Forces: Falling Objects

What to do in advance: You need to have two pieces of A4 paper (scrap) and two identical film canisters, one of which is filled with sand (or something else to give it more mass).

What to do with pupils (part I): Show them the two pieces of paper and explain that you are going to drop them both from the same height at the same time. Get the pupils to vote for the piece of paper that they think will hit the floor first (can include an 'option 3' of them hitting the floor together). Before you drop the paper, screw up one of the pieces into a ball. Announce the winner (to a chorus of groans!) and then discuss with the pupils.

You can also do a similar experiment looking at water resistance where you drop differently shaped pieces of plasticine (but equal mass) through water in a clear water tank.

Questions to stimulate pupils' thinking

- Some of you seem to be unhappy with the outcome of my experiment– why?
- Why did the screwed up paper hit the ground first?
- Why did changing the shape of the paper make a difference?
- Can anyone think of a situation where you'd want to increase the air resistance?
- Can anyone think of a situation where you'd want to decrease the air resistance?

What to do with pupils (part II): Show them the two film canisters, including what's inside (one is empty and one is not) and explain that you are also going to drop them both from the same height at the same time. Again, get the pupils to vote for their predictions - which canister do they think will hit the floor first (can include an 'option 3' vote of them hitting the floor together). Announce the result – that both film canisters hit the floor at the same time and then explore the science behind it through discussion with the pupils.

Questions to stimulate pupils' thinking

- Why did pupils make the predictions that they did?
- Do both film canisters experience the same amount of air resistance? Why?
- Why did both film canisters hit the ground together, even though one was heavier?

The science behind it

Objects fall because of gravity, a force that pulls things towards the centre of the Earth. When objects fall through air there is a force that pushes against the direction of motion, like friction, and it is called 'air resistance'. This is because objects moving through air have to push past the

air molecules as they travel. Smaller shapes have less air to push out of the way as they move, so they experience less air resistance.

It seems intuitive to assume that in situations with identical air resistance, heavier objects fall faster, but how heavy an object is doesn't actually affect the speed of the fall at all. The first person to notice this was Galileo. He was a brilliant scientist because he decided to check what everyone else just assumed was true. So, the story goes, he went to the top of the Leaning Tower of Pisa with two heavy balls that were the same size but different weights. He then leaned over the side and dropped them both at the same time (the nice thing about having a leaning building is that when you drop things they're not going to knock off the side of the building). Galileo had a friend standing on the ground, watching and listening to see which one hit the ground first, and that was the first time that anyone ever actually noticed that weight doesn't affect falling speed!