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PRINT CLEARLY

Physics 1B – WHITTEN SQ2010

SECOND HOUR EXAM, MAY 21, 2010

11:00 – 11:50 A.M.

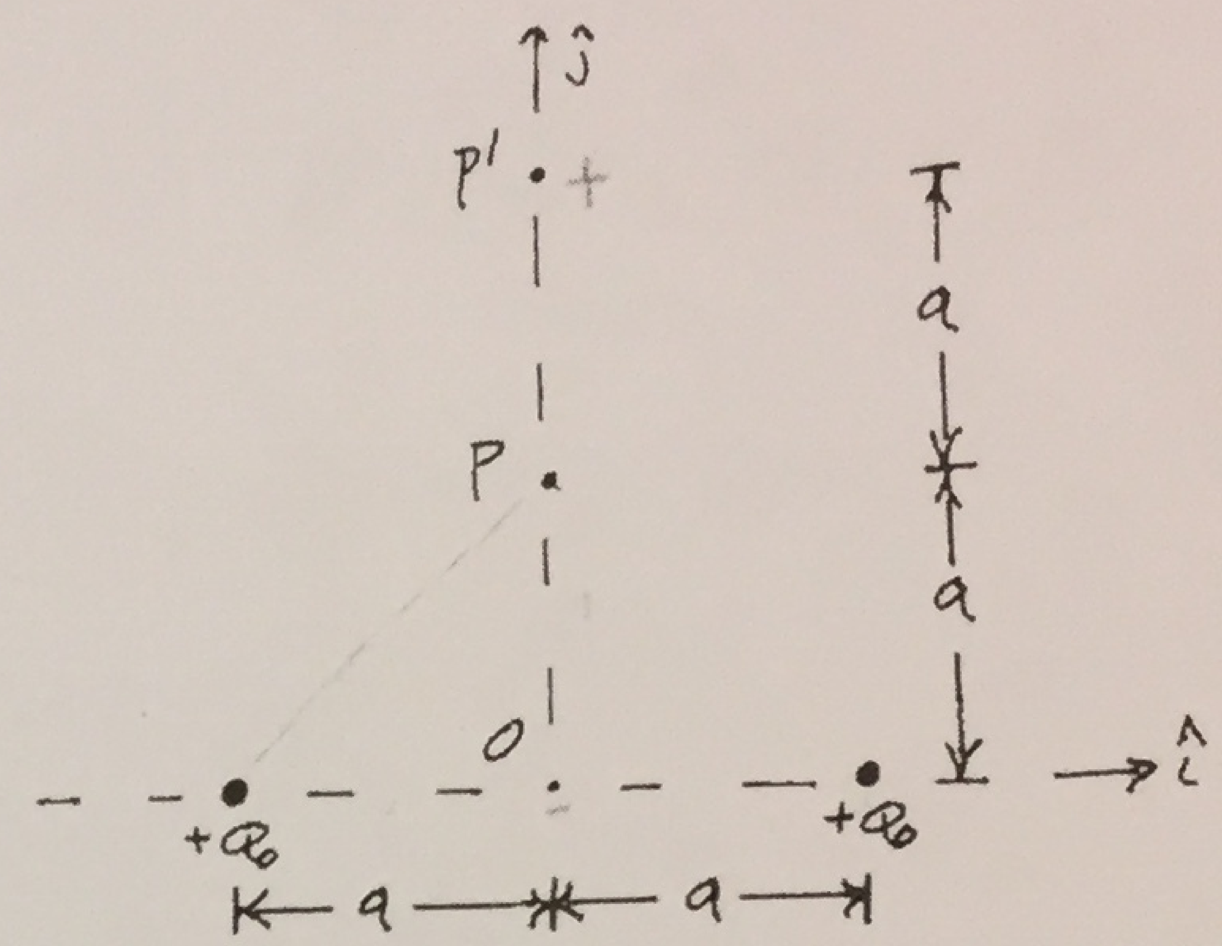
Indicate your reasoning clearly and include all calculations on the pages you hand in. If your work is not entirely on a given problem's page, indicate on that page where the work is located.

Problem 1. 14

Problem 2 27

Problem 3. 17

Total Score 58

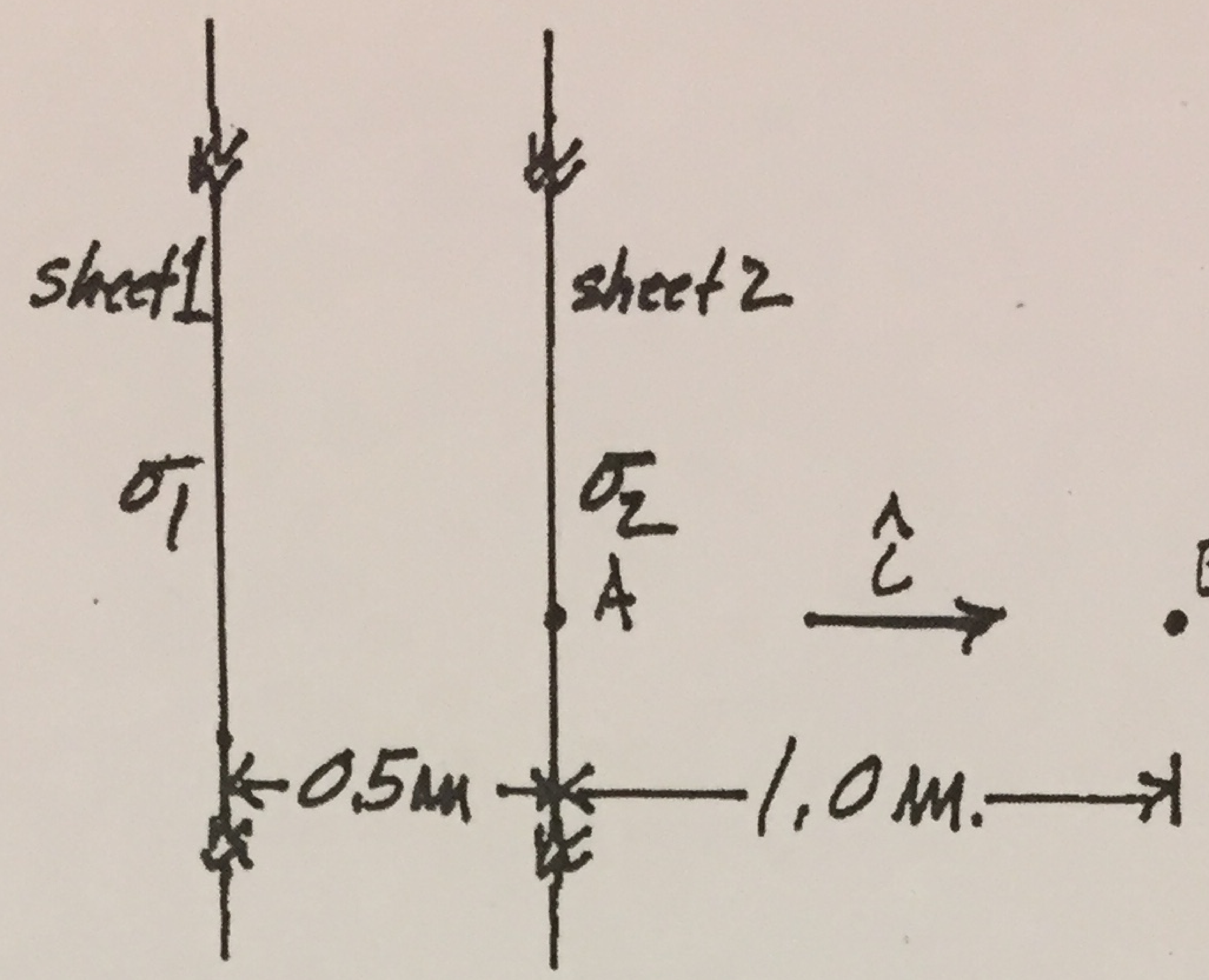


(34) 1.

(13) A) With the two point charges $+Q_0$ at the positions indicated a third point charge is placed at either position O or position P'. For these two situations calculate the value of the third charge such that $\vec{E}(P) = 0$

(11) B) Again a third charge is placed either at position O or at position P'. However, for these two situations now calculate the value of the third point charge such that V (P) = 0 (Use the convention $V(\infty) = 0$).

(10) C) For part A) calculate the electrostatic potential energy for the two situations.



(34) 2. Consider two infinite sheets a distance 0.5 meters apart with respective constant surface charge densities σ_1 and σ_2. $\sigma_1 = +4 \times 10^{-9}$ Coulombs/m^2 and $\vec{E} = 75\hat{i}$ volts/meter between the sheets.
(in mks units $\frac{1}{\varepsilon_0} = 1.13 \times 10^{11}$)

(20) A.) Calculate σ_2 (Coulombs/m^2).

+20

(7) B.) Calculate $\vec{E}$ (vector, volts/m) to the right of sheet 2 and to left of sheet 1..

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(7) C.) Calculate the potential difference V(A) - V(B) in volts.

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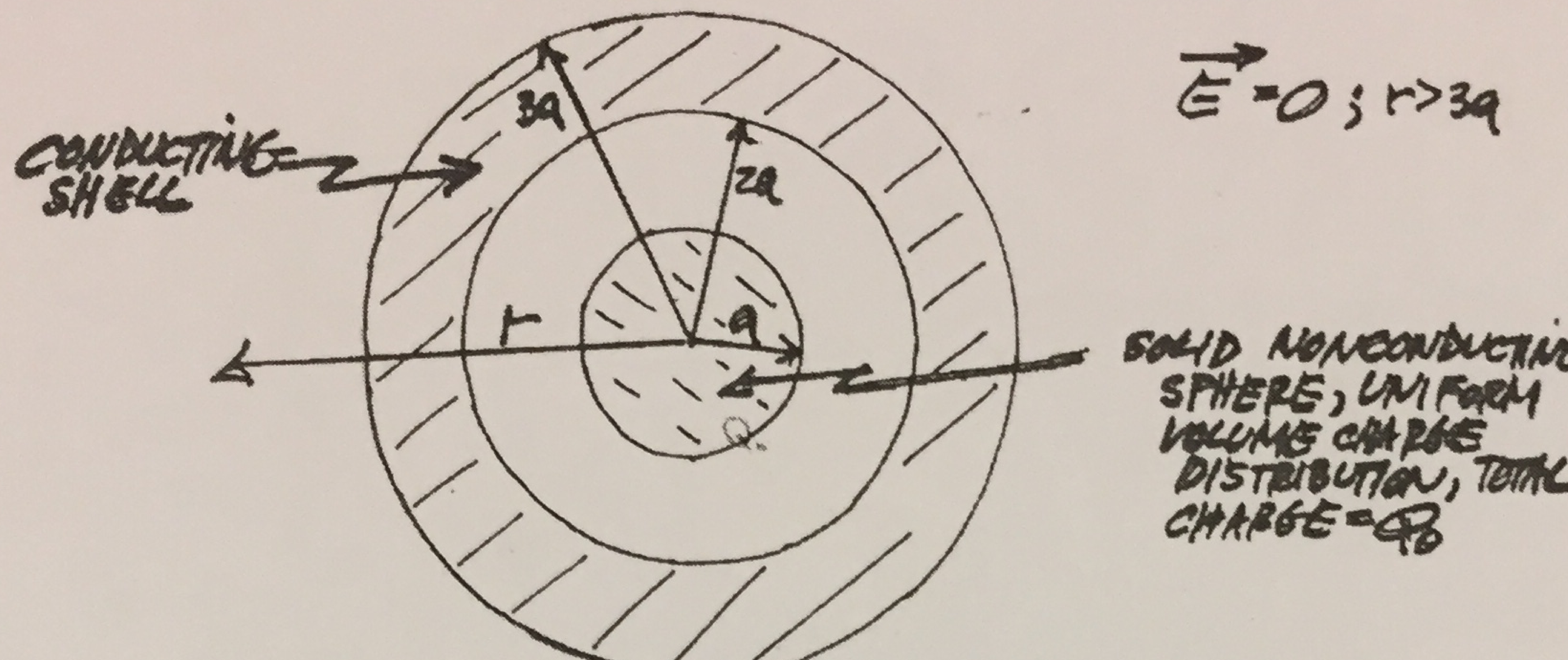

(34) 3. A conducting spherical shell of inner radius $2a$ and outer radius $3a$ is concentric with a solid non-conducting sphere of radius a having a total charge Q_0 uniformly distributed through its volume. The electric field for $r>3a$ is given by $\vec{E} = 0$.

(12) A) Determine the net charge and the distribution of charge on the conducting shell.

(12) B) Determine $\vec{E}$ for $3a > r > 2a$; $2a > r > a$; and $a > r \geq 0$.

(10) C) Using the convention $V(r = \infty) = 0$ determine $V(r)$ everywhere and show that $V(r=0) = \dfrac{Q_0}{4\pi\varepsilon_0 a}$