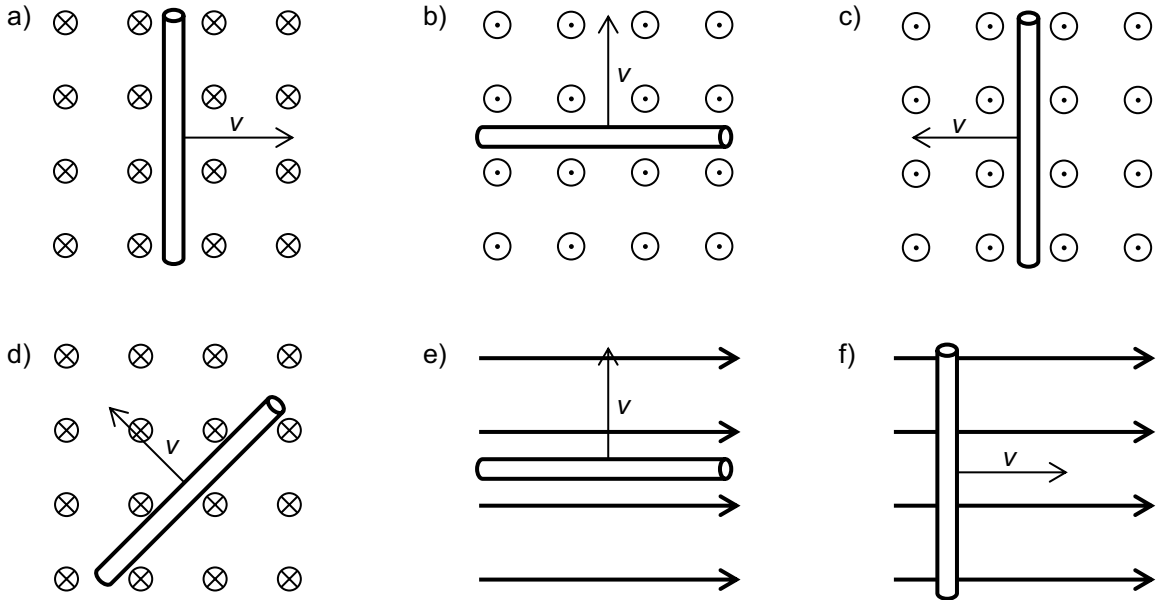
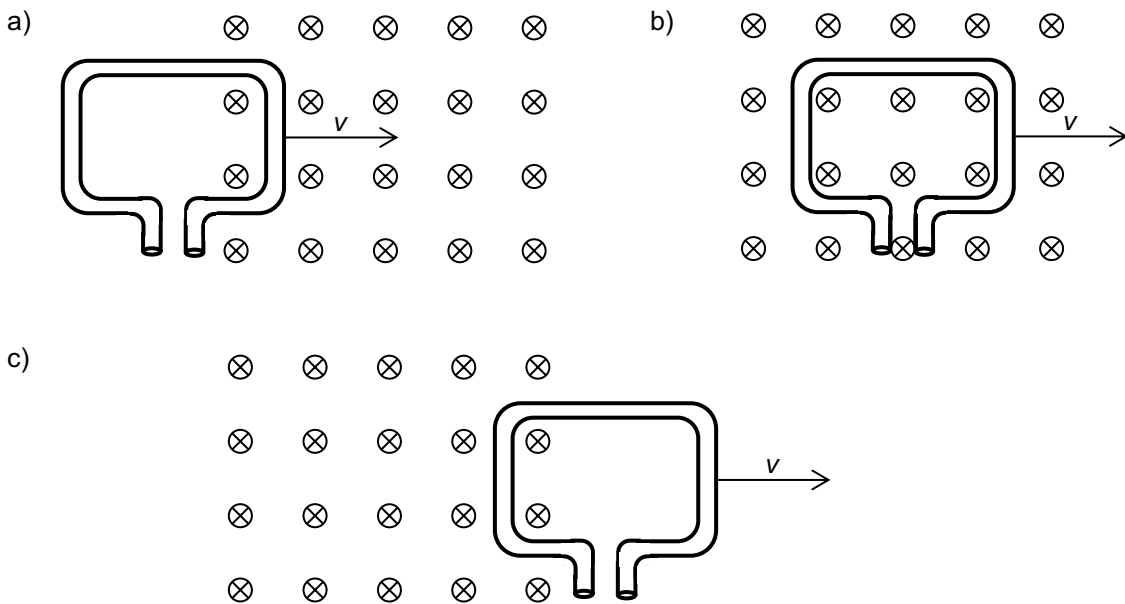


1. Various metal rods are moving in a uniform magnetic field. Draw in the picture
- the direction of the magnetic force acting on the electrons in the rod
 - where the electrons go due to this force
 - whether a voltage is induced between the ends of the rod. If yes, label them + and -.
- Hint: In some cases no voltage is induced. Explain why!*



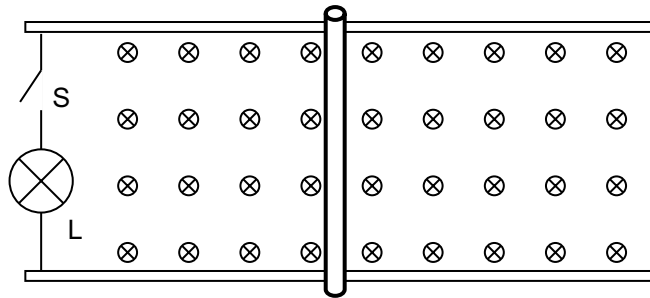
2. A rectangular loop of wire is moved through a magnetic field. At first only the right side of the loop of wire is within the magnetic field, then the whole loop of wire, and finally only the left part of the loop of wire is withing the magnetic field. Draw in the picture

- the direction of the magnetic force acting on the electrons in different parts of the loop of wire
- where the electrons go due to this force
- whether a voltage is induced between the ends of the loop of wire. If yes, label them + and -



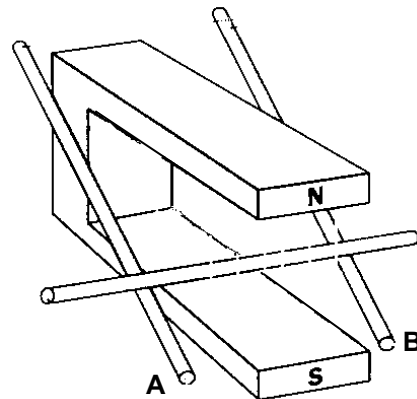
3. A metal rod of 1'435 mm length is moving at a constant speed of $144 \frac{\text{km}}{\text{h}}$, perpendicular to a magnetic field of $43.0 \mu\text{T}$. Calculate the induced voltage.
4. A plane is flying from East to West. The tips of the metal wings are spaced 30.0 m apart and a voltage of 0.50 V is induced. The vertical component of the magnetic field of the Earth is $43.0 \mu\text{T}$. Determine the velocity of the plane.

5. A metal rod is sliding on conducting rails (ignore friction). The rod was given a push and then it was left to its fate.



- a) What happens, if the switch S is closed? Does the rod accelerate, decelerate or does it move on with constant speed? Give reasons for your answer.
- b) What happens, if the switch S is open? Does the rod accelerate, decelerate or does it move on with constant speed? Give reasons for your answer.
- c) Is the lamp (L) lit? Give reasons for your answer.

6. An iron rod is rolling down an inclined pair of rails (ignore friction).
- a) Draw the magnetic field produced by the horseshoe magnet.
- b) The electrons in the rod are displaced due to this movement. Draw in the picture where they go.
- c) Assume the points A and B are connected by a wire to create a closed circuit. What do the electrons do now?
- d) When the points A and B connected to close the circuit, the rod moves slower than without connection. Why?



7. A metal rod of 20.0 cm length is moving at a constant speed of $5.00 \frac{\text{m}}{\text{s}}$, perpendicular to a magnetic field of 0.10 T. The resistance of the wires and the light bulb is 0.15Ω (see picture of problem 5.)
- a) What is the induced voltage between die rod's ends?
- b) Calculate the induced current.
- c) What is the electric power?
- d) Determine the electric energy produced in 10.0 seconds.
- e) What is the mechanical energy required for moving the rod during 10.0 seconds?

solutions:

3. 2.47 mV

4. $1'395 \frac{\text{km}}{\text{h}}$

7. a) 0.10 V

b) 0.67 A

c) 67 mW

d) 0.67 J

e) 0.67 J