

Keystone - Chapter 20: Magnetic Force

An electron and a proton are both in motion near each other as shown; at this instant they are a distance r apart. The proton is moving with speed v_p at an angle θ to the horizontal, and the electron is moving straight up with a speed v_e .

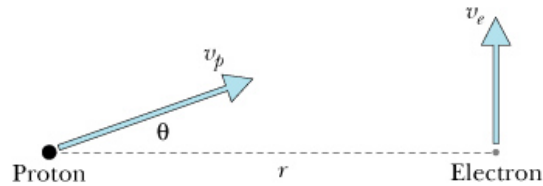


Figure 1: A proton and an electron exert forces on each other

- (a) Calculate the x and y components of the force that the proton exerts on the electron.
- (b) Calculate the x and y components of the force that the electron exerts on the proton.
- (c) Consider carefully your results. Are the magnetic forces on electron and proton equal and opposite? Does reciprocity hold for magnetic forces?
- (d) Will the total momentum of the two particles remain constant? Is this a violation of conservation of momentum for an isolated system?

This problem is 20.P.44 from M&I vol 2, second edition.