

1 Spherical Shell Step Functions

One way to write volume charge densities without using piecewise functions is to use step (Θ) or delta (δ) functions.

Consider a spherical shell with charge density

$$\rho(\vec{r}) = \alpha 3e^{(kr)^3}$$

between the inner radius a and the outer radius b . The charge density is zero everywhere else.

- (a) What are the dimensions of the constants α and k ?
- (b) By hand, sketch a graph the charge density as a function of r for $\alpha > 0$ and $k > 0$.
- (c) Use step functions to write this charge density as a single function valid everywhere in space.