MIDTERM 1

Physics 9C-03 **NAME:**

Feb. 1, 2001 **Student ID #:**

General Instructions: This examination is closed book. Only a calculator is allowed. Please show all your work and box your answers. Credit will only be given for *complete* solutions. Answers must have correct units. There are five problems on four pages. Note that not all the problems are worth the same number of points.

[25 points] 1. Two thin concentric spherical shells each carry a charge Q, uniformly distributed over the shell. The radii of the shells are a and b with $a < b$.

Find the electric field everywhere, giving both its magnitude and direction. Do not just state the answers for the magnitudes, but show how they follow from Gauss' law.

Find the potential everywhere, using the usual convention that $V = 0$ at $r = \infty$.

[10 points] 2. If the electric potential $V(x, y, z) = x + xy^2 + z^3$, what is the electric field $\vec{E}$?

[20 points] 3. Four equal charges q_1 are situated at the corners of a square. The sides of the square are length a.

What is the net force on a charge q_2 placed at the center of the square?

What is the electric potential at the center of the square?

Suppose one of the four q_1's is removed. Now what is the net force on q_2?

[20 points] 4. Three infinite planes of charge have charge densities $+\sigma$ $+2\sigma$, and $-\sigma$ as shown.

Find the electric field everywhere. Give both magnitude and direction.

Find the potential difference $V_b - V_a$.

Find the potential difference $V_c - V_a$.

Find the potential difference $V_e - V_d$.

[25 points] 5. In the circuit shown, find the current in each resistor and the values of the potential at the points A, B, and C.