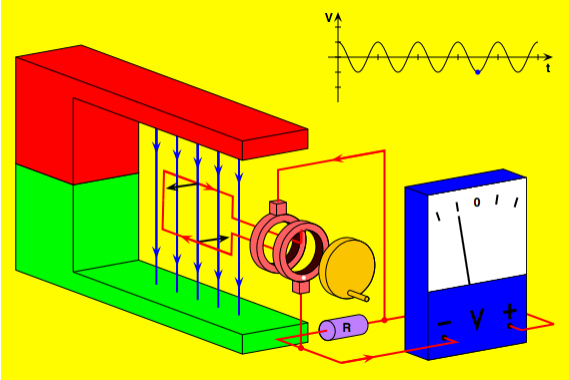
7.4.2 The a.c. generator

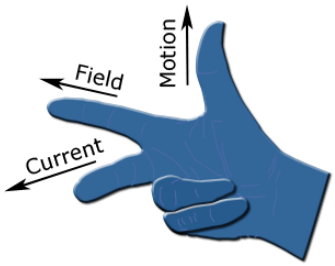
videos

When a coil of wire is rotated in a magnetic field alternating potential difference is induced across the ends of the coil. If the ends of the coil are connected to a circuit, an alternating current (a.c.) is generated in the circuit.

Open the following simulation:
https://www.walter-fendt.de/html5/phen/generator_en.htm



In the position shown in the diagram (left), the top and bottom parts of the loop of wire are cutting through field lines. The potential difference is shown on the voltmeter. The ends of the loop of wire are connected via slip rings and brushes to an external circuit containing a resistor (R). The potential difference generates a current in the circuit.



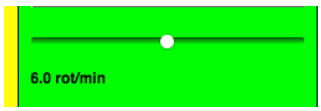
Fleming's Right Hand Rule can be applied to the section of wire at the top of the loop. Field is pointing downwards, movement is to the left, so the current direction is outwards. (try it!)

As this section of the loop rotates down to the bottom, it cuts through the magnetic field in the opposite direction.

(1) Using Fleming's Right Hand Rule, what direction does the current flow at this position?

The loop continues to rotate, and this section of the loop will repeatedly cut through the magnetic field is alternating directions.
(2) How does this affect the current?

Now increase the rotation speed using the slider.

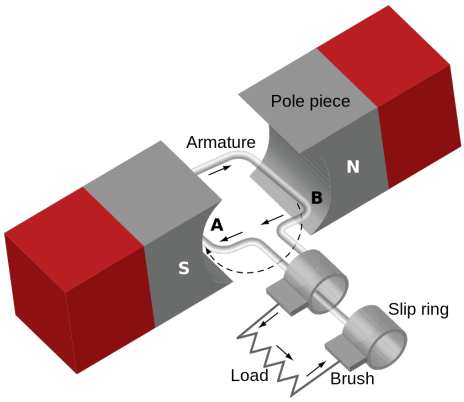


(3) Describe two effects this has on the induced voltage.

(4) How do the effects in question 3 affect the current?

A bigger potential difference can be induced by i) increasing the number of loops (coils), ii) inserting a soft iron core in the middle of the coil.

(5) What <u>other</u> factor would increase the induced potential difference?



Slip rings and brushes are used to connect the rotating coil to the external circuit (see diagram).
(6) Why are they necessary?

(7) Give two examples of where generators are used.