Physics 132 01 (8 am)
September 21, 2007
Test 1

Name: ____

If any question is unclear, *please* ask immediately. Be sure to show your work **clearly draw a box around your answer**. Partial credit may be given for work *if* it can be understood.

If you get stuck on the **math** at any point, be sure to indicate clearly the **physics** you are using and how you would continue if you could do the math.

Problem 1: (20 pts.) A proton moving to the right at 3.80×10^5 m/s enters a region where a uniform 56 000 N/C electric field points to the left. How far will the proton get before its speed reaches zero? (The mass of a proton is 1.67×10^{-27} kg.)

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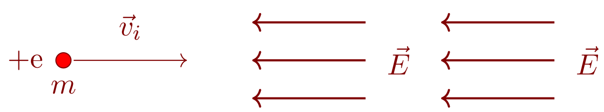
Problem 2: (20 pts.) A proton moving to the right at 3.80×10^5 m/s enters a region where a uniform 56 000 N/C electric field points to the left. How far will the proton get before its speed reaches zero? (The mass of a proton is 1.67×10^{-27} kg.)



Way #1: Use $F = ma$. Since the electric field points to the left, use $E = -56\,000\,\mathrm{N/C}$.

$$
\begin{aligned}
F &= ma \\
eE &= ma \implies a = \frac{eE}{m} \\
v_f^2 &= v_i^2 + 2a(x_f - x_i) \\
0 &= v_i^2 + 2\left(\frac{eE}{m}\right)\Delta x \\
\Delta x &= -\frac{1}{2}\frac{mv_i^2}{eE} \\
\Delta x &= -\frac{1}{2}\frac{(1.67 \times 10^{-27}\,\mathrm{kg}) \times (3.80 \times 10^5\,\mathrm{m/s})^2}{(1.602 \times 10^{-19}\,\mathrm{C}) \times (-56\,000\,\mathrm{N/C})} \\
\Delta x &= \boxed{0.0134\,\mathrm{m}}
\end{aligned}
$$

Way #2: Use energy conservation and recall that $\Delta V = -E\Delta x$.

$$
\begin{aligned}
K_i + U_i &= K_f + U_f \\
K_i + eV_i &= K_f + eV_f \\
\frac{1}{2}mv_i^2 &= 0 + e(V_f - V_i) = -e(E(\Delta x)) \\
\Delta x &= \frac{1}{2}\frac{mv_i^2}{(-eE)} = -\frac{1}{2}\frac{mv_i^2}{eE} \\
\Delta x &= -\frac{(1.67 \times 10^{-27}\,\mathrm{kg}) \times (3.80 \times 10^5\,\mathrm{m/s})^2}{2 \times (1.602 \times 10^{-19}\,\mathrm{C}) \times (-56\,000\,\mathrm{N/C})} \\
\Delta x &= \boxed{0.0134\,\mathrm{m}}
\end{aligned}
$$