

Torque on a Current Carrying Coil in a Magnetic Field

Apparatus

horseshoe magnet or pair of bar magnets, loop of wire attached to power supply

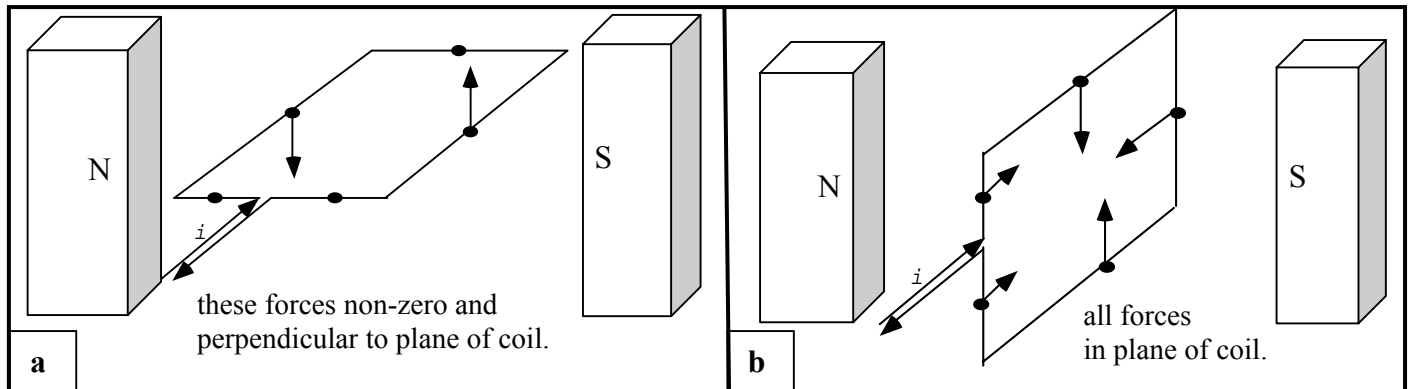
Action

The students turn on the power supply and experiment with placing the coil at different angles and observing its behaviour.

The Physics

The force is proportional to the cross product of the current in the wire and the external field, $F \propto i \times B$. When the coil is horizontal (figure a) the magnetic field is perpendicular to the current at the points shown and hence the force is a maximum, and itself perpendicular to both the current and the field. In this position the coil will begin to rotate when the power is switched on.

When the coil is vertical (figure b) the forces will be in the plane of the coil and in different directions. They will tend to cancel and the coil will not move in this position.



Accompanying sheet

Torque on a Current Carrying Coil in a Magnetic Field

Align the coil between the magnets and turn on the power supply.
Explain what happens.
Explain what happens when the coil is aligned the other way.

The diagram shows two configurations of a current-carrying coil between two vertical bar magnets labeled 'N' and 'S'. The magnetic field is directed from N to S.

In the left configuration, the coil is horizontal. The current i flows into the page on the left side and out of the page on the right side. The force on the left side points down, and the force on the right side points up.

In the right configuration, the coil is vertical. The current i flows into the page on the left side and out of the page on the right side. The force on the left side points right, and the force on the right side points left.