

Potential Energy of Many Charges



Suppose one of the charges is negative. Now what is the total energy required to bring the three charges in from infinitely far away?

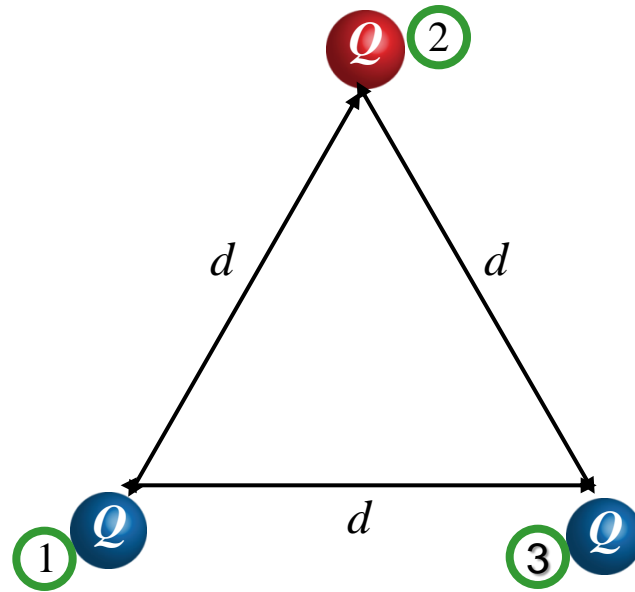
A) 0

B) $\Delta U = +1 \frac{Q^2}{4\pi\epsilon_0 d}$

C) $\Delta U = -1 \frac{Q^2}{4\pi\epsilon_0 d}$

D) $\Delta U = +2 \frac{Q^2}{4\pi\epsilon_0 d}$

E) $\Delta U = -2 \frac{Q^2}{4\pi\epsilon_0 d}$



$$W = \sum W_i = + \frac{1}{4\pi\epsilon_0} \frac{Q^2}{d}$$

$$\Delta U = - \frac{1}{4\pi\epsilon_0} \frac{Q^2}{d}$$

Work by E to bring in first charge: $W_1 = 0$

Work by E to bring in second charge: $W_2 = + \frac{1}{4\pi\epsilon_0} \frac{Q^2}{d}$

Work by E to bring in third charge: $W_3 = + \frac{1}{4\pi\epsilon_0} \frac{Q^2}{d} - \frac{1}{4\pi\epsilon_0} \frac{Q^2}{d} = 0$