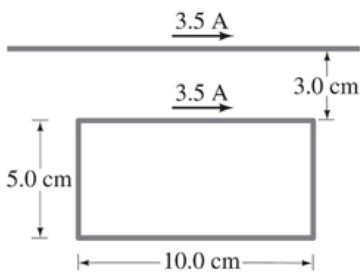


## Seminar 11: Lectures 25-27

### Straight Wires, Magnetic Field, and Force:

- Two straight parallel wires are separated by 6.0 cm. There is a 2.0 A current flowing in the first wire. If the magnetic field strength is found to be zero between the two wires at a distance of 2.2 cm from the first wire, what is the magnitude and direction of the current in the second wire?
- A rectangular loop of wire is placed next to a straight wire, as shown in the figure below. There is a current of 3.5 A in both wires. Determine the magnitude and direction of the net force on the loop.

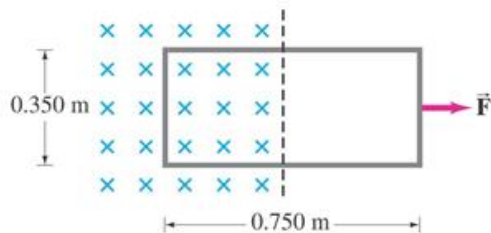


### Ampere's Law, Solenoids and Toroids:

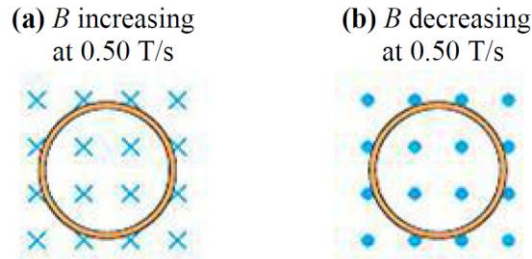
- A 32 cm long solenoid, 1.8 cm in diameter, is to produce a 0.30 T magnetic field at its centre. If the maximum current is 4.5 A, how many turns must the solenoid have?

### Faraday's Law and Induction:

- Part of a single rectangular loop of wire with dimensions shown in the figure below is situated inside a region of uniform magnetic field of 0.650 T. The total resistance of the loop is 0.280  $\Omega$ . Calculate the force required to pull the loop from the field (to the right) at a constant velocity of 3.40 m/s. You can neglect gravity.

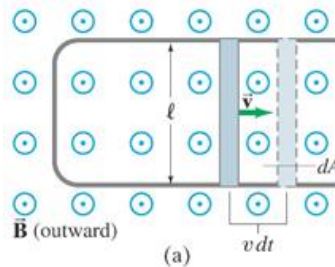


5. The figure below shows a 10-cm-diameter loop in two different magnetic fields. The loop's resistance is  $0.20\ \Omega$ . For each, what are the size and direction of the induced current?



#### Motional EMF:

6. In the figure below, the rod moves to the right with a speed of  $1.3\ \text{m/s}$  and has a resistance of  $2.5\ \Omega$ . The rail separation is  $l = 25.0\ \text{cm}$ . The magnetic field is  $0.35\ \text{T}$ , and the resistance of the U-shaped conductor is  $25.0\ \Omega$  at a given instant. Calculate (a) the induced emf, (b) the current in the U-shaped conductor, and (c) the external force needed to keep the rod's velocity constant at that instant.



#### Generators:

7. A 250 loop circular armature coil with a diameter of  $10.0\ \text{cm}$  rotates at  $120\ \text{rev/s}$  in a uniform magnetic field of strength  $0.45\ \text{T}$ . What is the rms voltage output of the generator? What would you do to the rotation frequency in order to double the rms voltage output?

#### Back EMF, and Counter Torque; Eddy Current:

8. A motor has an armature resistance of  $3.05\ \Omega$ . If it draws  $7.20\ \text{A}$  when running at full speed and connected to a  $120\text{-V}$  line, how large is the back emf?

#### Transformers:

9. A model-train transformer plugs into  $120\ \text{V ac}$  and draws  $0.35\ \text{A}$  while supplying  $7.5\ \text{A}$  to the train. (a) What voltage is present across the tracks? (b) Is the transformer step-up or step-down?