7-12 5-9 radius a, $\rho = Ar^n$

$$Q = 4\pi A \int_0^a r^{n+2} dr = 4\pi A \frac{1}{n+3} a^{n+3}$$

inside G.L.

$$E(4\pi r^2) = \frac{1}{\varepsilon_0} \int_0^r \rho \, dV = \frac{4\pi A r^{n+3}}{n+3} \frac{1}{\varepsilon_0} = \frac{Q}{a^{n+3}} \left(\frac{r}{a}\right)^{n+3} \frac{1}{\varepsilon_0}$$

$$E_{in} = \frac{1}{4\pi\varepsilon_0} \frac{Q}{a^{n+3}} r^{n+1} \qquad E_{out} = \frac{Q}{4\pi\varepsilon_0 r^2}$$

Inside $$U_m = \frac{\varepsilon_0}{2} \int_{r'<a} E^2 d\tau = \frac{4\pi\varepsilon_0}{2} \left(\frac{Q}{4\pi\varepsilon_0 a^{n+3}}\right)^2 \int_0^a r^{2n+2} r^2 dr$$

$$= \frac{1}{2} \frac{1}{4\pi\varepsilon_0} \frac{Q^2}{a^{2n+6}} \frac{1}{2n+5} a^{2n+5}$$

$$U_{m,in} = \frac{1}{8\pi\varepsilon_0} \frac{Q^2}{a} \frac{1}{2n+5}$$

Outside $$\frac{\varepsilon_0}{2} \frac{Q^2 4\pi}{(4\pi\varepsilon_0)^2} \int_a^\infty \frac{1}{r^4} r^2 dr = \frac{Q^2}{8\pi\varepsilon_0} \left[-\frac{1}{r}\right]_a^\infty$$

$$U_{m,out} = \frac{Q^2}{8\pi\varepsilon_0 a}$$

$$U_{m\,total} = \frac{Q^2}{8\pi\varepsilon_0 a} \left[1 + \frac{1}{2n+5}\right]$$

for $n=0$, $U_n = \frac{Q^2}{8\pi\varepsilon_0 a} \frac{6}{5} = \frac{3Q^2}{20\pi\varepsilon_0 a}$ check!

$$\frac{U_{m\,r<a}}{U_{m\,tot}} = \frac{1}{1 + \frac{1}{2n+5}} = \frac{2n+5}{2n+6}$$