

SECOND MIDTERM

Name (print) Zhukov Name (signed) _____

Discussion Instructor (circle): Gramada Hansen Li Zhukov

Discussion Section # _____

SHOW ALL WORK!!!!

REPORT ALL NUMBERS TO THREE SIGNIFICANT FIGURES!

Use the conversion constants and data given on the front page.

- 15 (a) Calculate the work necessary to assemble the charge configuration shown.
10 (b) Find the work needed to bring a charge $-2Q$ from infinity to point P. P is halfway between the two charges.



$$\begin{aligned} a) \quad W = U &= k \left(3 \frac{Q^2}{a} + 2 \frac{Q^2}{2a} + \frac{Q^2}{3a} \right) = \\ &= \frac{kQ^2}{a} \left(3 + 1 + \frac{1}{3} \right) = \frac{13}{3} \frac{kQ^2}{a} \end{aligned}$$

$$\begin{aligned} b) \quad W &= -2Q \cdot V_P \\ V_P &= 2 \cdot \left[\frac{kQ}{1.5a} + \frac{kQ}{0.5a} \right] = 2 \frac{kQ}{a} \left[\frac{2}{3} + 2 \right] = \\ &= 2 \frac{kQ}{a} \cdot \frac{8}{3} = \frac{16}{3} \frac{kQ}{a} \end{aligned}$$

$$W = - \frac{32}{3} \frac{kQ^2}{a}$$