

PHGN361 2010 Practice Exam 2: NAME

Start from fundamental principles and derive all results. **Explain each step for credit.**

1. Derive an expression for (a) the potential and (b) the electric field inside a parallel plate capacitor using separation of variables. The plates are separated by a distance d along the z axis. Assume infinite plates and a 12 V battery across the plates with the lower plate grounded. Explain how you would check your answer.

2. (12 points) The potential at the surface of a sphere is $V(\theta) = V_0 \cos \theta$. Determine an integral expression for the voltage outside the sphere. The general radial solution is $R(r) = A_l r^l + \frac{B_l}{r^{l+1}}$ while the general angular solution is $P_l(\cos \theta)$ where l is an integer. Note: $\int_{-1}^1 P_l(x) P_m(x) dx = \frac{2}{2l+1} \delta_{lm}$.