$$= \frac{qQ}{4\pi\varepsilon_0}\left(\frac{1}{2R}\right)$$

$$\Delta U_{s\to p} = \Delta KE = \frac{1}{2}mv_p^2 - \frac{1}{2}mv_s^2$$

$$\Rightarrow v_p = \sqrt{\frac{qQ}{4\pi\varepsilon_0 mR}} = \underline{\underline{2.3\ m/s}}$$

c) Apply the how-to now for $r < R$

<u>Step 1</u> Find $E(r)$ for $r < R$

G's Law $\quad LHS = E \cdot 4\pi r^2$

$RHS = q_{in}/\varepsilon_0$

how much charge is inside radius r?

$$\frac{q_{in}}{Q} = \frac{V_{in}}{V}$$

$$q_{in} = \frac{Q}{\frac{4}{3}\pi R^3}\,\frac{4}{3}\pi r^3 = \frac{Qr^3}{R^3}$$

$$\vec{E}(r) = \frac{1}{4\pi r^2}\,\frac{Qr^3}{\varepsilon_0 R^3} = \frac{Q}{4\pi\varepsilon_0}\,\frac{1}{R^3}\,r\,\hat{r}$$