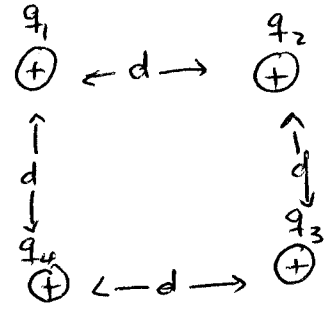
Physics 102
Quiz # 6
Chapter 25

Name : Solution Id : Sec. # :

How much work is required to bring four identical (+ 4.0 μC) charges from infinity to the four corners of a square of side 20 cm long?

$W_{app} = \Delta U$

Choose $U = 0$ at $r \to \infty$



then

$W_{app} = U_{12} + U_{13} + U_{14} + U_{24}$

$U_{23} + U_{34}$ +

Since $q_1 = q_2 = q_3 = q_4$

and $r_{12} = r_{23} = r_{34} = r_{14} = d$

$r_{13} = r_{24} = \sqrt{2}\,d$

then

$U_{12} = U_{23} = U_{34} = U_{14}$; $U_{24} = U_{13}$

$\Rightarrow W_{app} = 4U_{12} + 2U_{13}$

$= 4k\frac{q^2}{d} + \frac{2kq^2}{\sqrt{2}\,d} = \frac{kq^2}{d}\left\{4 + \sqrt{2}\right\}$

$\Rightarrow \boxed{W_{app} = 3.9 \text{ J}}$