6.3 Energy changes

# Braking distance and velocity

Apparatus:

* Light gate assembly (to measure velocity) plus datalogger
* 100g mass
* metre rule
* suitable surface (e.g. bench top)

d

100g mass

light gate

Procedure

* Push the 100 g mass so that it slides freely through the light gate and measure the distance it travels until rest.
* Repeat this process for as many different speeds as possible.
* Record your results in a suitable table or spreadsheet.
* Draw a graph of velocity against stopping distance.
* Draw a graph of velocitysquared against stopping distance.

Safety

The metre rule can be used as a barrier to prevent the mass flying off the end of the bench when pushed too violently.

Questions:

What can you conclude from the graphs you have drawn?

Estimate the frictional force on the mass.

# Results and conclusions

External references

This activity is taken from Resourceful Physics <http://resourcefulphysics.org/>

# A slide

A child is playing with a nearly frictionless car down a smooth flexible track. She arranges the identical length of track in two ways.



In both arrangements the track runs from the same place on the edge of a table to floor level.

1. She thinks that the car runs off the track at very nearly the same speed in both arrangements when started from rest at the top of the track (the point nearest the table). Is she right or wrong? Give a reason for your answer.

2. She thinks the car takes longer to run down the top arrangement than down the bottom arrangement, when started from rest at the top of the track. Is she right or wrong? Again, justify your answer.

3. Suppose she now lets a car of twice the mass of the previous one run from rest down the top arrangement. Will this car, which has twice as great a mass, take a shorter, the same, or a longer time to run down the track? Give a reason for your answer.

# The high jump – energy changes

Note: *g* = 9.8 N kg-1 = 9.8 m s-2

1 A jumper of mass 75 kg jumps a height of 1.9 m

(a) Calculate the gravitational potential energy of the jumper at his highest point.

(b) Calculate the vertical velocity of the jumper just before impact with the crash mat. (HINT: what was the vertical velocity of the jumper at the top of his jump?)

(c) Show that the kinetic energy associated with his vertical velocity is equal to the gravitational potential energy at the top of his jump.

(d) The jumper is stopped over a distance of 0.3 m when he lands on the crash mat.

Calculate the average force on the jumper as he comes to rest.