Home Work Problem Set 6

6-1 An electron follows a helical path in a uniform magnetic field given by mT. At time t = 0, the electron’s velocity is given by m/s. (a) What is the angle φbetween v and B ? The electron’s velocity changes with time. Do (b) its speed and (c) the angleφchange with time? (d) What is the radius of the helical path? (HRW28-30)

6-2 A beam of electrons whose kinetic energy is K emerges from a thin-foil “window” at the end of an accelerator tube. A metal plate at distance d from this window is perpendicular to the direction of the emerging beam (Fig. 28-57). (a) Show that we can prevent the beam from hitting the plate if we apply a uniform magnetic field B such that B ≧ (2mK/(e2 d2))1/2 in which m and e are the electron mass and charge. (b) How should B be oriented? (HRW28-74)

6-3 Figure 28-50 shows a wood cylinder of mass m = 0.250 kg and length L = 0.100 m, with N = 10.0 turns of wire wrapped around it longitudinally, so that the plane of the wire coil contains the long central axis of the cylinder. The cylinder is released on a plane inclined at an angle θto the horizontal, with the plane of the coil parallel to the incline plane. If there is a vertical uniform magnetic field of magnitude 0.500 T, what is the least current *i* through the coil that keeps the cylinder from rolling down the plane? (HRW28-53)

6-4 A proton of charge + *e* and mass *m* enters a uniform magnetic field *B* = *B*i with an initial velocity *v* = *v*0xi + *v*0yj. Find an expression in unit-vector notation for its velocity *v* at any later time *t*. (HRW28-76)

 