Homework Discussion, Week 5

Physics 1302 Dr. Andersen

Chapter 22

8.) Since the force on the electron is zero when it moves in the $+x$-direction, the magnetic field must point in either the $+x$ or $-x$ direction, since the force is zero only when the particle moves along the field line. Applying the right hand rule to the situation where the electron moves in the $+y$-direction, I find that a force in the $-z$-direction indicates a field in the $-x$-direction (remember, electrons are negatively charged, so will feel a force in a direction opposite that of a positive particle.) Because the $+y$-axis is perpendicular to the $+x$-axis, the force will be a maximum in this case, so $F = |q|vB$, so just solve for B.
Answer: 1.4 T.
21.) a) The period (i.e. time to complete one circle) we derived in class was $T = 2\pi m/|q|B$, so for a semi-circle is just $t = \pi m/|q|B$. b) The period doesn't depend on the speed. c) Same as in (a) because of (b).

29.) Equate the weight of the wire with the magnitude of the magnetic force (which will need a minimum current when $\sin\theta = 1$), so $mg = ILB$. Solve for I.

74.) a) In order for the fields to add to zero, the field created by the current in the wire must point in a direction opposite that of the external field. Using the right hand rule (v2.0) shows that the field is in the $+z$ direction on the $+y$ axis, and in the $-z$ direction on the $-y$ axis, so the net field will be zero on a point on the $-y$ axis. b) We need to find the distance from the wire where the induced and external fields have the same magnitude, so we just need to substitute into the formula for the field produced by a long straight wire.
Answer: b) 0.43 m