Electric motor

1. Here's a rectangular loop of wire in a magnetic field, which is mounted to rotate about the dashed axis. If a voltage is applied, electrons pass through the loop of wire.

   For different positions of the loop of wire (pictures A to E), do the following:

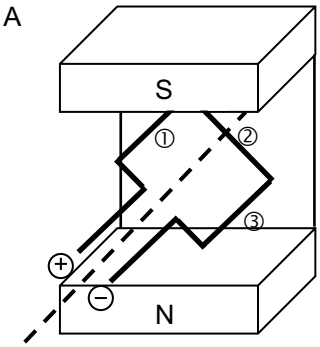
a) Draw the representation of the magnetic field of the horseshoe magnet (as arrows)
b) Draw in the picture, in which direction the electrons move through parts ①, ② and ③ of the rectangular loop of wire
c) Draw the direction of the magnetic force acting on the parts ①, ② and ③ of the rectangular loop of wire
d) Does the loop of wire rotate? If yes, in what direction (clockwise or counterclockwise)? If no, why not?
e) Picture A and E look almost identical; but they are not. What is the difference?

   .....

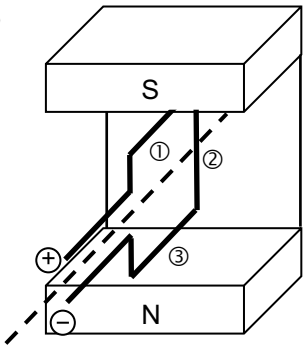
f) What change needs to be made in picture E, for the loop of wire to continue rotating in the same direction as it does in pictures A and C? Give reasons for your answer.

   .....

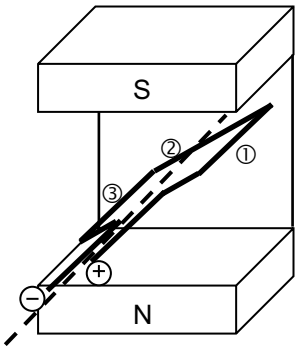
A



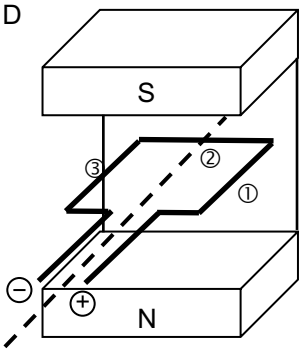
B



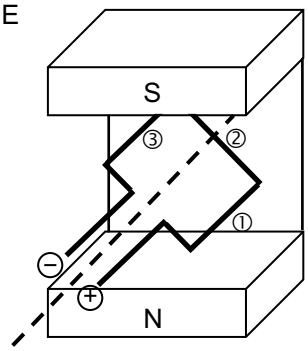
C



D



E



2. Look at these animations of an electric motor:

   https://www.geogebra.org/m/gc8r3gda

   https://www.walter-fendt.de/html5/phen/electricmotor_en.htm

   What is the difference to 1.? How is the problem of 1.f) solved?

3. Here's a picture from the animation of Walter Fendt.

a) Label: *voltage source*, *rotating loop of wire*, *split ring*, *contacts*.

b) Which parts rotate along with the loop of wire, and which parts don't?

c) Which parts of the split ring conduct electricity, which ones don't?