If r<R, $V(r) = -\int_{\infty}^{r} \vec{E} \cdot d\vec{L}$

$$= -\int_{\infty}^{R} \vec{E} \cdot d\vec{L} - \int_{R}^{r} \vec{E} \cdot d\vec{L}$$

$$= -\int_{\infty}^{R} \frac{Q}{4\pi\varepsilon_0 r^2} dr - \int_{R}^{r} \frac{Q}{4\pi\varepsilon_0 R^3} r\, dr$$

$$= +\frac{Q}{4\pi\varepsilon_0 R} \qquad - \frac{Q}{4\pi\varepsilon_0 R^3} \frac{r^2}{2}\Bigg|_{R}^{r}$$

$$= \frac{Q}{4\pi\varepsilon_0}\left(\frac{3}{2R} - \frac{r^2}{2R^3}\right)$$