George A. Williams

SECOND MIDTERM

2

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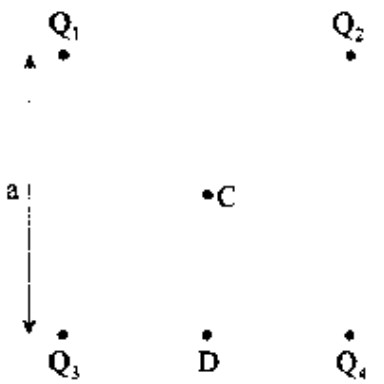
Discussion Section # _____ Student ID #: _____

SHOW ALL WORK!!!!!
REPORT ALL NUMBERS TO THREE SIGNIFICANT FIGURES!
Use the conversion constants and data given on the front page.

A square distribution of charges is set up as shown. The side of the square is "a."



(a) Calculate the electric potential, in volts, at point C, the center of the square.
(b) Calculate the electric potential, in volts, at point D, the middle of the bottom side of the square.
(c) Find the work, in Joules, necessary to bring a charge $Q = 6.00 \times 10^{-3}$ C to point C, from infinity.

$Q_1 = +1.50 \times 10^{-3}$ C
$Q_2 = -2.50 \times 10^{-3}$ C
$Q_3 = +4.75 \times 10^{-3}$ C
$Q_4 = -3.25 \times 10^{-3}$ C
$a = 1.20 \times 10^{-2}$ m

a) $\varphi_C = k \dfrac{Q_1 + Q_2 + Q_3 + Q_4}{a/\sqrt{2}} = k \dfrac{0.5 \cdot 10^{-3}}{\frac{1}{\sqrt{2}} \cdot 1.2 \cdot 10^{-2}} = 5.30 \cdot 10^{8}$ V

b) $\varphi_D = k \dfrac{Q_1 + Q_2}{a\frac{\sqrt{5}}{2}} + k \dfrac{Q_3 + Q_4}{\frac{a}{2}} = \dfrac{2k}{a}\left(-\dfrac{1 \cdot 10^{-3}}{\sqrt{5}} + \dfrac{1.5 \cdot 10^{-3}}{1}\right) =$

$= 1.58 \cdot 10^{9}$ V

c) $W = Q \cdot \varphi_C = 6 \cdot 10^{-3} \cdot 5.30 \cdot 10^{8} = 3.18 \cdot 10^{6}$ J