

Teachers' guide

Objectives of the lesson

Cognitive objectives:

- Students observe what happens when we change one parameter
- Students compare the different cases.
- Students follow the scientific way of thinking
- Students verify their hypotheses
- Students are able to organize an inquiry

Emotional objectives:

- Students wonder if their hypothesis are correct and verify them through experiments
- Students are encouraged to make hypotheses and experimenting
- Students accept that their assumptions could be wrong

Psychomotor objectives:

- Students collaborate with each other to achieve the objectives of the activity
- Students can handle the measurement instruments
- Students can communicate effectively with their groups and in the plenary discussion, develop their critical thinking skills and be creative when they are asked to solve a problem

Before you start the activity

Before you start the lesson, you need to prepare at least one inclined plane. You can just take a plank and set on 3-4 books, or LEGO sets, as you see in the picture below:



What you have to do is let the vehicle go from the upper part of the plank and measure how far it can go on the ground. Don't push it, just let it go.

Note the STARTING POINT with a paper tape, so that all groups start from the same point. If, when they meet the ground, cannot easily continue their motion, use a piece of paper.

Introduction to the activity

Slides 2-4: Usually, car races are about which car can move faster. Discuss in brief with your students about it and highlight the safety rules.

However, the present activity is about which car can go further and which are the parameters that affect it, which is not necessarily the speed. You can note that “how fast” is a different question than “how far”, and that in science it is very important to be precise in our questions and the words we use.

Scientific way of thinking and working

The lesson is about taking measurements and extracting results. In the worksheet you will do two inquiries, one that is related to the weight of the vehicle in the downhill and one about wheels of different radius. During the presentation (slides 5-8), follow the written conversation between the students and their teacher, so that students understand that when scientists do an investigation (inquiry) they need to be very careful when taking measurements, and repeat them 2-3 times, because there are errors. Then, we change only one parameter per time, the one we want to infer if it affects the problem, keeping the others fixed. Highlight to the students that scientists always work like this.

Simple machine

In the building process you will meet a crown gear that meshes with an 8-teeth gear and a pulley. You can refer to them in brief. The inclined plane is also a simple machine, that we use to take measurements. You can refer to some of its applications if you have time.

Building

Follow the instructions. The construction is relatively small.

During the inquiry

Each group does their measurements one after the other. Take care to just let their vehicle go downhill the inclined plane, without pushing it. Adjust the number of inclined planes you have according to the number of the students' groups. Each group can let a brick of different color at the point their vehicle stopped (always at a specific part of the vehicle, for instance next to the front wheel) and then measure the distance with a meter. Also, define the zero point in the indicator. If students know of the degrees, you can use a protractor.

Answers to the worksheet

1. From the wheels, through a pulley, the motion is transmitted to the axle, where there is a crown gear, that meshes with a simple gear.

Simple machines: pulley, gear (and crown gear). Say a few words about the pulley and the crown gear.

2. We see that each time the vehicle does not move the same distance. Tell the students about the errors in measurements and that to avoid them they need to repeat them many times. Using the weight, the vehicle moves further.

3. The big wheels have a greater radius, so the length of the circle is greater. So, the distance moved is greater.

The inference is that the vehicle with the greater wheels goes further in the downhill.

Suggestions for further inquiries if you have time:

You can try a different inclination for the inclined plane (the greater the inclination the further it will move)

In an uphill, the heavier vehicle, with the same initial force applied stops earlier, whereas the vehicle with the greater wheels will go further.