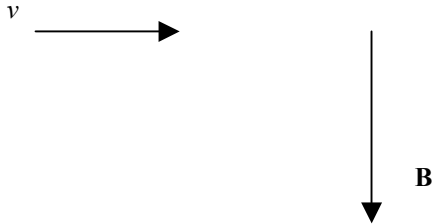


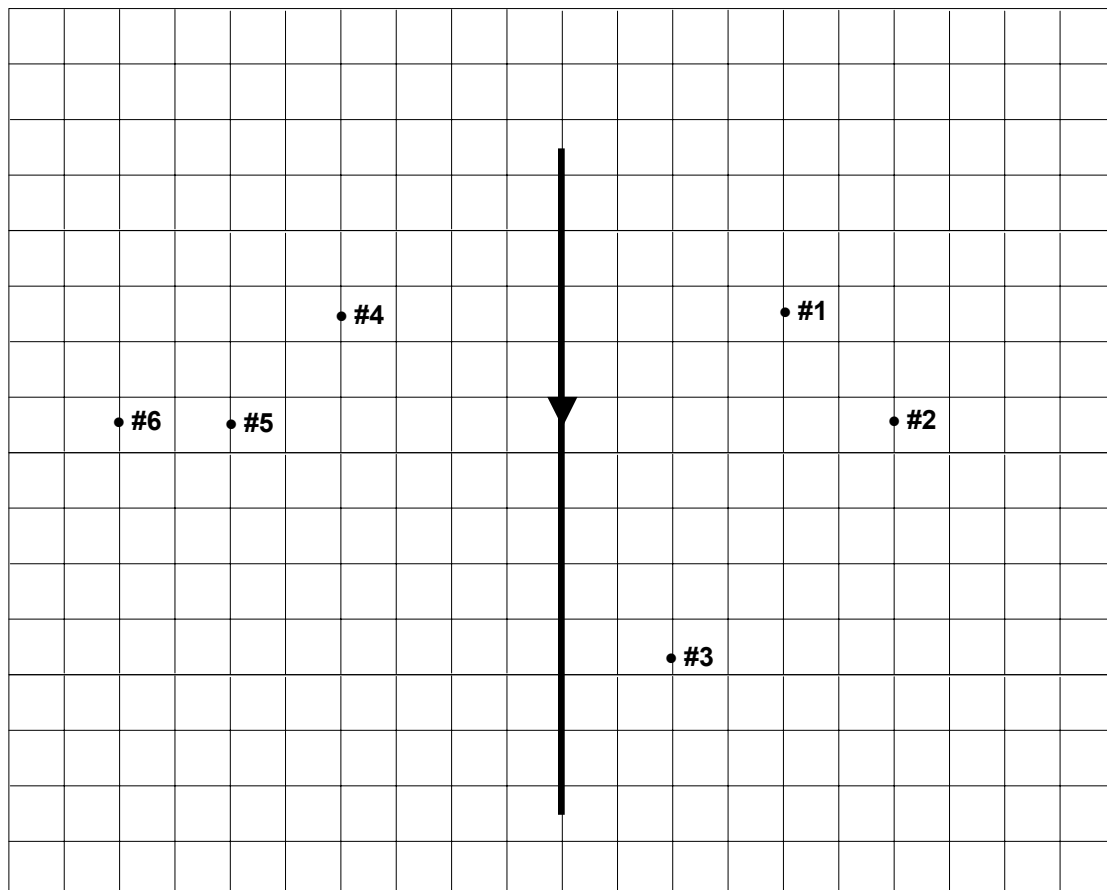
Magnetism Worksheet

1. A particle with charge q is traveling at a speed v in the direction indicated. A uniform magnetic field is present; its magnitude is B and its direction is shown. What is the magnitude and direction of the uniform electric field that would have to be present to ensure that the particle travels in a straight line? (Give answer in terms of B , v , and q .)



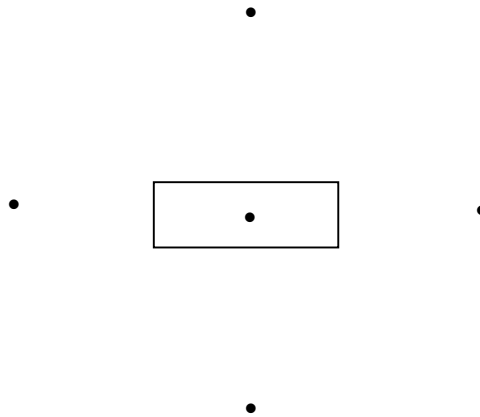
2. A uniform magnetic field points in the negative z direction. A 2-m length of wire is located in the xy plane.
- a) Rank in order of magnitude (largest to smallest) the forces on the wire if the current is traveling in the (A) 0° direction; (B) 30° direction; (C) 45° direction; (D) 90° direction. (If two or more are equal, use “equals” signs.) [Directions are *relative to* the positive x -axis direction, so positive x is the “ 0° ” direction.] *Note that the wire **remains** in the xy plane the whole time.*
- b) Will the direction of the force on the wire be the **same** for cases A-D, or will it vary when the direction of the current changes? Explain your answer.

3. A single long wire carrying a current is shown. The direction of the current is indicated. At point #1, the magnitude of the magnetic field produced by the current is equal to "B." Indicate the direction of the magnetic field at point #1, and the direction *and* the magnitude (in terms of "B") of the magnetic field at all other points shown (#2-6).

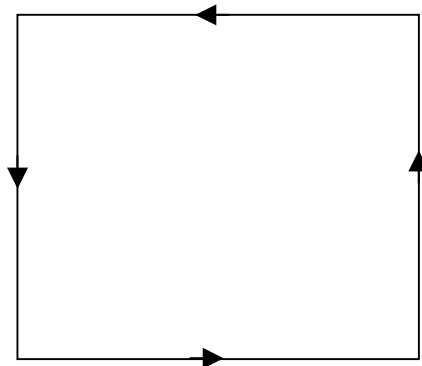


4.

a) The diagram shows a “top” view of the bar magnet, looking directly (“head-on”) at the north pole. Indicate the directions of the magnetic field at the five points indicated (use the Magnaprobe). Is this a *uniform* magnetic field?



b) Suppose we place the current loop shown below directly over the north pole of the magnet (i.e., lay it flat on the diagram above, centered on the point at the middle of the rectangle). Indicate the direction of the force on each of the four sides of the current loop (due to the magnetic field of the magnet).



- c) What will happen to the loop? That is, will it move, rotate, both, or neither? Explain your answer.
- d) Is the *south pole* or the *north pole* of the current loop closer to the north pole of the magnet? Is that consistent with your answer to (c)?
- e) Recalling the similarities between bar magnets and current loops, try to explain why magnets attract and repel each other. (Use the other side of this page.)

5. Explain why two rectangular bar magnets will attract or repel each other, depending on how the poles are oriented with respect to each other. Sketch two diagrams, one showing attraction and the other showing repulsion. Label north and south poles of each magnet, and indicate the *direction of flow* of the net current “inside” each bar magnet (that is, the electric current that originates from the movement of electrons inside the atoms of the magnetic material).