

1.3 Experiments and Variables

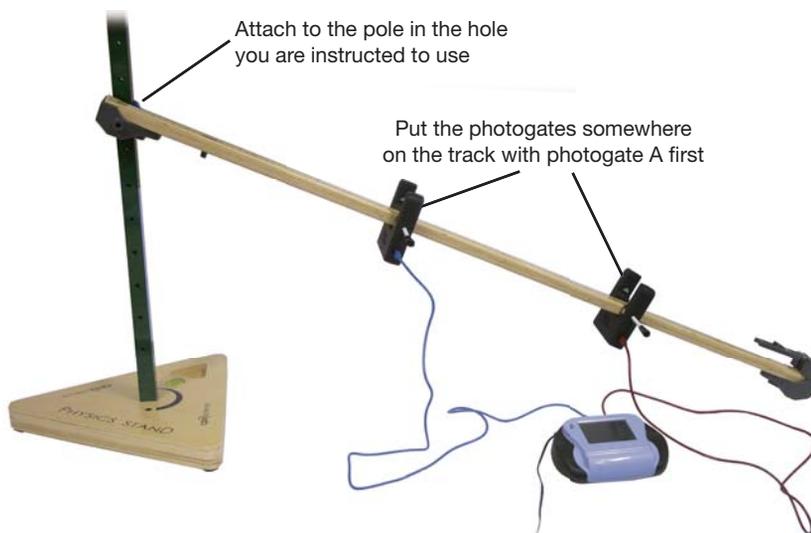
How do you design a valid experiment?

Experiments help us collect evidence so we can unlock nature's puzzles. If an experiment is well planned, the results can provide an answer to a scientific question like "What would happen if I did this?" If the experiment is not well planned, you will still get results, but you may not know what they mean. In this investigation, you will experiment with a car on a ramp. Only by paying careful attention to the variables can you make sense of the results.

Materials List

- Energy Car
- SmartTrack
- DataCollector
- Two photogates

1 Setting up the experiment



1. Attach the SmartTrack to the physics stand with a blue threaded knob. Your teacher will tell you which hole in the stand it should be attached. Each group will have a different angle.
2. Place two photogates on the SmartTrack and connect them both to the DataCollector. Be sure to place photogate A higher up the hill than photogate B.
3. Roll the car down and use Table 1 to record the time it takes the car to pass between the photogates (t_{AB}).

2 Stop and think

- Which track should have the fastest car? Which track should have the shortest time between photogates?
- Write a one-sentence hypothesis that relates the time between photogates to the angle of the track.
- Use Table 1 to record the results from each group in your class. Record the times in the column labeled “First Trial.” Leave the column labeled “Second Trial” blank. How do the results compare with your hypothesis? Can you give a reason why they did or did not behave as you expected?

Table 1: Photogate times from A to B

	First Trial	Second Trial
Attachment hole (holes from bottom)	Time from A to B (s)	Time from A to B (s)

3 Variables

- List at least six variables in your system which affect the time between photogates.
- Which variable is the experimental variable in your class? How do you know?
- What should be done with the other variables (other than the experimental variable)? Why should this be done?
- Name two variables that should not be included in your system. These variables should not have much (or any) influence on the time from photogate A to B.

4 A controlled experiment

- With your teacher and the rest of your class, decide on how to control the variables other than the experimental variable.
- Practice rolling the car until you can get three consecutive times within 0.0010 seconds of each other.
- Repeat the experiment using the experimental and controlled variables you discussed and decided upon. Record the new data in the column titled “Second Trial.”

5 Applying what you have learned

- Does the second trial of the experiment produce results that agree with your hypothesis?
- Why does the second trial produce better agreement with your hypothesis than the first trial did?
- If something does not work, discuss what you should do to try and find the problem. List at least three steps that relate to variables, experiments, and controls.