Problems Due Week Beginning Nov 1, 1999.

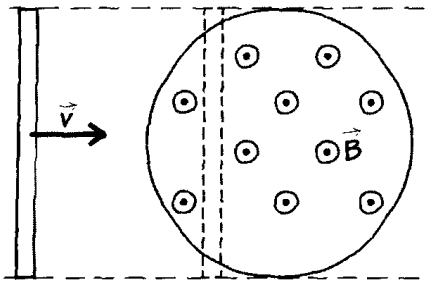
Prob3117: A circular loop of area A rotates with angular frequency ω about its vertical diameter. The rotating loop is placed in a horizontal constant magnetic field, B. What is the emf induced in the loop?

Hint:

Prob3119. The spacecraft Voyager I is moving through interstellar space, where the magnetic field is 2×10^{-10} T. Assume that Voyager I has an antenna 5 m long. If the spacecraft moves so that the antenna rod is perpendicular to the magnetic field when Voyager I has a speed of 8×10^{3} m/s, what is the emf induced across the antenna?

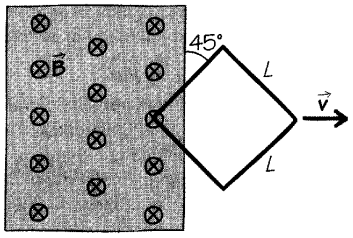
Hint:

Prob3127: A rod of length L moves at constant speed v into the region between the poles of a horseshoe magnet, where there is a constant magnetic field perpendicular to the rod in a circular region of radius R such that L = 2R (see fig.). What is the emf induced in the rod as a function of time?



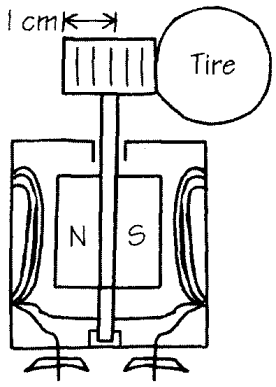
Hint:

Prob3132: A square wire loop of dimensions L x L lies in a plane perpendicular to a constant magnetic field. The field exists only in a certain region, with a sharp boundary as shown in figure below. The sides of the loop make a 45 degree angle with this boundary, and an external force moves the loop at a speed v out of the region of constant field. How much power must be supplied by the external force as a function of time?



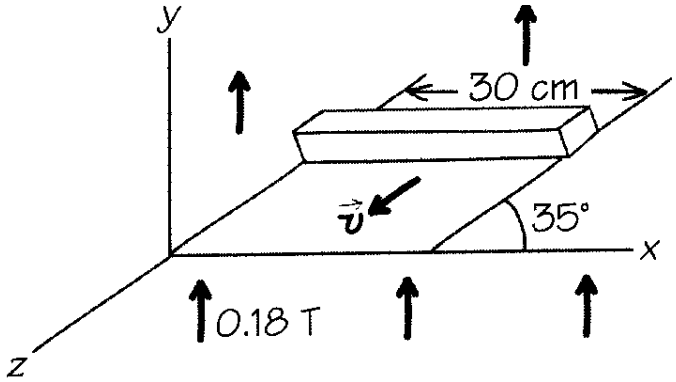
Hint:

Prob3147. The headlight of a bicycle is powered by a small generator that is driven by a wheel of the bicycle. The generator contains two coils fixed at the sides of the generator and connected in series with appropriate polarity (see Fig.). Each coil consists of 70 turns and has an area of 8 cm2. A small permanent magnet is rotated in front of the coils, so that the magnitude of the magnetic field in the coils varies between 0.1 T and zero. At what speed of the bicycle will the maximum emf be 6.4 V, given that the radius of the friction wheel is 1.0 cm?



Hint:

Prob3150.:A 30-cm-long wire of square cross section with a mass of 25 g and a resistance of 0.05 Ω slides without friction down parallel conducting rails of negligible resistance (see fig.). The rails are connected to each other at the bottom by a resistanceless rail parallel to the wire so that the wire and rail form a closed rectangular



conducting loop. The plane of the rails makes an angle of 35 degrees with the horizontal, and a uniform vertical magnetic field of 0.18 T, pointing upward, exists throughout the region. What is the steady speed of the wire?

Hint: