

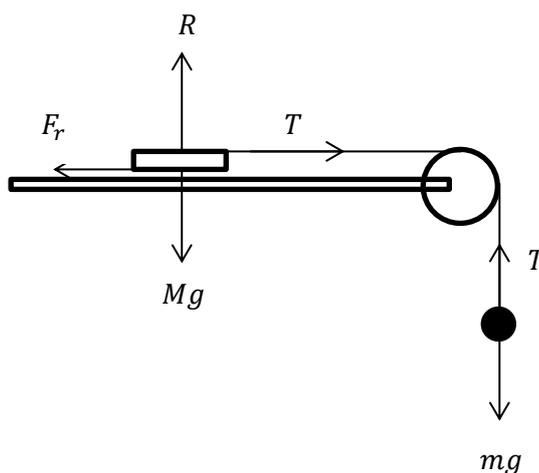
The law of friction experiment

Aim: To establish the inequality $F_r \leq \mu R$ as a model for friction.

Equipment:

- Friction block - This can be constructed from a piece of wood with some sort of material attached to the bottom in order to create a rough surface. A small nail or tack towards the front enables a string to be easily attached.
- A selection of masses including 100 g and 10 g masses
- Pulley clamped to edge of table
- String
- Blu-tac

The experiment is based upon the scenario illustrated below. Throughout this resource the forces are referred to by the letters shown.



Practical notes:

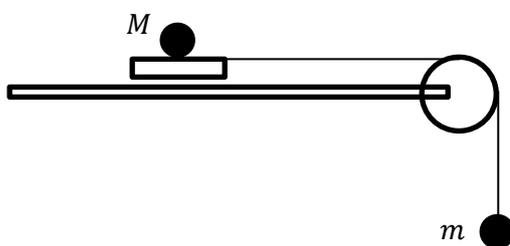
- Masses can be attached to the block using Blu-tac.
- This is an experimental law and is only valid over a certain range. It is therefore unlikely that students will produce a set of results that fit a straight line. This should be seen as an opportunity to discuss the limitations involved in experiments.
- Students could be given different 'friction blocks' to use and thus find different values of the coefficient of friction. Trying the same block on a different surface would emphasise the point that the coefficient of friction is dependent on the two surfaces in contact rather than a property of an object.

Adapted from an activity of the same name in 'Mechanics in Action' (1990)

The law of friction - Student sheet

- Equipment:**
- Friction block
 - A selection of masses including 100 *g* and 10 *g* masses
 - Pulley clamped to edge of table
 - String
 - Blu-tac

- Set up the equipment as shown in the diagram below and draw a force diagram that represents the scenario:



- Add masses to m until the pull on the M causes the block to slide along the table. Note down the values of M and m . A suggested starting value of is 50 *g*.
- Repeat for different values of M e.g. 100 *g*, 150 *g*, 200 *g*, etc.
- Record your results and plot the data on a graph of F_r against R . How is F_r related to R ?
- What can you say about the law of friction?
- What can you say about the coefficient of friction?

Some further points to explore:

Q: What happens to the coefficient of friction when you conduct this experiment on a different surface?

Q: Can you find the coefficient of friction for other 'friction blocks'? Try to predict a value before you begin the experiment.