Make a Magnetic Rocket

Teacher Notes for Years 7-10

To propel an object forward requires force, which we will borrow from a handful of magnets.

Video Summary

Vanessa demonstrates a Magnetic Accelerator. It is a line of three steel ball bearings sitting on a track, attached to a small neodymium (rare-earth) magnet. The magnet keeps the balls attached in a row, and stops them from rolling away.

A fourth ball is rolled towards the magnet. The magnet attracts the ball, causing it collide forcefully with the magnet. The momentum of this collision is transferred through the magnet and the three motionless balls, much like how a Newton's Cradle works.

The final ball flies free with a velocity greater than the initial ball.

Ollie uses this principle to scale-up the magnetic accelerator. Using wooden skewers and blu-tack, he creates a track that has five magnets with two steel ball bearing on one side of each magnet.

The magnets are placed apart far enough so that they don't attract and stick to each other.

Due to the attractive force of the magnet at each station, momentum is added, until the final ball flies off at a velocity much greater than the initial ball which starts the process.

Figure 1: The magnetic rocket. Using skewers, ball bearings, magnets and blu-tack.

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Figure 2: Alternative versions. Other non-magnetic material could be used for a track.

Science Understanding (Year 8 & 10)

Physical sciences

Energy appears in different forms including movement (kinetic energy), heat and potential energy, and causes change within systems. (Year 8)

The moving ball bearings are an example of kinetic energy. However, the velocity of the final ball is much greater than the initial ball that was pushed into the magnets.

Students could explore where the additional energy came from, with particular attention to the fact that energy cannot be created.

Energy transfer through different mediums can be explained using wave and particle models. (Year 9)

The steel balls are very inelastic. When they collide, they tend not to deform to absorb the collision. As such, the energy of the collision is passed onto the next ball in the line.

The motion of objects can be described and predicted using the laws of physics. (Year 10)

Students could try measuring the speed of the final ball compared to the initial ball, and calculate the total acceleration that the magnets have provided.

Students could also explore the relationship between the magnetic rocket and a "Newton's Cradle", where momentum is transferred through a line of five balls.