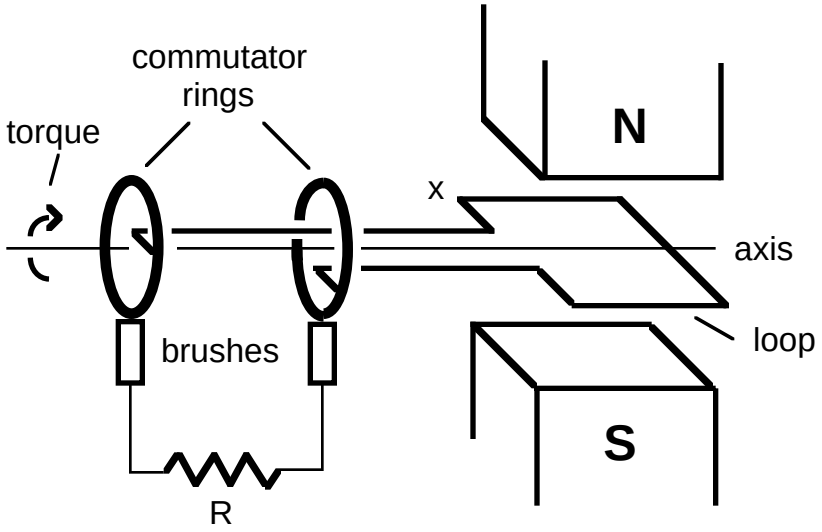
The Electric Generator : Notes/W.S.-25

An electric generator is a device which converts mechanical energy into electrical energy. The mechanical energy can come from moving water, wind, or even muscle power.

In its simplest form, a generator consists of a piece of wire that is made to move in a magnetic field. An emf is generated by Faraday's law. This emf can do useful work.

The generator may be AC or DC. In an alternating current (AC) generator, the current moves back and forth (alternates). In a direct current (DC) generator, the current flows in one direction only.

The Simple Generator



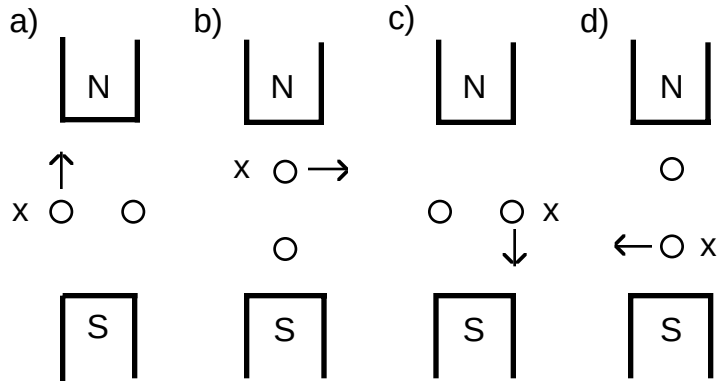
The loop is rotated using mechanical energy, so, by Faraday's law, an emf is induced in the loop. The loop is attached to the two commutator rings (copper) which are in contact with the brushes (carbon or graphite). The loop, commutators and brushes are conductors. The two brushes are connected to the resistor. There is an emf across the resistor which can do useful work. The axle is not shown.

Problems:

1)a) Find the maximum emf generated. B = 2.0 T, A = 1.5 cm^2, frequency = 8.0 cycles per second, (use the formula: emf(max) = $2\pi fAB$).

b) Find the average emf generated during the first one-quarter turn (use emf = $\Delta\Phi/\Delta t$).

2) Give the conventional current direction in the loop; into page (i), out of page (o), or zero (z). The diagrams below show the loop looking down the axis from the left in the above diagram.

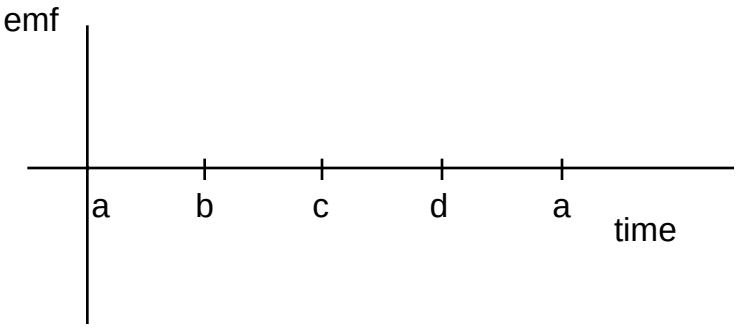


3)a) In problem 2) above, when is the flux a maximum; when the loop is in position a), or b)?

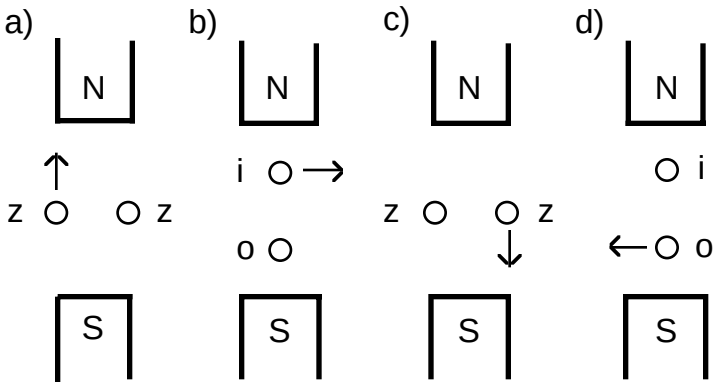
b) In problem 2) above, when is the emf a maximum; when the loop is in position a), or b)?

4) Is the generator AC (alternating current), or DC (direct current)?

5) Draw the (qualitative) emf versus time graph.



Answers: 1)a) 0.015 volts, b) 0.0096 volts, 2)



3)a) a, b) b, 4) AC, 5)