

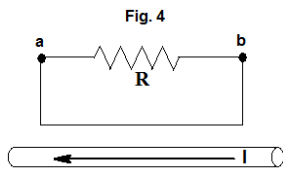
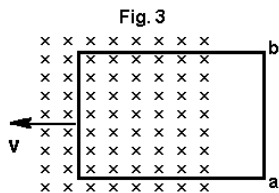
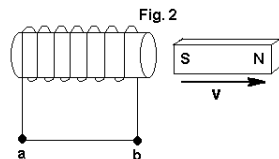
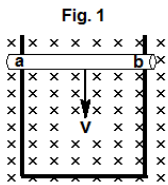
**Instructions:**

- Do all of your work on this sheet.
- Show all of your steps in problems for full credit.
- Be clear and neat in your work. Any illegible work, or scribbling in the margins, will not be graded.
- Place your answers in a box.
- If you need more space, you may use the back of the page and write **On back** in the problem space.

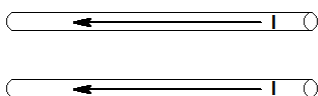
**1. Multiple Guess (3 pts)** Find the answer which best fits the question and write it in the space provided.

- The Earth's magnetic field is parallel to the Earth's surface
  - at the equator;
  - at the North Pole;
  - at the South Pole;
  - at Wilmington, NC;
  - None of these.
- A current carrying wire is perpendicular to your paper with the current going into the paper from above. The magnetic field produced looks like
  - a uniform field directed from left to right.
  - a uniform field directed from right to left.
  - clockwise concentric circles in the plane of the paper.
  - counterclockwise circles in the plane of the paper.
  - None of these.
- If the magnetic field points out of your paper and a negative charge moves from left to right in this field, then the force is directed
  - towards the bottom;
  - out of the paper;
  - into the paper;
  - towards the top;
  - none of these.

**2. Definition/Principle (4 pts)** In the following closed loops, indicate the direction of the induced current by the direction of flow between points a and b.

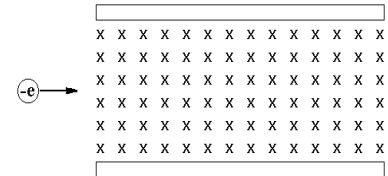


**Bonus:** a. Two 30.0 cm long wires separated by 5.0 cm each carry 2.0 A in the same direction. What is the magnitude and direction of the force on the lower wire due to these currents?



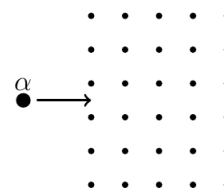
**3. Problems (13 pts)**

- A beam of electrons enters a velocity selector with a 0.35 T magnetic field and a 50.0 V/m electric field.
  - Draw the proper charges on the plates.
  - What is the speed of the undeflected electrons?



- An alpha particle ( $6.64 \times 10^{-27}$  kg,  $q = 2e$ ) enters a 0.5 T magnetic field and follows a circular path whose radius is 15.0 cm. How fast is the particle moving?

- Draw the alpha particle path.



- What is the current in a long, straight wire if the magnetic field 25.0 mm from the wire is  $7.80 \times 10^{-5}$  T?

- A wire one meter long is directed at a  $60^\circ$  angle to a 4.8 mT magnetic field. What is the magnitude of the force on the wire, if it carries a current of 1.5A?

- A 18.0 cm long conducting rod is moving perpendicular to a 1.5 T magnetic field. How fast must the rod move in order to produce an emf of 2.5 mV across the rods' ends?