

A cube of side a is fashioned from material with a volume charge density $\rho_{ch} = Ar^2$ where A is a constant and r is the distance from the origin.

- (a) Assuming the center of the cube is located at the origin, calculate the electric flux through the cube.
- (b) Now assuming that the material has a volume charge density $\rho_{ch} = Br^{3/2}$ calculate the scalar potential at the origin.
- (c) Consider a third situation with a uniform charge density ($\rho_{ch} = \text{constant}$). Obtain the triple integral you would need to evaluate to obtain the scalar potential at the origin in this case. Do not attempt to evaluate this integral. If you did you will see why you were asked to assume the charge density of part (b)...

Although it is not easy (possible ?) to obtain an analytic solution to the scalar potential in case (c), it is possible in this case to determine the ratio of the scalar potential at the center of the cube to that at one of the corners.

- (d) For the final part of this problem see if you can determine this ratio. You will not need to evaluate any integrals. Note that no credit will be given if it is clear you used a software package in your analysis.