

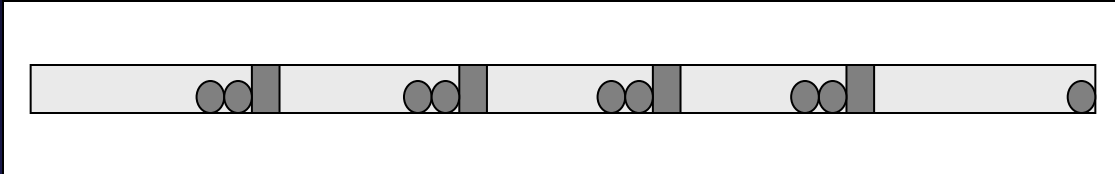
# GAUSS RIFLE

What to do

1. Arrange the steel balls according to the diagram below
2. Gently roll the first ball towards the first magnet



**CAUTION!** Do not place any body parts along rail of rifle during operation.



How does the Gauss Rifle accelerate the steel ball?

Rolling the first ball will give it an initial kinetic energy. The first magnet exerts a force on the steel ball which accelerates it, increasing its kinetic energy. When the ball collides with the first magnet it comes to rest. Energy must be conserved, so the kinetic energy of the ball is transferred to the magnet. The magnet transfers this kinetic energy to the second ball, which transfers the energy to the third ball. This energy causes the third ball to move toward the second magnet.

The second magnet exerts a force on the third ball, increasing its kinetic energy. A similar collision occurs between the third ball and the second magnet. This sets the fifth ball into motion. A chain reaction is occurring along the Gauss Rifle. After each collision, the moving ball has a velocity higher than the ball that was previously moving.

Would a Gauss Rifle work if there was only one ball on the side of each magnet?

The Gauss Rifle can be thought of as a linear accelerator.

Linear particle accelerators are used extensively in physics to accelerate charged particles to high energies. This is not done with magnets, but by applying alternating voltages along the accelerator. The accelerator consists of a line of charged tubes, with alternating positive and negative voltages. At a gap between two tubes the particle will be attracted to the next tube along. The attraction causes the particles to experience an acceleration. This is similar to the way that the steel balls were accelerated when attracted to the magnets in the Gauss Rifle.



A magnetic field also exerts a force on charged particles. This principle can be used in the construction of particle accelerators.

Circular particle accelerators use a magnetic field to exert a force on charged particles within the accelerator. This causes the particles to move in a circular path. Each time the particles move around the accelerator they can be accelerated, allowing for large energies to be achieved.

