Name: _____

Homework on Velocity Selector, Charge to Mass Ratio, Hall Effect

1. An beam of electrons are moving horizontally through a horizontal magnetic field with magnitude 3 T that makes an angle of $35°$ with the path of motion. The beam is being fired between two large conducting plates placed above and below the beam with a potential difference of 700 V that are spaced at 1 mm apart. The beam is not deflected either up or down. What is the speed of the electrons in the beam?

2. A Thompson apparatus for measuring the charge-to-mass ratio of electrons is set up, with conducting plates that are 5.0 cm long and separated by 0.9 cm. From the end of the plates to the screen of the tube is 25.0 cm. The electrons are fired with a velocity of 2.97×10^{7} m/s. If a potential of 30 V is applied across the deflection plates, by how much will the beam deflect? What is the magnitude of a crossed magnetic field that will allow the beam to pass through the plates undeflected?

3. The number density of free electrons in gold is 5.90×10^{28} electrons per cubic meter. If a metal strip of gold 2 cm wide carries a current of 10 A, how thin would it need to be to produce a Hall Voltage of at least one 1 mV. What would the drift velocity of the electrons be in this case?