

1 Electric Field and Charge

Consider the electric field

$$\vec{E}(r, \theta, \phi) = \begin{cases} 0 & \text{for } r < a \\ \frac{1}{4\pi\epsilon_0} \frac{Q}{b^3 - a^3} \left(r - \frac{a^3}{r^2} \right) \hat{r} & \text{for } a < r < b \\ 0 & \text{for } r > b \end{cases} \quad (1)$$

- (a) (4pts) Use step and/or delta functions to write this electric field as a single expression valid everywhere in space.
- (b) (4pts) Find a formula for the charge density that creates this electric field.
- (c) (2pts) Interpret your formula for the charge density, i.e. explain briefly in words where the charge is.