GCSE Physics required practical activity 8: Acceleration

Student sheet

Required practical activity	Apparatus and techniques
Investigate the effect of varying the force on the acceleration of an object of constant mass and the effect of varying the mass of an object on the acceleration produced by a constant force.	AT 1, AT 2, AT 3

Investigating acceleration using an air track and light gates

In this activity you will investigate the relationship between the acceleration of an object and the size of the force acting upon it. You will use an air track. This produces a cushion of air which allow gliders to move almost friction free.

Learning outcomes
1 **2** **Teachers to add these with particular reference to working scientifically**

Method

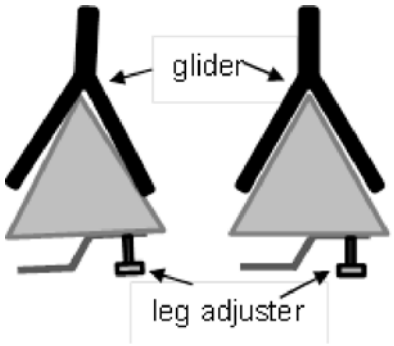
You have access to the following:

- linear air track and gliders
- bench pulley, string and small weight stack eg 1 N in steps of 0.2 N
- card 10 cm x 5 cm
- two clamp stands, clamps and bosses
- two light gates, interface and computer
- Blutak or similar to attach the weights to the glider.

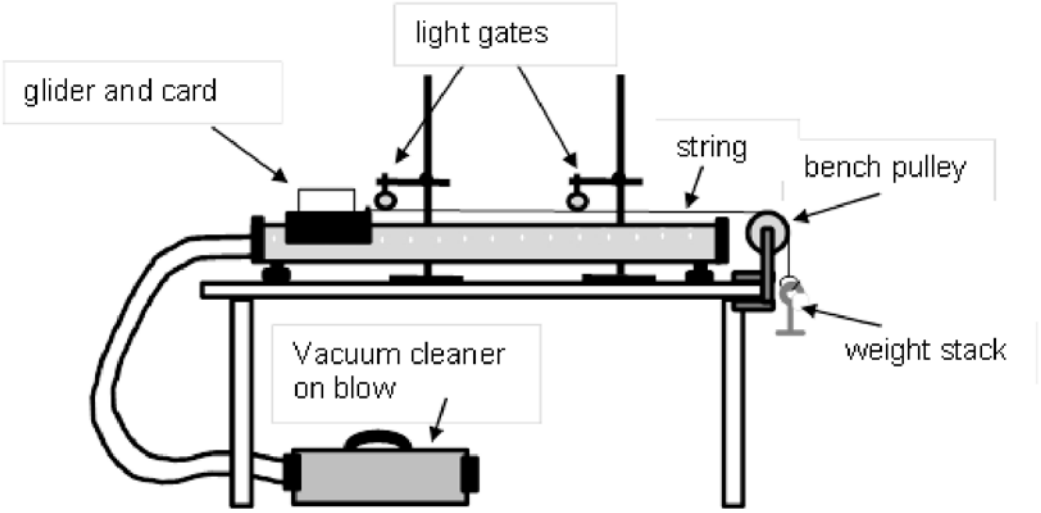
You should read these instructions carefully before you start work.

1. Place the air track on a bench and attach it to the vacuum cleaner, set on 'blow'.
2. Place a glider on the air track and switch on the vacuum cleaner. The glider should lift up off the air track and be free to move.
3. Adjust the legs of the air track so that the glider moves without touching and the air track is horizontal. There are two separate adjustments to make. With the vacuum cleaner on:

    - place the glider above the adjuster that tilts the air track from side to side. Adjust the length of the leg until the glider does not touch the sides;
    - then place the glider in the middle of the air track and adjust the other leg until the glider does not move when released.



4. Cut out a piece of card measuring 5 cm x 10 cm and place it, with the long side horizontal, in the groove on the glider.
5. Clamp the two light gates horizontally and place them above the air track so that the card passes through them as the glider moves.
6. Connect the light gates to the interface and computer. Start the software for timing. You should have the opportunity to choose acceleration using two light gates. Type in the length of the card (10 cm) when asked by the software.
7. Check the movement of the glider by gently pushing it along the track with the software running. The acceleration should be close to zero. Switch off the vacuum cleaner.
8. Attach the bench pulley to the end of the air track away from the vacuum cleaner.
9. Tie a length of string to the glider, pass the string over the pulley and attach the weight stack to the free end. Make sure the string is horizontal and is in line with the air track.
10. Switch on the vacuum cleaner. The glider should accelerate through the light gates as the weight falls to the ground.
11. If necessary, move the second light gate so that the glider passes through it before the weight hits the ground. Otherwise the glider will stop accelerating too early.



12. The first experiment will investigate how the acceleration depends upon the force. The force is provided by the weight stack. Attach the full weight stack (1 N) to the end of the string, switch on the software, make sure the glider is in position and switch on the vacuum cleaner. The glider should accelerate through the light gates towards the bench pulley. Record the acceleration. Repeat. If the two values are not similar, repeat again. Record your readings in a suitable table, and calculate the mean.

Force in N	**acceleration in cm/s^2**			
	first go	**second go**	**third (if necessary)**	**mean**

13. Remove one weight (0.2 N) and attach that to the glider. This will keep the total mass constant. (The weight stack is being accelerated too.)

14. Repeat the experiment for a force of 0.8 N, 0.6 N, 0.4 N and 0.2 N. Remember to attach each weight to the glider as it is removed from the weight stack.

15. Plot a graph of acceleration in m/s^2 against force in N.