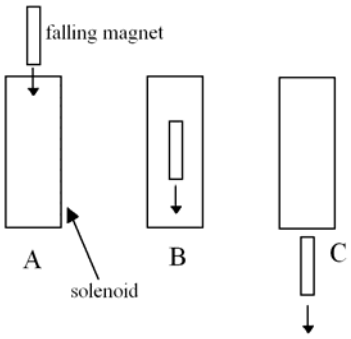
The emf signal from a solenoid due to a bar magnet falling through it.

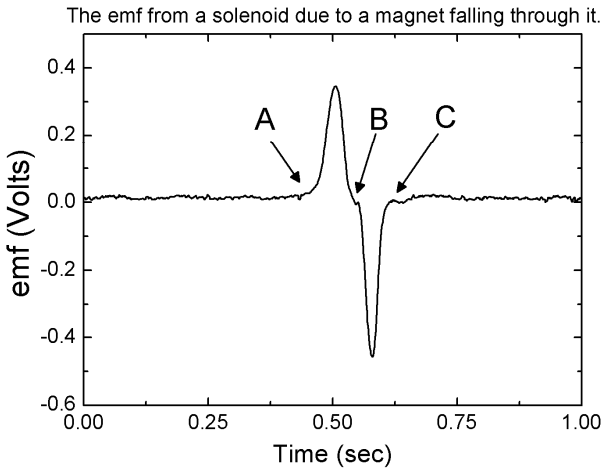
A bar magnet was dropped through a solenoid as shown in the diagram on the right.



The positions of the falling bar magnet are: just before it enters the solenoid (A), in the middle of the solenoid (B), as it exits the solenoid (C).

The bar magnet face was rectangular measuring 1 cm by 1.5 cm, and was 7cm in length. The solenoid had a diameter of 4 cm and a length of 15 cm. The relative size of the bar magnet to the solenoid are approximately as shown in the diagrams. The magnet was an Alnico magnet.

The emf produced in the solenoid was measured with a digital oscilloscope, which gave the following trace.



The A, B, and C positions are indicated on the graph. There are a couple of features to note:

(a) The sign of the emf as the magnet enters the solenoid is opposite to that when the magnet exits.

(b) The two peaks are not the same width because the magnet is falling freely and thus accelerating, so the induced emf occurs more quickly as the magnet nears the other end of the solenoid.

(c) There is zero emf when the centre of the magnet corresponds to the centre of the solenoid.