

Lenz's Law and Rail Guns

Teacher Notes for Years 7-10



The Rail Gun video demonstrates the use of Lenz's Law to accelerate an object.

Video Summary

Both the ring launcher and the rail gun use called Lenz's Law to give an object momentum.

Lenz's Law can be observed when a magnet moves over a piece of wire. A current is induced in the wire by the moving magnetic field. Similarly, a current flowing along a wire creates a magnetic field.

In the case of the ring launcher that Mitch uses, at one end is a coil of wire. When the device is turned on, current flows through the wire, creating a powerful magnetic field.

The aluminum ring on the launcher is within this field, so a current is induced to flow around the ring. Because of this current, there is now a second magnetic field created around the ring.

The magnetic field around the ring is opposite to the coil's magnetic field, so the ring is repelled away from the coil.

A similar process is happening with Vanessa's rail gun. The 'bullet' is made from two cylindrical magnets on the ends of a metal rod. A current flows down one rail and over the bullet. This flowing current creates a magnetic field that repels the magnets, causing the bullet to move.

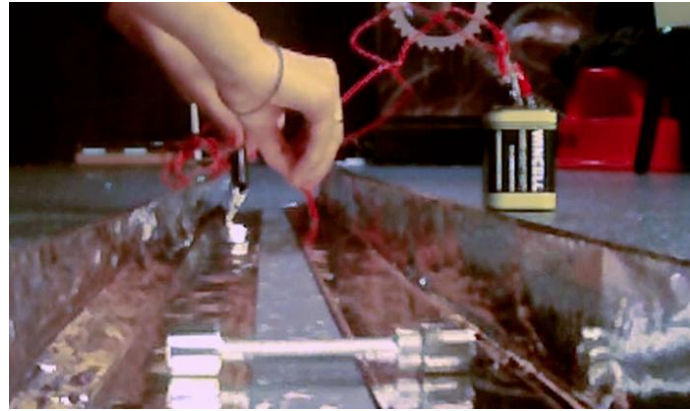


Figure 2: The rail gun and 'bullet'.

Science Understanding (Year 7 & 10)

Physical sciences

Change to an object's motion is caused by unbalanced forces acting on the object. (Year 7)

The ring launcher fires by generating an opposite magnetic fields. The fields in the ring and the launcher want to move away from each other. As the launcher is anchored by Mitch's hand, it is the ring that flies away.

Energy conservation in a system can be explained by describing energy transfers and transformations. (Year 10)

Energy in the form of electricity in the coil is used to generate the magnetic field. The field's strength is proportional to the electrical current in the wire. Conversely, the amount of current induced in a wire is proportional to the strength of the magnetic field. Increasing the size of the rail gun's battery will make the bullet move faster.

Science as Human Endeavour (Year 7)

Nature and development of science

Scientific knowledge changes as new evidence becomes available, and some scientific discoveries have significantly changed people's understanding of the world. (Year 7)

Lenz's law derives from work done by Michael Faraday. Faraday's insights into the links between electricity and magnetism overturned the prevailing thoughts of his day, and lay the way to new inventions such as the electric motor.



Figure 1: The ring launcher.