

7.3 Investigation: Friction and Load

Aim

To test the relationship between friction force and weight of an object being pulled along the surface..

Choose a smooth surface without any indentations. e.g. a vinyl floor or smooth table.

Equipment

Set of 100g weights, wooden or plastic sled, scissors, rubber bands or spring balance, pencil, ruler, Graph paper

Datalogging Option: Force sensor and datalogger.

Make a prediction

Does weight affect the size of friction?

Method 1 using a rubber band.

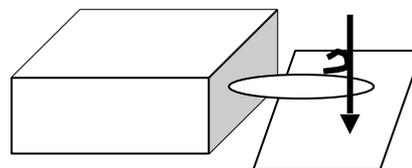
Note: The force required to start an object moving is a measure of the Static Friction between the object and the surface, it is being pulled over.

1. Connect a sled to a rubber band. You can use a block with a hook or make your own cardboard sled:

Make an open cardboard box 10x15cm

Locate the centre on one side of the 10 cm long sides on the cardboard. Use the scissors to carefully poke a hole through the cardboard 2 cm up from the base. Use a small pencil to hold the rubber band inside the hole.

2. Insert a longer pencil into the rubber band from the outside. Hold it straight up and down and have it press lightly on the paper.
3. Mark a starting line. Gently pull the cardboard sled horizontally along the surface with the pencil. The distance the pencil's point moves before it starts to move is an indication of the force required to move the empty sled .
4. Measure the length of pencil line before it moved and record your data in the results table
5. Repeat step 3 twice more and average your results.
6. Add a 100 g weight to the sled and repeat steps 3 to 5



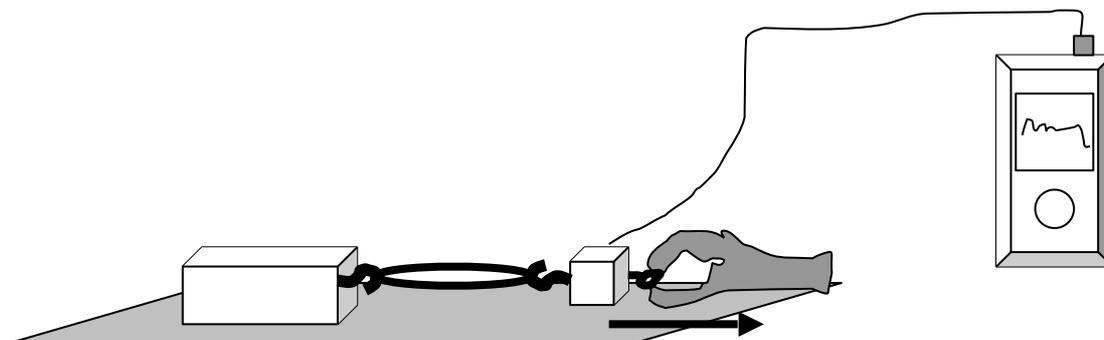
7. Continue to repeat steps 3 and 4, adding an extra 100g for each new trial to a maximum of 500g.

Method 2 using a Force Meter or Spring balance

Repeat the above steps but use the balance as an alternative to the rubber band and read the maximum force before it moves.

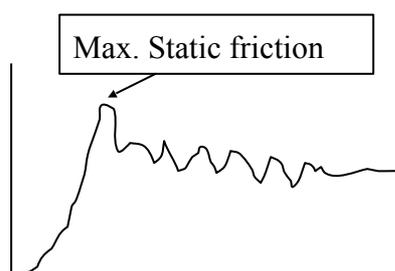
Method 3 Datalogging using a Force sensor

1. Set up the sensor to your datalogger with a maximum force of about 5 Newtons
2. Connect the sensor by the hook to a sled, also with a hook. Use a loop of string to connect them.



3. Start the sampling on the datalogger about 10 times per second for a duration of 5s.
4. Start before pulling and pull the block with the force sensor slowly and evenly.
5. Examine the graph on the datalogger. It should be similar to the diagram below showing a peak at the maximum Static friction just before it moves. If not try the experiment again.
6. Record this maximum value on your graph.
7. Now add 100g weights to your sled and restart you sampling. Record the max. static friction again.
8. Continue up to 500g.

For a force sensor, the graph should be similar too:



Results

Load	Pencil mark length or Force size			
	Test 1	Test 2	Test 3	Average
Empty sled				
+100g				
+200g				
+300g				
+400g				
+500g				

Conclusion

1. Did your results prove you were right?
2. Why did it work/ not work?
3. What other things could you test?