Seesaw

Most children playgrounds contain a seesaw. Did you know that this fun and simple game is a perfect example of how a lever works? You can perform the next experiment and find out how a lightweight child can lift a heavier child on the seesaw using the principle of levers!

Discover:
- How does Force generate Moment?
- How can we calculate Moment?

Level Of Difficulty ★★★★★

Materials Needed:
- Engino® Simple Machines (STEM40) or Levers & Linkages (STEM01).

Procedure:

1. Find the instructions online and build the **seesaw** model.

2. Remove one wheel from one side of the seesaw and observe what happens.

3. Use your finger, on one side only, to restore the balance again. Then move your finger slowly towards the middle, trying different distances from the centre. Can you feel the difference in effort?

4. Leaving only one wheel on the left side of the seesaw, take the remaining wheels from the package and try to find out how many wheels you need to put on the right side in order for the seesaw to balance . On the right, you can see 4 possible cases to try out (**exercise 1**). Balance the seesaw in each one by stacking on wheels connected with pulleys at the positions indicated. The distances from the center for placing the wheels are: 24, 12, 8 and 6 units.

5. Complete **exercises 2, 3 and 4.**

1. Write the number of wheels that are needed to balance the seesaw in each case.

case 1 Wheels needed to balance: *1*

case 2 Wheels needed to balance: *2*

case 3 Wheels needed to balance: *3*

case 4 Wheels needed to balance: *4*

2. Let's do some simple math: Multiply the number of wheels with the distance (how many units) from the center, for each side and for each case. What results did you come up with?

case 1	Wheels needed to balance x 24 units =	1 x 24 = 24
case 2	Wheels needed to balance x 12 units =	2 x 12 = 24
case 3	Wheels needed to balance x 8 units =	3 x 8 = 24
case 4	Wheels needed to balance x 6 units =	4 x 6 = 24

3. What conclusion can be extracted from your observations above, about the left and the right side?

The conclusion is that when the seesaw is in balance, the left side moment (F1 x S1) is equal to the right side moment (F2 x S2), which in our example is equal to 24.

4. With that in mind, how can a lightweight child balance the seesaw when playing with a heavier child?

The lightweight boy should sit at the edge of his side, as away from the center (fulcrum) as possible. The heavier boy should start moving closer and closer to the center of the seesaw until balance is achieved.

First-class lever

I bet all of you have been to the doctor for a general check-up! Do you remember getting on a weird device with movable beams and some strange numbers written on them? What do you think is that device and how does it work exactly? You are about to find out by carrying out the following experiment.

Discover:
- What is a first-class lever?
- How does a balance beam scale work?

Level Of Difficulty ★★★★★

Materials Needed:
- Engino® Simple Machines (STEM40) or Levers & Linkages (STEM01).
- Beans, pebbles or any other small materials.

Procedure:

1. Find the instructions online and build the **movable weight scale** model.

2. Complete **exercises 1** and 2.

3. Try to balance the model with the help of the movable part (the part that contains a wheel) and count the distance from the fulcrum in squares, starting from the unit piece near the fulcrum.

4. Now, we will need some small materials to put as weights on the scalepan (weighing pan). These could be pebbles, beans, erasers or even other Engino parts that are included in your set. Put 3 or 4 of these materials on the scale and observe what happens.

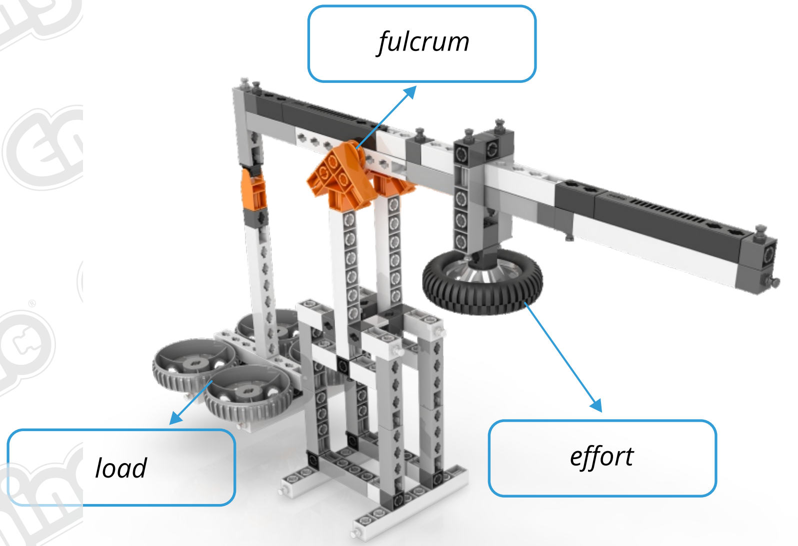
5. You will probably see that the balance is lost and the scale is leaning on the scalepan's side. Restore the balance again by adjusting the movable weight.

6. Place some more materials on the loading base until it's fully loaded and try to balance the beam again. Is it possible? Why does this happen? Answer **question 3** according to your experiments.

7. Complete **exercise 4.**

Engino® "movable weight scale" model

1. Look at your Engino® "movable weight scale" and fill-in the boxes with these words: **load, effort, fulcrum**.



2. Which one of the three elements (load, fulcrum, effort) of the lever above is placed between the other two? What class of lever is this?

*The **fulcrum** is placed between the load and the effort. This is a **first-class** lever.*

3. How does a balance beam scale work?

*The beam balances if the moment of the scalepan is **equal** to the moment of the movable part, thus achieving balance of moments. For example, on a doctor's weighing scale, the nurse moves the movable part until the beam is balanced and then she reads the number that it reached. That number is your weight!*

4. In the following images you can see some examples of first-class levers. Take a look at the pictures and show with arrows where the load, the effort and the fulcrum are applied.

Claw hammer

Scissors

Pliers

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