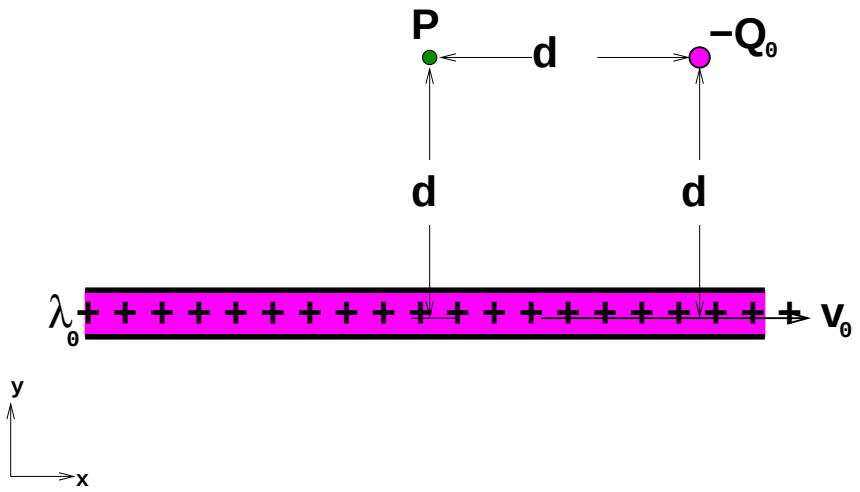
Physics 122: Practice Problem of the Day

Problem #20: A moving line of charge

Saturday, April 6, 2009



An infinitely long thin line of charge with linear charge density λ_0 is moving with constant velocity v_0 in the x direction (along $\hat{i}$) as shown above. There is also a single motionless negative point charge of strength $-Q_0$ located a distance d from the line as shown.

Part (a) What is the magnitude and direction of the electric field at point P? Write down your answer as a *vector* using the coordinate system shown (x points right, y points up and z points out of the page.)

Part (b) What is the magnitude and direction of the magnetic field at point P, again please use vector notation.

Part (c) If a positive point charge q_p with velocity $\vec{v}_p = v_p\hat{k}$ is found at position P What is the magnitude and direction of the net force on P due to the electric and magnetic fields?