

Pushes, pulls and balanced forces

Grade 7 science (Year 8 · Class 7) · Lab

Name: _____ Date: _____ Class: _____

Why is it harder to drag a loaded box across sandpaper than across plastic? This lab uses a spring scale to measure friction on four surfaces and with two different loads, then looks for the pattern.

Level: Grade 7 science (Year 8 · Class 7) · **Curriculum:** MS-PS2-1, MS-PS2-2

Aim

To investigate how the surface and the weight of a block affect the friction force that opposes its motion.

Equipment

- A wooden block with a hook, mass 0.50 kg
- A second slotted mass of 0.50 kg to place on top
- A spring scale (0 to 10 N)
- Four surfaces: plastic sheet, wooden board, carpet square, sandpaper
- String

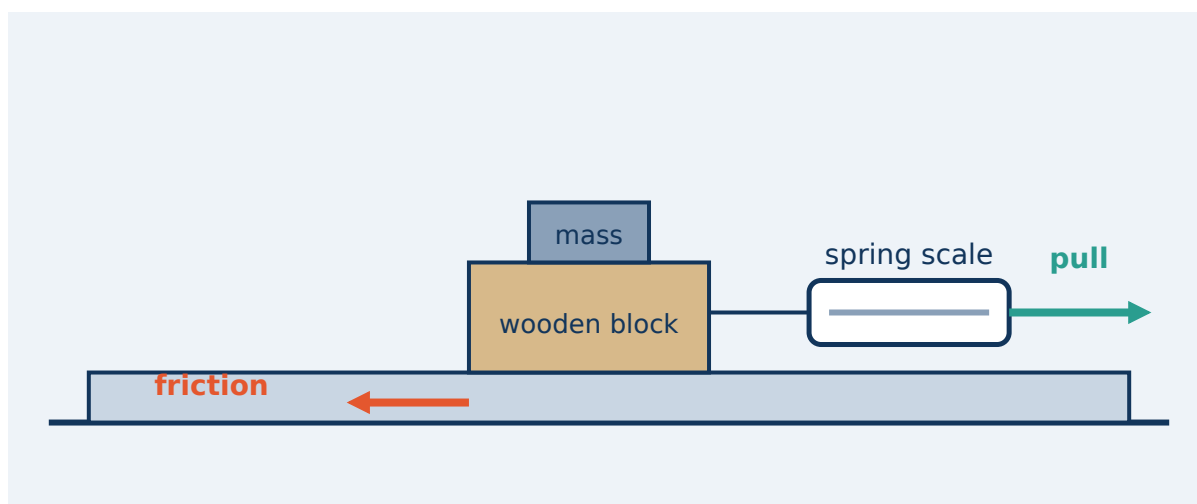
Safety

Safety

Pull gently and keep the string in line so that the block does not jump. Keep your feet out of the path of the block and do not let the mass fall from the table.

Method

1. Check that the spring scale reads zero when held horizontally.
2. Place the 0.50 kg block on the plastic sheet. Pull it at a slow, steady speed and read the scale while it moves.
3. Repeat for the wood, the carpet and the sandpaper.
4. Add the second 0.50 kg mass on top, so the load is 1.00 kg, and repeat for all four surfaces.
5. Take each reading twice and record the mean.



The scale reading while the block moves at steady speed equals the friction force.

Results

Sample measurements from one group are shown below. The weight of the 0.50 kg block is 4.9 N and of the 1.00 kg load is 9.8 N.

Surface	Pull with 0.50 kg block (N)	Pull with 1.00 kg load (N)
Plastic	1.2	2.4
Wood	2.0	4.1
Carpet	2.8	5.5
Sandpaper	3.3	6.5

Analysis questions

Question 1 Variables

1. State two independent variables.
2. State the dependent variable.
3. Name one variable that must be kept the same.

Question 2 Why steady speed?

Explain why the scale reading equals the friction force only when the block moves at a steady speed.

Question 3 Ranking surfaces

Rank the surfaces from least to most friction using the 0.50 kg results.

Question 4 Effect of load

Compare the 1.00 kg readings with the 0.50 kg readings. Calculate the ratio for sandpaper and describe the pattern.

Question 5 Friction compared with weight

Calculate friction $\div$ weight for wood with each load (weights 4.9 N and 9.8 N). What do you notice?

Question 6 Prediction

Predict the friction force on plastic for a 1.50 kg load (weight 14.7 N), using the 0.50 kg result.

Question 7 Uncertainty

The scale can be read to ± 0.1 N. Calculate the percentage uncertainty on the plastic reading of 1.2 N and say what it means.

Question 8 Better friction measurements

Describe two changes that would make the friction readings more precise and more repeatable.