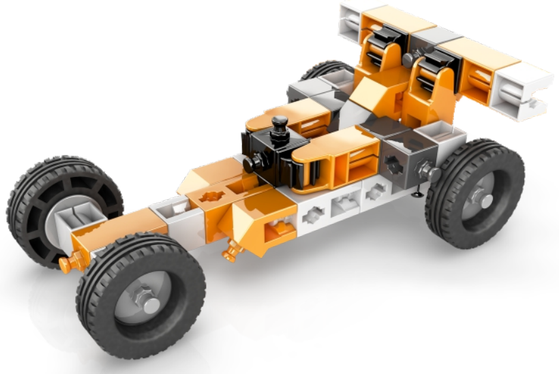
Experiment with the inertia car

As you have already learned a car is a vehicle used to transport people. Car safety is vital since car accidents happen every day. An extremely important feature of car safety is the seatbelt, since it crucially minimizes injuries! Seatbelts are used to secure the vehicle's passengers against harmful movement that may be caused by a sudden stop or during a collision. The number of fatal and serious injuries will be decreased as soon as passengers fasten their seatbelts . A lot of people have saved their lives because they have being wearing their seatbelt. Remember to fasten your seatbelt when travelling by car!



- Which physic's law takes place when the car starts or stops suddenly?
- How important is to wear a seatbelt?

Are you ready to imitate an accident and observe the importance of wearing a seatbelt?
Let's perform the next page's experiment to get answers for the above questions!
Get ready to discover Newton's first law.

01

Learning about: **Newton's 1st Law**

Inertia Car

Did you notice that when the car suddenly stops you move forward? This is because you "want" to continue moving. However, when that car suddenly starts you move backwards, since you "want" to remain idle.

Discover:

- Newton's 1st Law
- The importance of wearing a seatbelt.

Level Of Difficulty ★★★☆☆

Materials Needed:
- Engino® (STH21)
- ~20cm string
- Small rubber band

Procedure:

1. Find the instructions and build the **Inertia Car** model. Place your model on the side of a table.

2. **Note** that the passenger should be placed onto the car for **each case**. Tie the end of the string on the orange part of the model as it is shown on the picture on the right.

3. Obviously it does not move by itself. Explain why in **exercise 1**.

1. The model is not moving. Why do you think this is happening?

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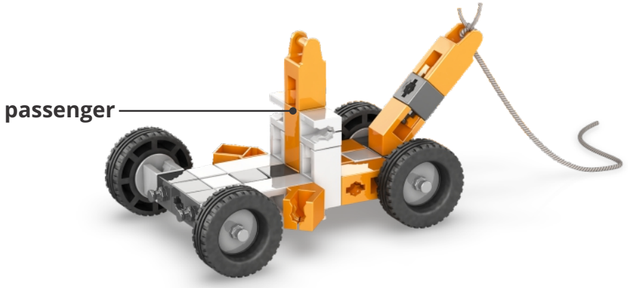

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Procedure:

4. Hold the string and pull the model **smoothly** for **case 1** and **sharply** for **case 2**. Write your observations on **exercise 2**.

5. For this step you are going to imitate an accident. Place a strong obstacle in a small distance in front of the model. Pull the model **smoothly** with an increasing speed until it hits the obstacle **sharply**. Then do **exercise 3**.

6. Repeat the procedure of **step 4** but for this case place the rubber band on the model in order to hold the passenger tightly (see the picture below). This way you will create a seatbelt. Answer **exercise 4**.

2. Complete the sentences using the words from the box below.

rest, moving, falling, change, sharply

The passenger has a different reaction in each case. In fact, in case 1 the passenger is ..... with the car while in case 2 he is ..... from the car. This is happening because the ..... of motion is caused in a different way. In addition, for the 2nd case the change of motion was caused ..... . The passenger was at ..... and he wants to remain at rest. He is falling in order to remain in the same position.

3. How is the passenger moving this time? Explain why.

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4. What do you observe? Why is it important to fasten your seatbelt while travelling inside a vehicle?

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Theory

Forces

We cannot see forces, but we can understand their effects when they are applied. When we pull a rubber band we can see that it stretches. A can is squeezed by the force applied from our hand. Generally, in order to change the shape of an object, temporarily or permanently, a force must be applied on it. Forces also cause objects to change their motion. In order to make an object move we must apply a force. The same applies if we want to reduce the speed of an object or change its direction of motion. One of the foremost scientific intellects of all time, Sir Isaac Newton, studied forces.

Newton's 1st law of motion

Newton's First law of motion states that every object remains at rest or continues to move at a constant velocity, unless acted upon by an external force. In other words, if the total force acting on an object is zero then the object is at rest or it is moving at a constant velocity. Simply, in order to alter an object's velocity, a force should be applied. If the force is in the same direction of movement, then the object will accelerate. If it is in the opposite direction, the object will decelerate. If the force is applied at an angle then the object will turn! Newton's first law is also called Law of Inertia and it is more observable in objects with big mass (e.g. a big ship).

Sometimes we observe the opposite effect, for example if we are on a bicycle and gain some speed, once we stop pedaling (meaning that we stop acting force) then pretty soon the bicycle will stop on its own. This is caused by friction. You may not see friction or realize it but it is always present, and unless we counterbalance friction by an opposite force the object will inevitably stop. In fact, the bicycle stops instead of keep moving because Newton's 1st law is in effect! Air resistance and friction between rotating parts are acting opposite to the direction of motion and decelerate the bicycle.

Inertia

The ability of a bicycle to keep moving even after we stop pedaling, is called Inertia. It is defined as the property of objects to resist any change in their motion. If an object is moving, then it will "want" to continue moving; if it is idle then it will "want" to remain idle. This "unwillingness" of objects to move is what we call Inertia. What if instead of a bicycle we had a car, or even a truck! The latter would be more difficult to start or stop moving. Inertia depends on the mass of an object, the bigger the mass the higher the inertia. This is what you feel when you are in a car and the driver applies the brakes or what pushes you back to the seat of the plane when it takes off! Therefore you must always wear your seatbelt when you are in a car, as to avoid the risk of injury.

Quiz

Exercise

a) Put a tick √ to indicate which of the following objects has **greater inertia**.

b) The car on the right is at rest. Estimate the total force acting on it.

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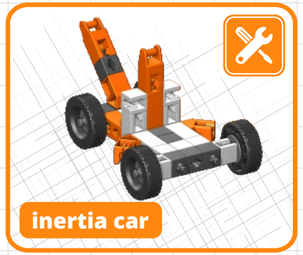
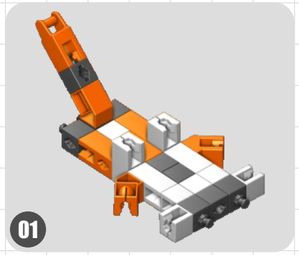
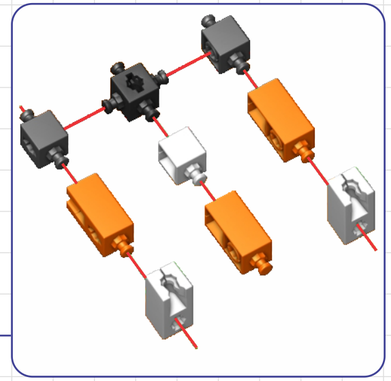
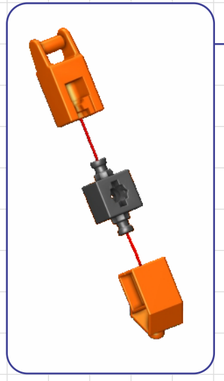
Knowledge check: check what you have learned.

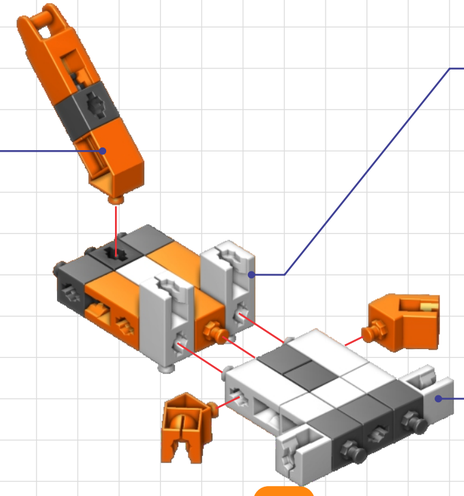
- [ ] What is force?
- [ ] What does Newton's 1st law state?
- [ ] How much total force is applied on an object at rest?
- [ ] What is inertia?
- [ ] Which objects (heavier or lighter) have more inertia ?

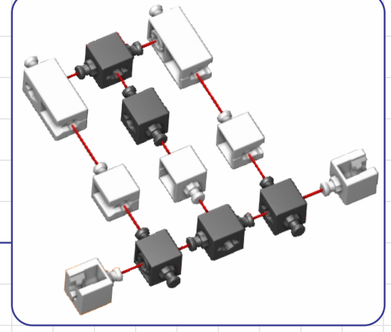












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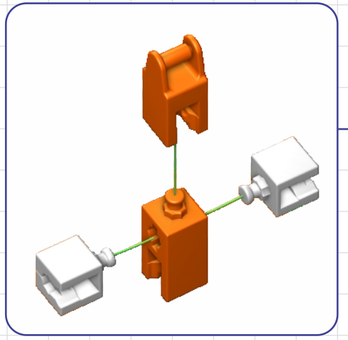

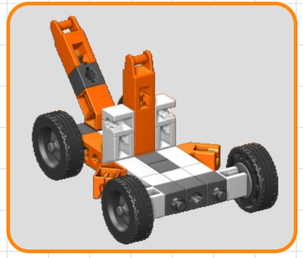

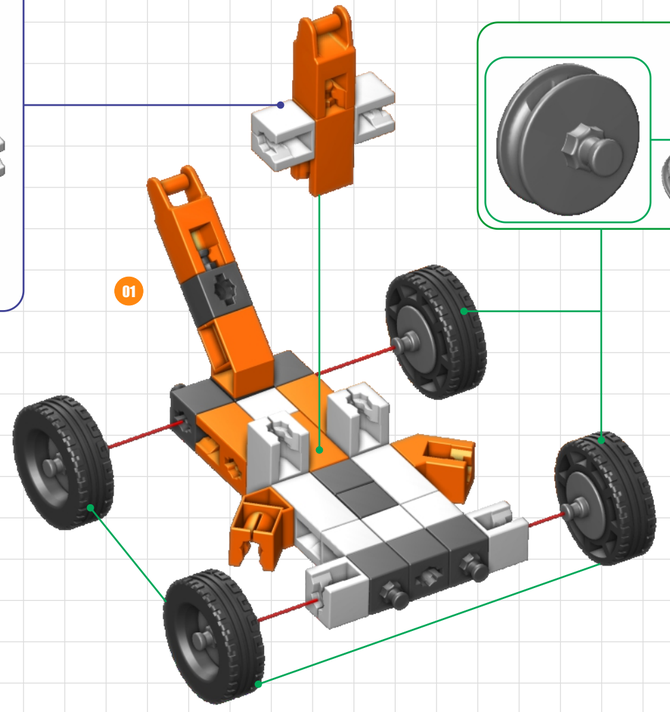

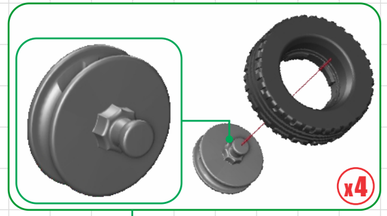

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