# Acceleration due to gravity

Subject: Physics

Overview:
A simple experiment using two light gates to measure the acceleration due to gravity. This experiment allows students to practise good experimental techniques as errors are easily observed due to acceleration of free fall being known as 9.81m/s^2

Aim:
To prove that the acceleration of free fall is 9.81m/s^2 and to look at how light gates can be used to investigate other physical concepts.

Equipment required: LogIT Datalogger.
Datalogging software, computer.
2 light gates.
Clamp stand.
Black card (10cm square).
Modelling clay or similar.
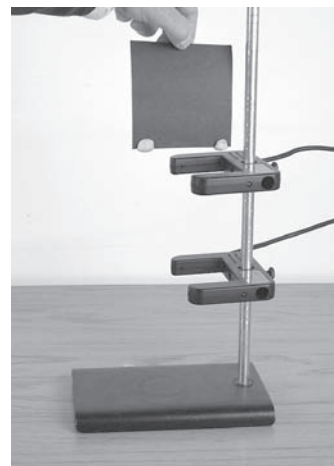
Hazards:
Take care that the object being dropped is suitable and not liable to cause injury.
Always check your local regulations or the school advisory service such as CLEAPSS or SSERC for guidance on the use of any hazardous material.

Method:
1. Connect the light gates to the data logger in channels 1 and 2 (channel 1 being the first light gate).
2. Connect the data logger to the computer and run the datalogging software. Set up 'Acceleration' from the timing menu of the software.
3. Place two equal mass pieces of modelling clay on the bottom corners of the black card.
4. Attach the light gates to the clamp stand as shown in the photo.
5. Start logging.
6. Hold the card as close to the top gate without triggering it and then drop the card.
7. The acceleration of free fall will be recorded.

Results:
• Did the results agree with the earths acceleration of free fall?
• What might be causing a problem?
• How might the problem of any inaccuracies be removed? Is this practical?
• How could you improve this particular experimental procedure?

Going further:
For more advanced students, try deriving the acceleration rather than using two light gates. This can be done using a ruler and a single light gate set to record the final velocity of the card after falling a set distance. By using the equation $\boldsymbol{v^2 = u^2 + 2as}$ where 'v' is the final velocity of the card, 'u' is the starting velocity, 's' is the distance travelled and 'a' is the acceleration.
By using this method, students can also make use of a spreadsheet to calculate the acceleration each time.
Also, the relationship between the distance travelled and velocity can be examined at the same time.

Try using a different number of paper cake holders and investigate how mass affects the velocity of a falling object. As each additional cup cake holder is added, the mass can be increased and the relationship between mass and free fall velocity examined.