PHYSICS 231 – SAMPLE TEST # 3

Problem 1

(a) Can a charged particle move in a magnetic field without experiencing any force? If so, how? If not, why not?

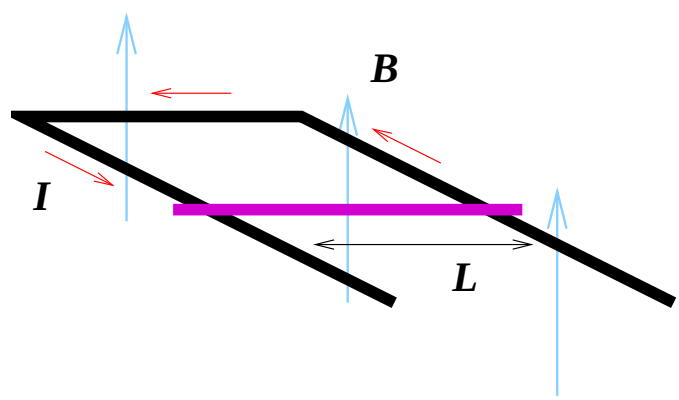
(b) A current was sent through a helical coil spring. The spring contracted, as if it had been compressed. Why?

(c) A square conducting loop is in a region of uniform, constant magnetic field. Explain how you would rotate the loop about an axis along one side so that no emf is induced in the loop.

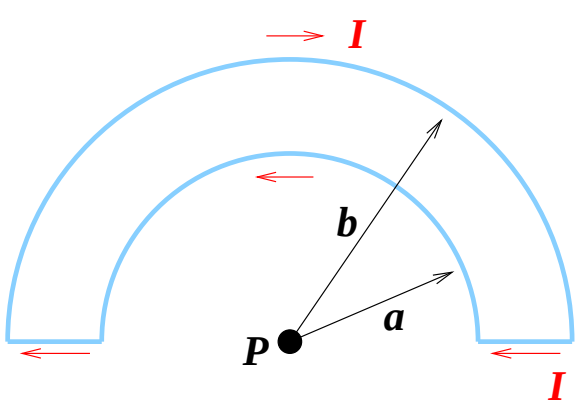
Problem 2

A conducting bar of mass $m = 25$ kg and length $L = 0.5$ m slides over horizontal rails that are connected to a voltage source. The voltage source maintains a constant current $I = 2 \times 10^3$ A in the rails and the bar, and a uniform magnetic field $B = 0.5$ T fills the region between the rails. The bar feels a magnetic force and gets accelerated by it.

(a) What is the magnitude and direction of the magnetic force?
(b) Calculate the acceleration of the bar.
(c) Find the distance the bar must travel along the rails to reach a speed $v = 10.0$ m/s.



Problem 3



The wire semicircles in the figure have radii $a = 10.0$ cm and $b = 15.0$ cm. The wire carries current $I = 0.2$ A.

(a) What is the direction of the magnetic field from each of the four sections of the wire at the center of curvature P?
(b) Calculate the magnitude of the magnetic field at P.