is possible to calibrate to almost 1 minute.

Move the small wheel up and down the pendulum until you find a position where the pointer goes around the dial in approximately 60 seconds.

Tip:

You can get close to 1 minute by positioning the wheel approximately 3 cm (approximately 1.18 in.) up the pendulum.

9. Windmill

Explore the scientific concepts of forces and motion, renewable energy, energy capture, storage and use.

Connect

Jack and Jill have found a huge but heavy treasure chest buried near an old mine. It is really heavy and though they try as hard as they can, they can't pull it out of the hole.

The old windmill nearby once used to lift water out of the mine and they are wondering if it can be of any help to them.

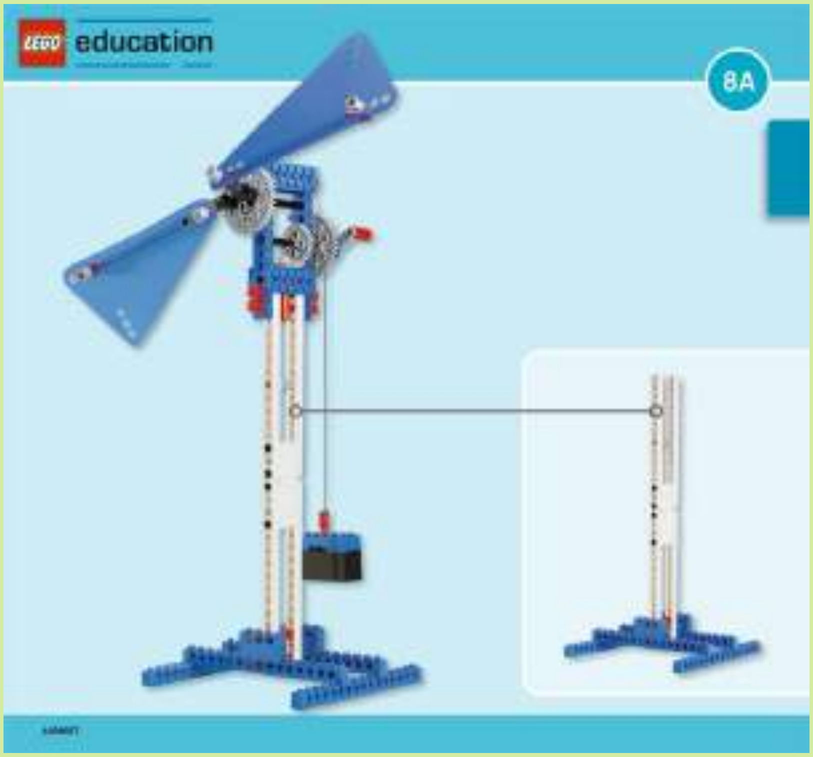
Zog the Dog has done a very good job helping them to dig out the treasure chest so he is pretty tired too. He walks away from Jack and Jill to rest a bit and suddenly finds a long piece of rope. He runs back to the two kids to suggest that they take him for a walk on his new "leash".

Jack has once seen a film where a mill was used to lift up something and seeing the rope he immediately tells Jill about his idea. Now they know they can figure out how to get the treasure out of the hole!

How can you use a windmill and a rope to lift a heavy load?
Let's find out!

Construct

Build the Windmill



Spin the mill by hand. Is it running smoothly?
If it feels stiff to turn, loosen the axle bushings and make sure all other elements fit tightly together.

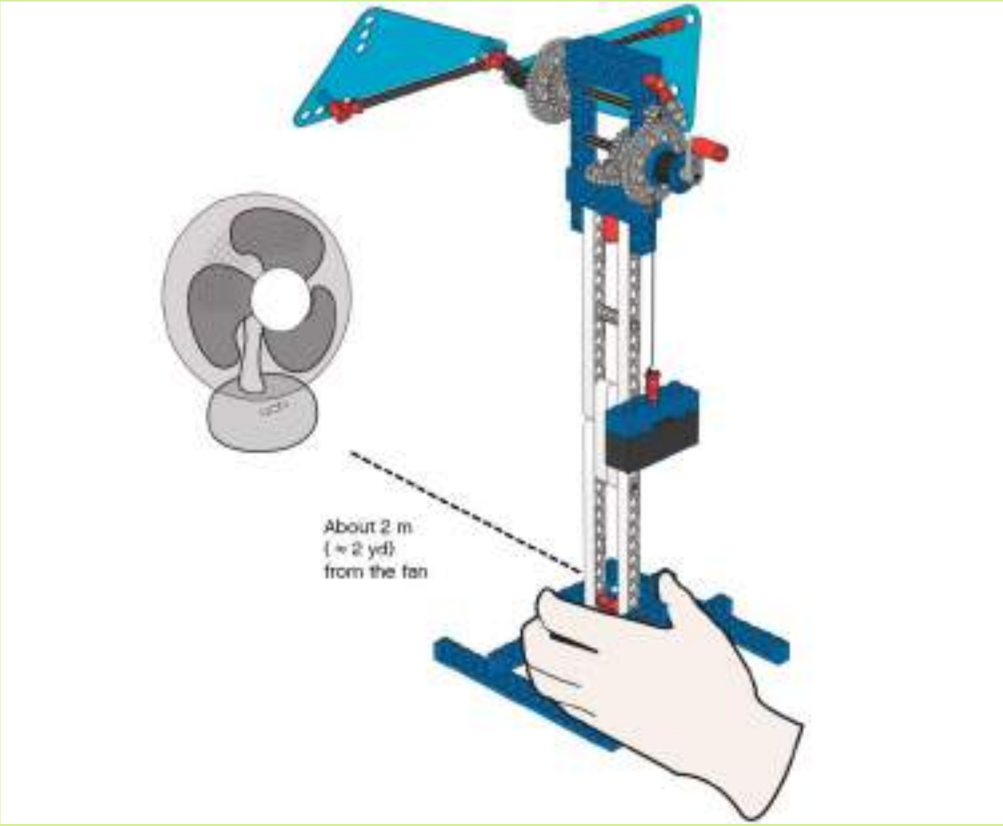
Setting up the Windmill
Position the fan on the floor near a power outlet.

Place the model about 2 m (≈ 2 yd) away from the fan.

Choose a power setting, and move the model back and forth to find a distance where the wind speed is just enough to lift the weight brick, slowly.

KEEP THIS POWER SETTING FOR ALL TESTS (until you want to test the effects of different wind speeds, of course).

Make a long line (e.g. with tape) in front of the windmill. This is the test zone (where it is safe), and behind the line several groups can test several mills at the same time. Check that all the windmills are getting the same amount of wind.



Contemplate

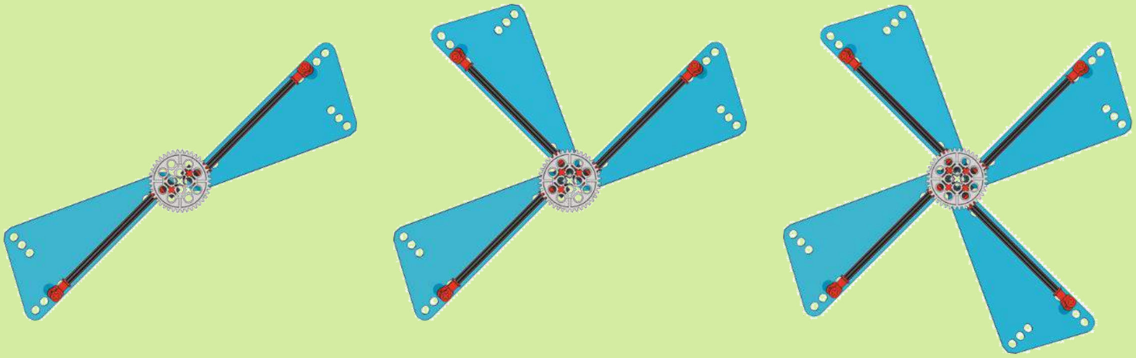
What is the best number of sails to use?
Predict and test which combination will lift up the treasure chest (weight brick) most quickly.
Can you explain why?

Example 3 is best. It has the most area in which to catch the wind energy.

Surprise!
Example 2 with the sails off-center is usually the worst. It is too unbalanced to work efficiently even though it has more area than Example 1 with just two sails.

Idea:
Does shape matter? If you have time, try making sails of different shaped pieces of card, but with the same area as that used in your models.

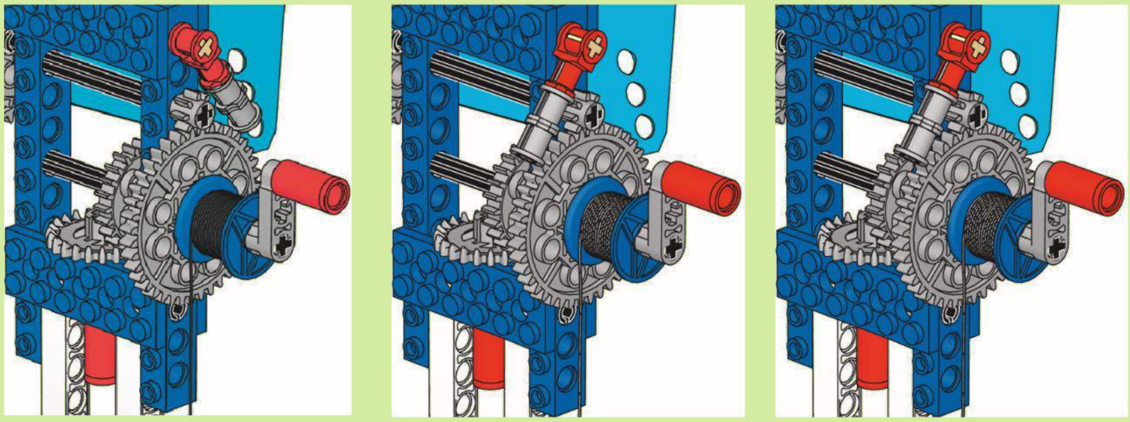
Note:
Each sail has an area of approx. 40 cm (≈ 15.7 in)2.



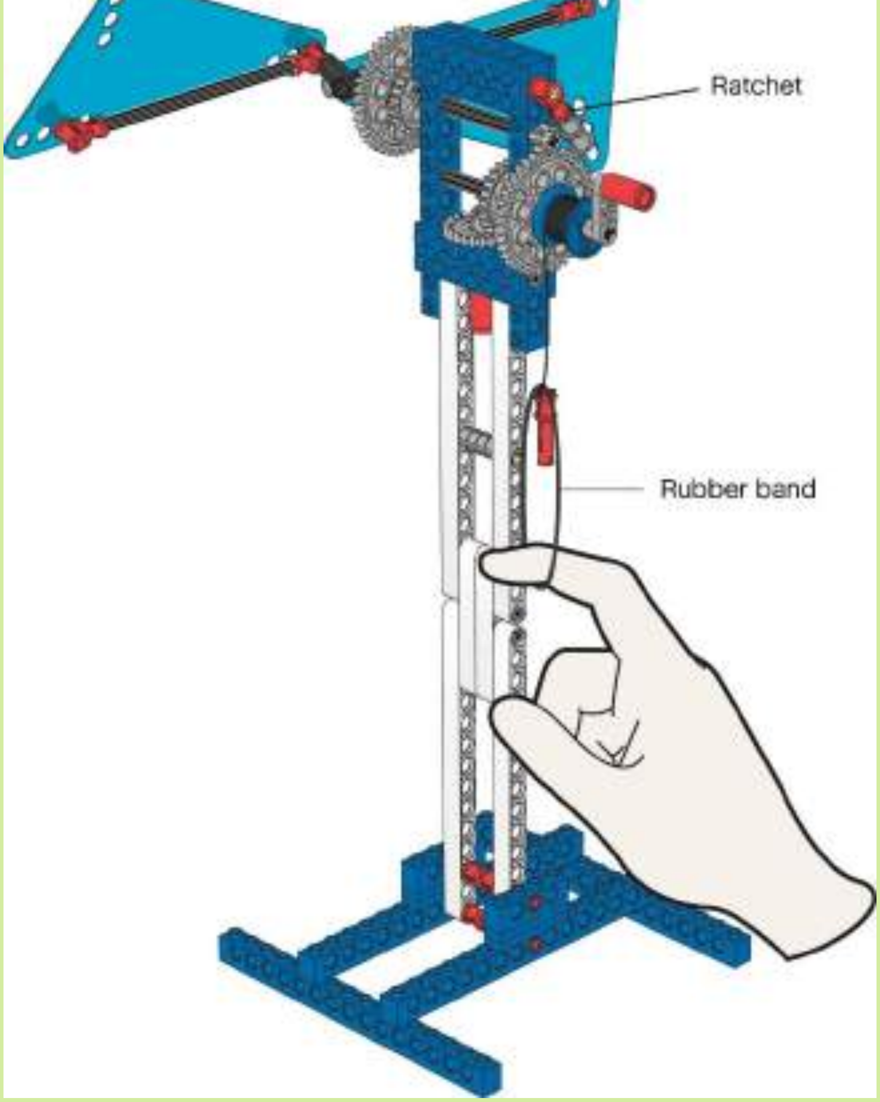
What does the ratchet do when:
The load is being lifted up and the wind stops?
The mill stops but the ratchet stops the heavy load from falling — a good safety feature.

The wind is blowing and you flip the ratchet to this position?
The mill stalls. The forces are opposite.

The load is up, the wind stops, and you flip the ratchet to this position?
It will become a fan powered by the energy stored in the falling load. You get the wind back again!



Rubber Band Force Meter
Tie a rubber band to the lifting string or use a spring balance to measure the lifting force before the mill stalls. Measure how much it stretches. You'll be amazed by the power generated!


Ratchet
Rubber band

10. Beam Balance

Explore the scientific concepts of levers, forces, effects of loads and solve problems involving scale factors.

The simplest weighing machine is a beam balance. The original form of a balance consisted of a beam with a fulcrum at its center. A change of weigh on either side of the balance will change the beams positioning and effect the balance achieved.

You will build a model beam balance and investigate how its function is influenced by changes in weight and position.

Construct

Build the Beam Balance and Loads

Make sure the arm moves up and down freely and the beam balance is in a state of equilibrium.

Contemplate

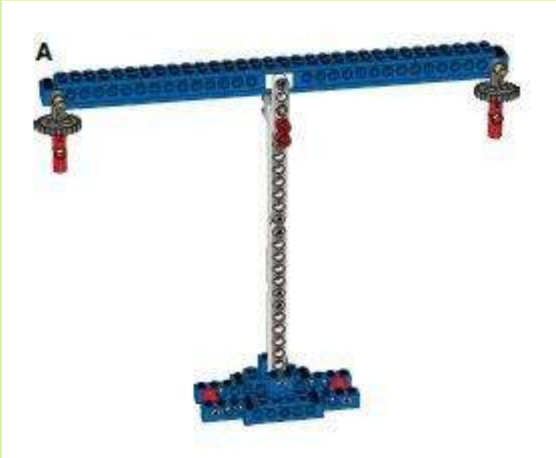
Why is it in a state of equilibrium?
Place the load and efforts as shown and use the formulas for levers to find the mechanical advantage and to explain what happens.

First, observe the mechanical advantage of beam balance A.
Record the mechanical advantage on the worksheet.

Hint:
You can find all of the formulas you need to perform this investigation in the principle models section for lever.

Then use the formula for calculating the amount of effort needed to lift a given load to explain why the beam balance is in a state of equilibrium.
Record your findings on the worksheet.

Hint:
Use this formula to help explain why each model is balanced: effort x length of effort arm = load x length of load arm.



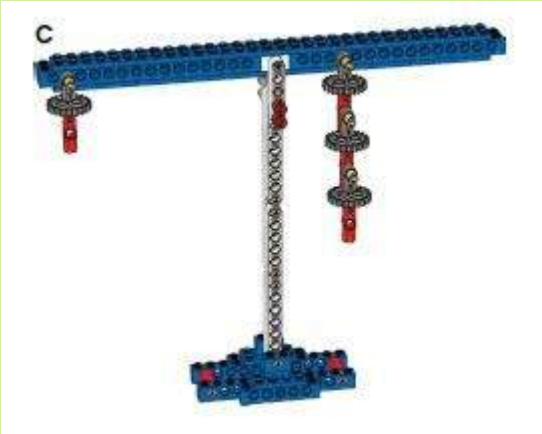
Next, follow the same procedure for beam balances B and C.
Beam balance A (page 10, step 10) presents a mechanical advantage of 1. The beam balance is in a state of equilibrium because the weight on each side of the fulcrum is the same and the distance of the weight from the fulcrum on each side is the same.

Did you know?

The loads weigh 2 g each. 

Beam balance B (page 11, step 11) presents a mechanical advantage of 2. The beam balance is in a state of equilibrium, because the weight on the left of the fulcrum is half the weight on the right but it is twice as far from the fulcrum as the weight on the right.

Beam balance C (page 12, step 12) presents a mechanical advantage of 3. The beam balance is in a state of equilibrium because the weight on the left of the fulcrum is one third the weight on the right but it is three times as far from the fulcrum as the weight on the right.



MIT SCRATCH

1. FACTORS (MATH- CHAPTER 6: BE MY MULTIPLE, I'LL BE YOUR FACTOR)

Definition:

- A **factor** is **one of two or more numbers that divides a given number without a remainder**.
- A **multiple** is a **number that can be divided by another number a certain number of times without a remainder**.

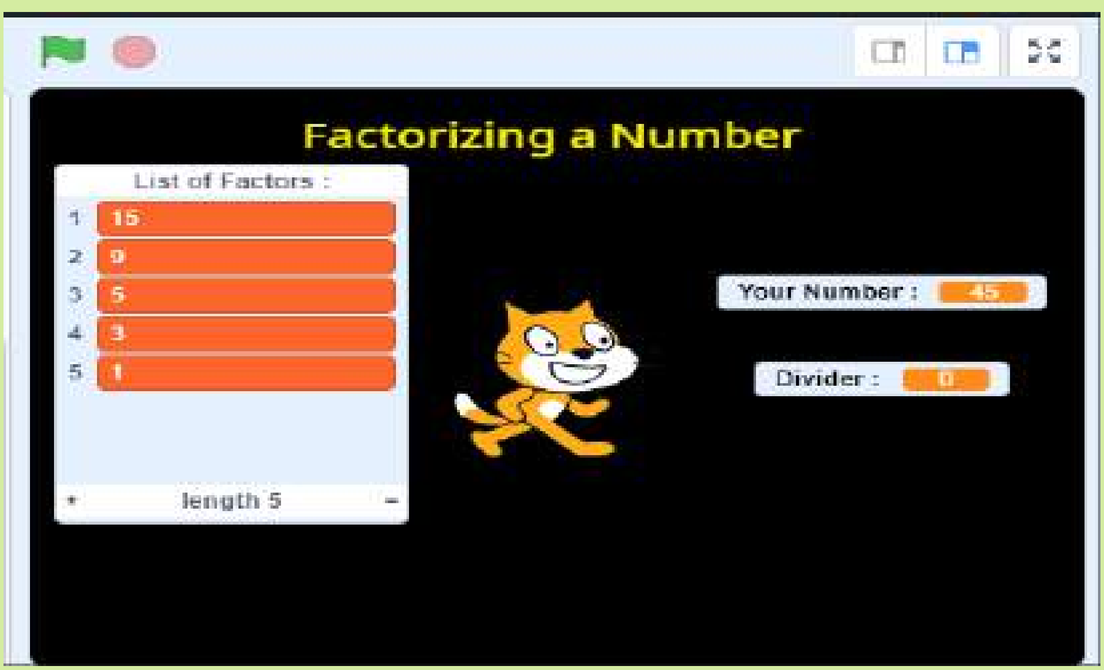
Multiples and factors are best explained by using a number sentence such as the following:

multiple of 2

2 X 3 = 6

factor of 6 factor of 6 multiple of 3

This number sentence tells us that 6 is a multiple of 2 and is also a multiple of 3.
It also tells us that 2 and 3 are factors of 6.



2. WATER DROPS COLLECTOR GAME (EVS-CHAPTER 6: EVERY DROP COUNTS)

Water, water, everywhere; not a drop to drink!

Although the Earth is constituted of 3/4th of water yet fresh drinking water is a basic necessity of life which is growing as a major crisis in today's world. Therefore, this game instills in students the importance of water and the necessity to reduce wastage of water. The young minds understand the serious message while being interactive with this game playfully.

3. PING-PONG GAME (MATH- CLASS 5: SHAPES AND ANGLES)

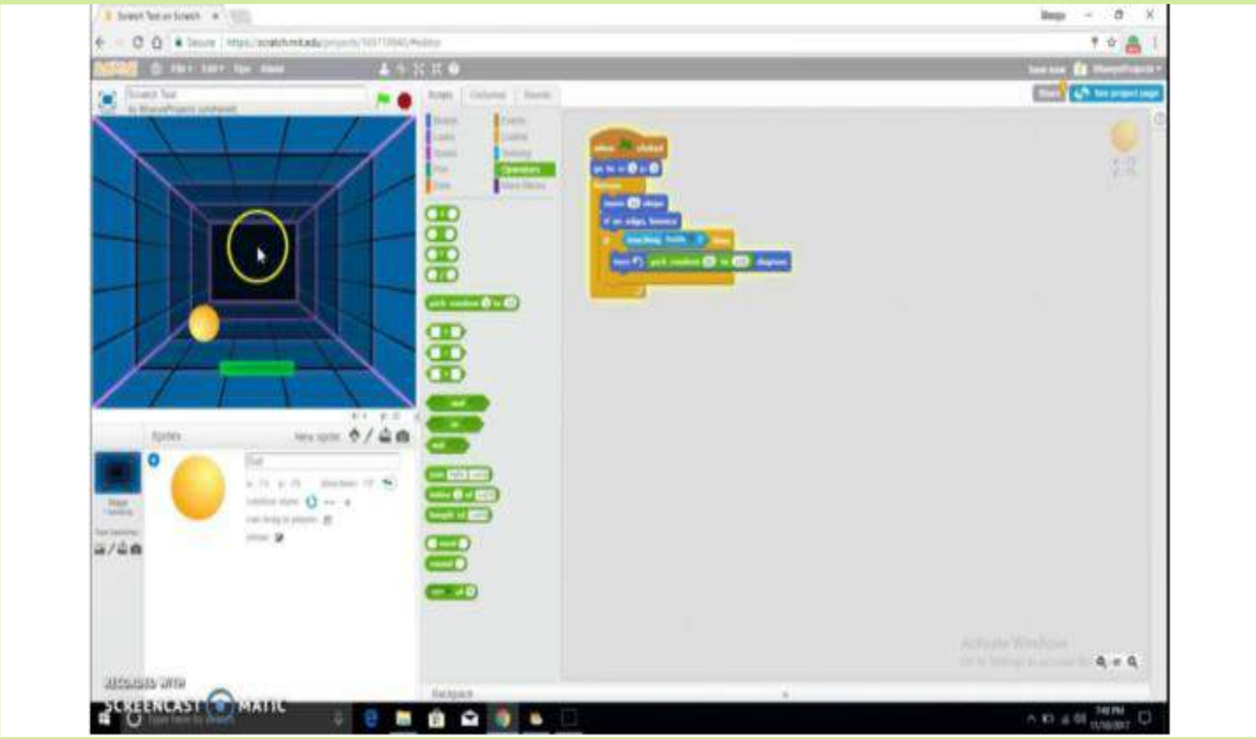
Definition

A shape can be defined as the form of an object or its outline, outer boundary or outer surface

An angle is a shape, formed by two lines or rays diverging from a common point (the vertex).

Everything we see in the world around us has a shape. We can find different basic shapes such as the two-dimensional square, rectangle, and oval or the three-dimensional rectangular prism, cylinder, and sphere in the objects we see around us. These geometric shapes appear in objects we see as credit cards, bills and coins, finger rings, photo frames, dart boards, huts, windows, magician's wands, tall buildings, flower pots, toy trains, and balloons.

Therefore, this interactive game allows students to learn the concept of shapes and angles in 2-D.



4. Story making (EVS- Class 5)

"Imagination is more important than knowledge. For knowledge is limited, whereas imagination embraces the entire world, stimulating progress, giving birth to evolution." – Albert Einstein

Nurturing students to imagine with sensitivity towards one's nature and the surrounding is a fundamental aspect of education. To bring in such outcome, the following mode of picture writing/story making could be implemented:

In this activity, students are allowed to imagine and write a story based on the picture represented above. The picture above is of a jungle where the nature is in complete harmony. The animals and plants are living happily and peacefully as essential beings for each other.

The students feel compassionate and responsible for nature and the peace that living harmoniously in this world as a loving community brings.

5. BASIC CALCULATOR (MATH- CHAPTER 13: WAYS TO MULTIPLY AND DIVIDE)

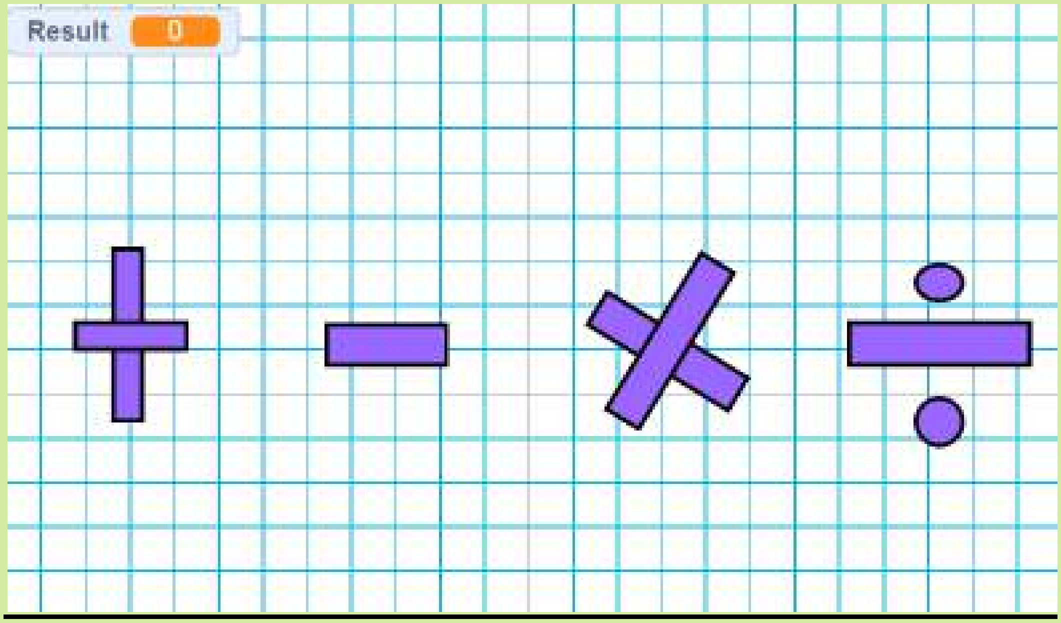
Time is money. Time is power. Time is everything.

In this fast pace world, people aim to save their time. With this comes the usage of calculators which is seen everywhere- in shops, at offices, homes, installed in computers and mobiles.

Taking this concept, this interactive activity is designed as such where the students make a calculator that does basic operations viz. addition, subtraction, multiplication and division.

Instead of only using calculators, the students learn how to make one which fills their cup of innovative outlook and also provide them with satisfying fulfillment.

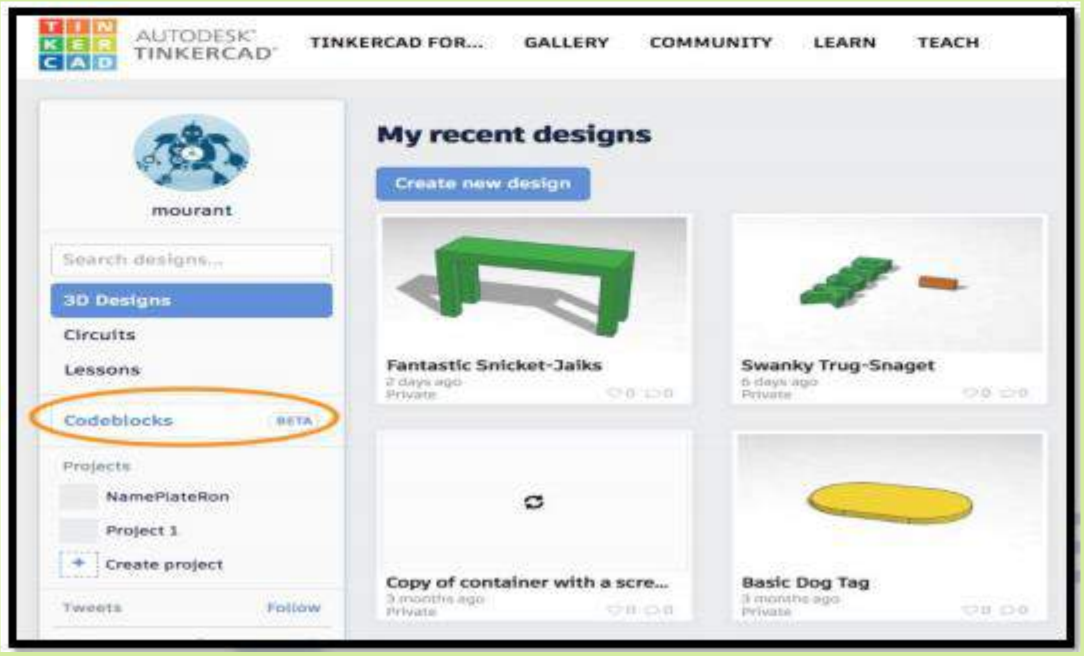
This activity is fun which gives the students the scope the ability to become inventors. Interesting?



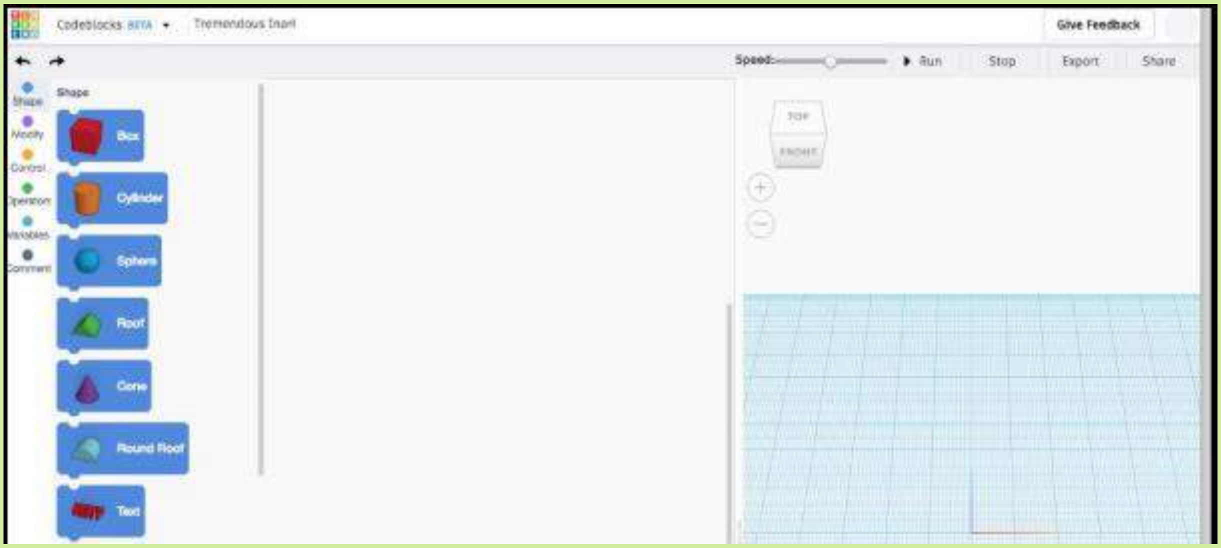
3D- INTRODUCTION TO CODEBLOCKS

CODEBLOCKS Introduction

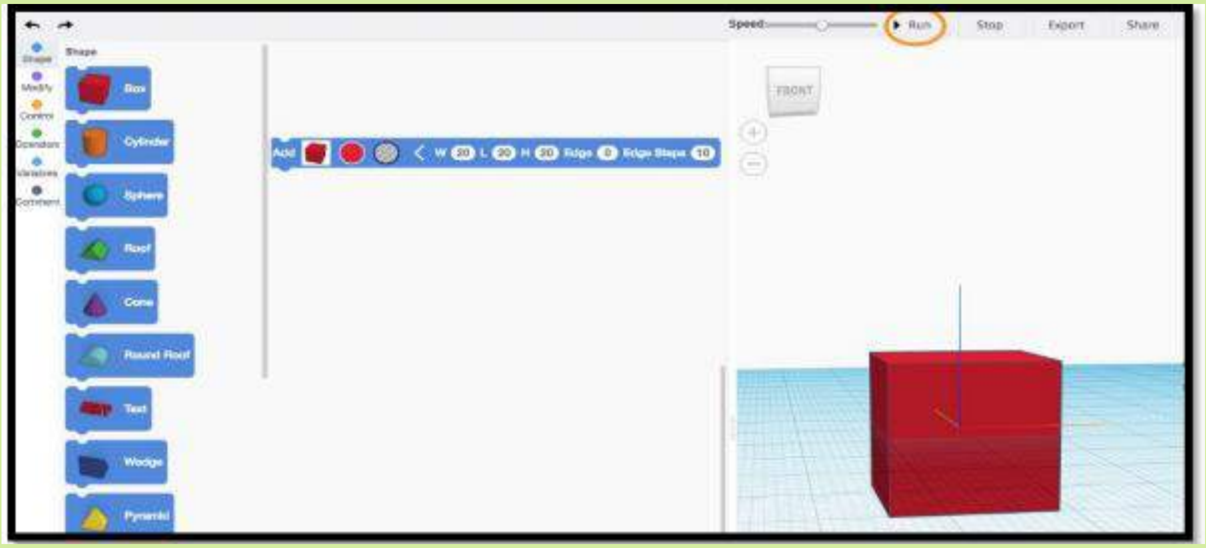
Codeblocks is a new beta addition to Tinkercad. It's allows the creation of 3D designs using visual programming. Codeblocks includes the creation and use of variables. Values of variables can be changed to easily create designs of different sizes.



Starters are examples of 3-D designs created using codeblocks. These are useful for learning how to use codeblocks. Your Code shows designs that you created or modified using codeblocks. Click on the “New Design” button at the top-right. The codeblocks development environment appears.

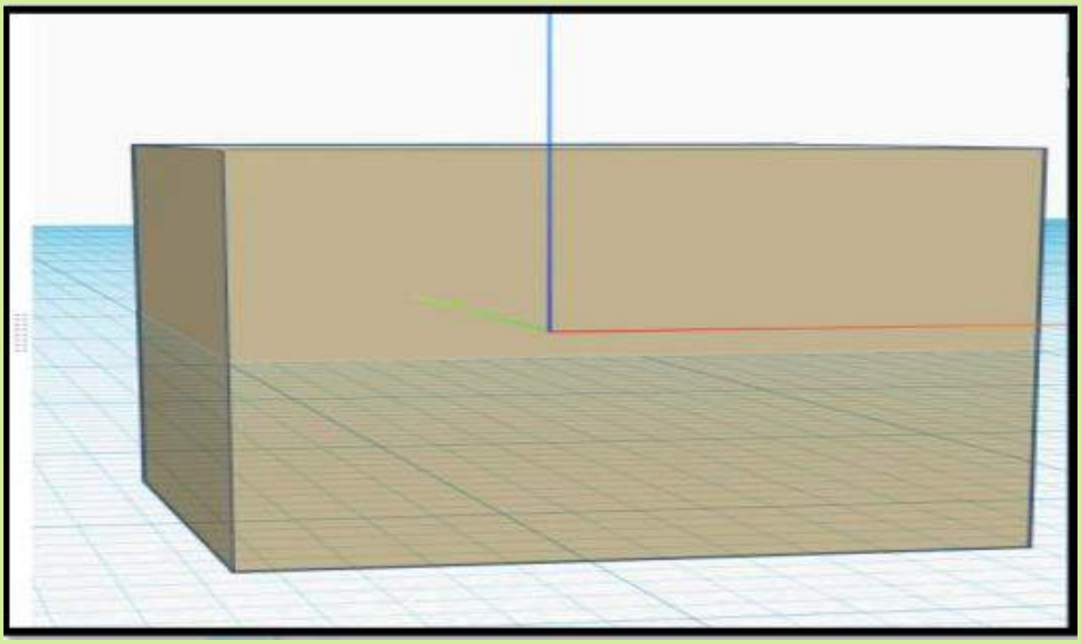


Drag the Box shape into the middle section and click on its arrow key (at its right edge) to expand it. Press the Run button to see the red box on a Tinkercad workplane.

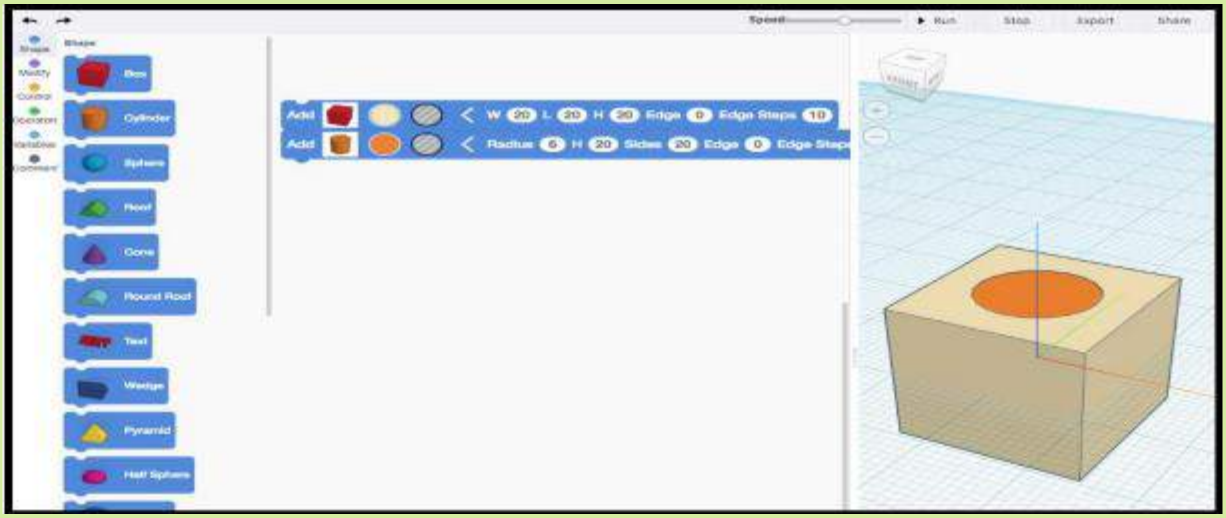


The general procedure is to make changes in a codeblock (such as the Add shape above) and press the Run button to see these changes rendered on the workplane. Press the red circle to change the color of the box. The gray-white button makes the box a “hole” (more on this below). The directional arrow is a toggle to expand/collapse the codeblock’s variables and values. Replace the number zero in the Edge container and click on the Run button to see rounded edges on the box.

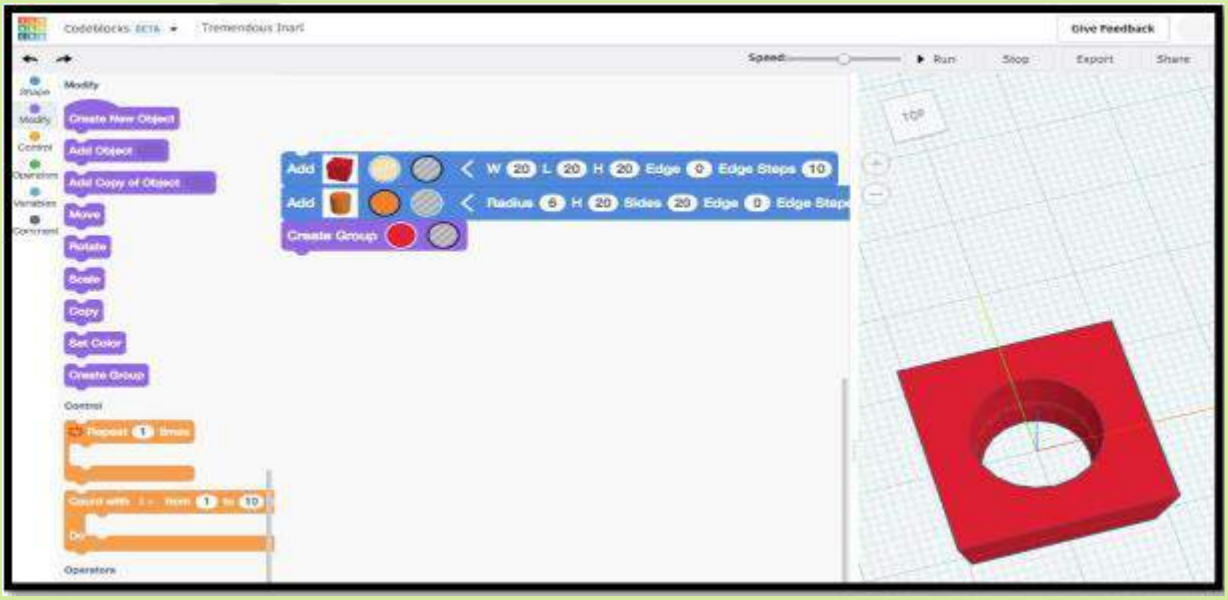
When a shape is added to the workplane, it’s center is placed at X=0, Y=0, Z=0. We have changed the color of the box, pressed the Run button and zoomed in to get the view below:



The coordinates icon is placed at the center point (X=0, Y=0, and Z=0) of the box shape. The X-axis (Width) is red, the Y-axis (Length) is green, and the Z-axis (Height) is blue. Note that half of the shape is below the workplane. How can we make a round hole in top of the box? Drag the Cylinder codeblock so that it snaps to the bottom of the Box codeblock. Expand it and set its Radius to 6. Press the Run button. I clicked-dragged the View-Cube (in the upper left) to get:



The box and the cylinder are aligned at their centers in the X, Y, and Z planes. Make the Cylinder a hole by clicking by clicking on its gray/white striped icon. We want to use the Create Group codeblock. To see the Modify codeblocks, click on the Modify button in the leftmost column (as shown below). Drag the Create Group codeblock, so that it snaps into the bottom of the Cylinder codeblock as shown below. Since the Cylinder is a hole, it will be subtracted from the Box, when the Create Group codeblock is executed. Click on the multicolor icon to choose the color of the resulting object. We have chosen red. Press the Run button.



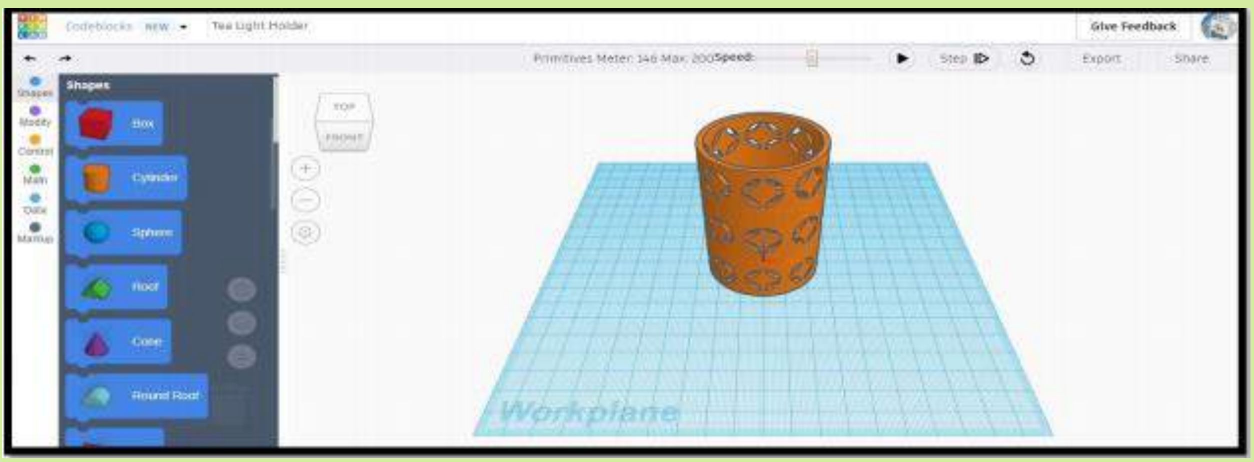
WEEK 2

Topic Index : CODEBLOCKS : Tealight Holder Design

Objective : To design tealight holder .

Description : A type of holder for tealight candles created and designed in various colors, materials, sizes and styles and used for various purposes. A tealight (also tea-light, tea lites or tea light, tea candles, t-lite or tcandles), or nightlight, is a candle in a thin metal or plastic cup so that the candle can liquefy completely while lit. They are typically small, circular, wider than their height and inexpensive. Because of their small size and low level of light, multiple tealights are often burned simultaneously. Tealights derive their name from their use in teapot warmers, but are also used as food warmers in general, e.g. fondue. They are a popular choice for votive candles. They are also suitable for accent lighting and for heating scented oil. Tealights may be set afloat on water for decorative effect.

Picture View :



Tools Used:

1. Move
2. Add
3. Set Variable

Learning Outcome :

1. Understanding the working of tealight holder.

2. Overview of basic code for writing program. Here the program is defined by combining the code blocks in the same way we would combine building blocks.

3. Learning of creating a computer program with the help of blocks that includes a loop.

WEEK 3

Topic Index : CODEBLOCKS : Basket Design

Objective : To design Basket and understand the function of basket.

Description :

Basket is a a container usually made by weaving together materials (as reeds, straw, or strips of wood). It is basically the quantity contained in a basket.

A basket is a stiff container that is used for carrying or storing objects. Baskets are made from thin strips of materials such as straw, plastic, or wire woven together.

Raw Materials:

Raw materials include a wide range of plant fibers including roots, cane, twigs, and grasses; reeds, raffia, and basket willows may be the best known. Concentrated cloth dyes are also used in some types of manufacture, and vegetable dyes are sometimes made by hobbyists to reproduce unique colorations imitating historic baskets. Wood is also used for some designs, particularly when the type of basket needs a solid bottom and for some types of handles. Other than raw materials, the basket maker needs tools like saws, awls, planes, knives, and beaters for hammering or bending pieces of willow. A tub is required for soaking fibers. If coiled baskets are to be made, sewing tools like blunt tapestry needles and thread are required. The manufacturer also needs patterns or designs. For the hobbyist, many of these items can be purchased in basket-making kits. There are three types of weaving to create a basket: coiling, twining and plaiting.

Coiled

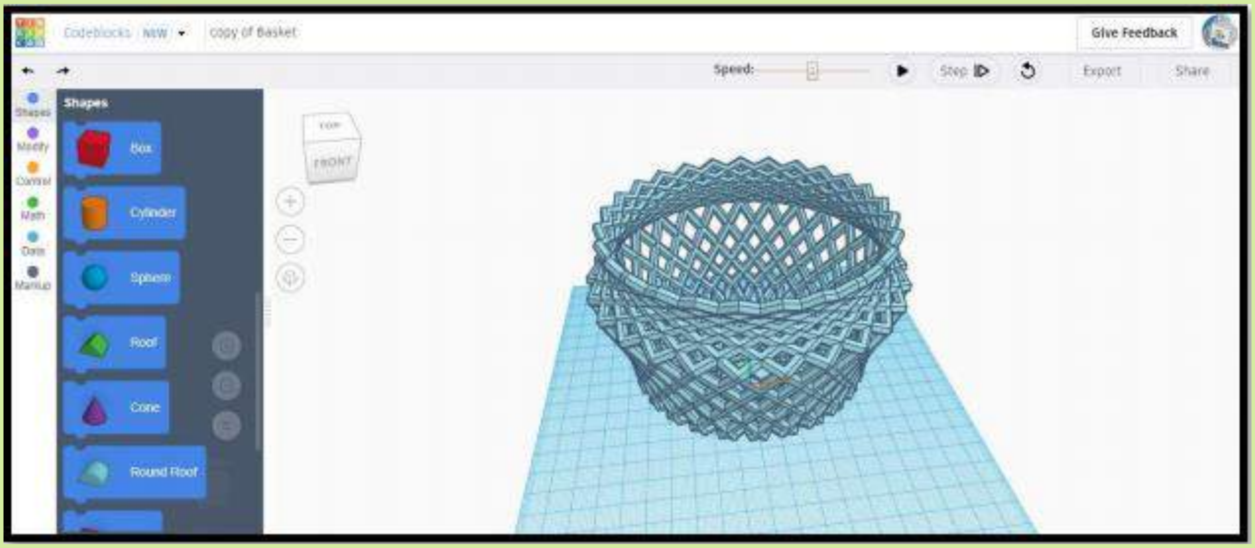
Coiling basket-weaving involves stitching coils of grass together. The grasses are coiled first. Then, the coils are stitched together. As the coils are stitched together, they are arranged to create a basket. This method of basket-weaving is ideal for soft materials such as grass because of the manipulation necessary to create the coils. Harder materials such as bark will crack, splinter, or break if coiled.

Twined

Twining is a method used by more advanced weavers. Twine baskets use three strands of material to weave a basket. The base of the basket, also called ribs, is made with a harder material such as cedar bark. Two softer materials such as day lilies are woven in opposite directions up and over the basket's ribs. Having to weave two materials in different directions is what makes this a more advanced weaving technique.

"Plaiting" basketry

Plaiting is simply layering material over and under other pieces. It is the simplest type of weaving and is often done in grade school art classes. A plaited basket can usually be finished in an afternoon.It is done by using materials that are wide and braidlike: palms, yucca or New Zealand flax.



Tools Used :

1. Loop

2. Basic Shape

3. Rotate

4. Create Variable

Learning Outcome:

1. Understanding the importance of Basket. 2
2. Overview of basic code for writing program. Here the program is defined by combining the code blocks in the same way we would combine building blocks.
3. Learning of creating a computer program with the help of blocks that includes a loop.

WEEK 4

Topic Index : CODEBLOCKS : Fidget Spinner Design

Objective : To design a Fidget Spinner by the 3D Software.

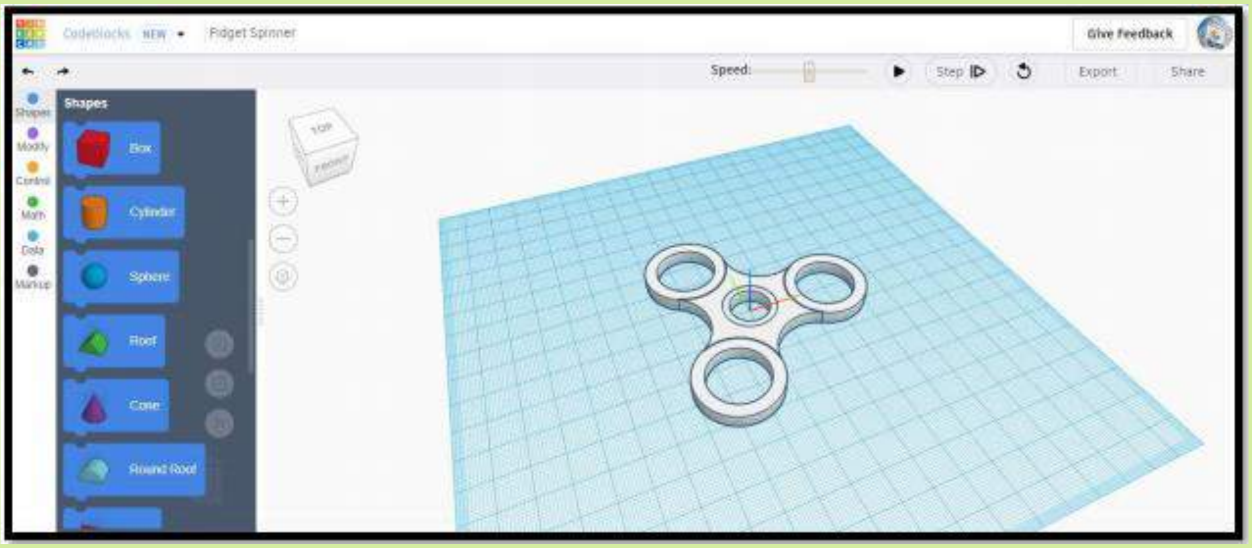
Description :

A fidget spinner is a toy that consists of a ball bearing in the center of a multi-lobed (typically two or three) flat structure made from metal or plastic designed to spin along its axis with little effort. Fidget spinners became popular toys in 2017, although similar devices had been invented as early as 1993.

The toy has been promoted as helping people who have trouble focusing or those who fidget to relieve nervous energy, anxiety, or psychological stress. There are claims that a fidget spinner can help calm down people who have anxiety and other neurological disorders like ADHD and autism. However, as of May 2017, there is no scientific evidence that they are effective as a treatment for ADHD.

The fidget spinner is a palm-sized toy that spins around a bearing to help people who have trouble focusing or often find themselves fidgeting, especially with their hands.

Where does fidget spinner come from? The fidget spinner is a palm-sized toy that spins around a bearing to help people who have trouble focusing or often find themselves fidgeting, especially with their hands. Fidget spinners became a toy craze in 2016–17. Some major news outlets credited their invention to Catherine Hettinger, who invented a stress-relieving spinning toy in 1993, whose 1997 patent expired in 2005. Patent disputes followed, centered on the fact that Hettinger’s toy features a different mechanism than the ones in the popular fidget spinners.



Tools Used:
1. Create Variable
2. Move
3. Add
4. Loop
5. Repeat

Learning Outcome:
1. Understanding the importance of Fidget spinner.
2. Designing and Building of Fidget Spinner.
3. Overview of basic code for writing program. Here the program is defined by combining the code blocks in the same way we would combine building blocks.
4. Learning of creating a Pattern by making the structure of Fidget Spinner.