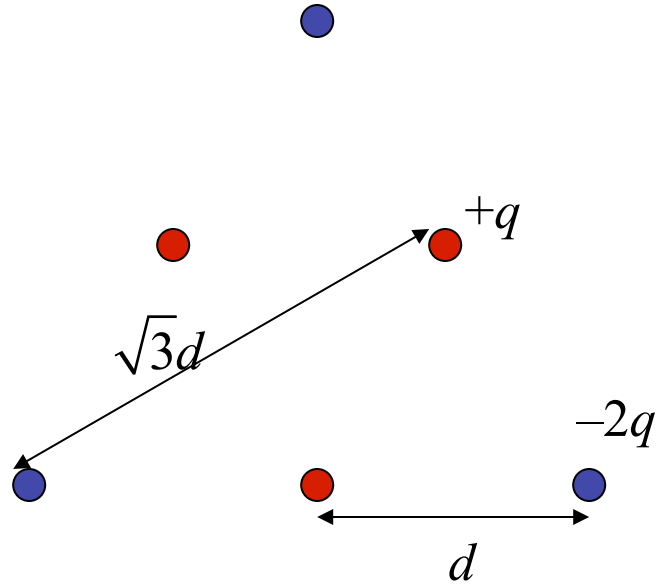
Energy of Assembly

Charges -2q at corners of equilateral triangle, +q at centers of sides. Side length 2d. What's U of assembly?



6 charges ➔ 5+4+3+2+1= (6*5)/2 = 15 pairs

3 – to – pairs: $U=k(-2q)(-2q)/(2d)= 2kq^2/d$

3 + to + pairs: $U=k(q)(q)/(d)= kq^2/d$

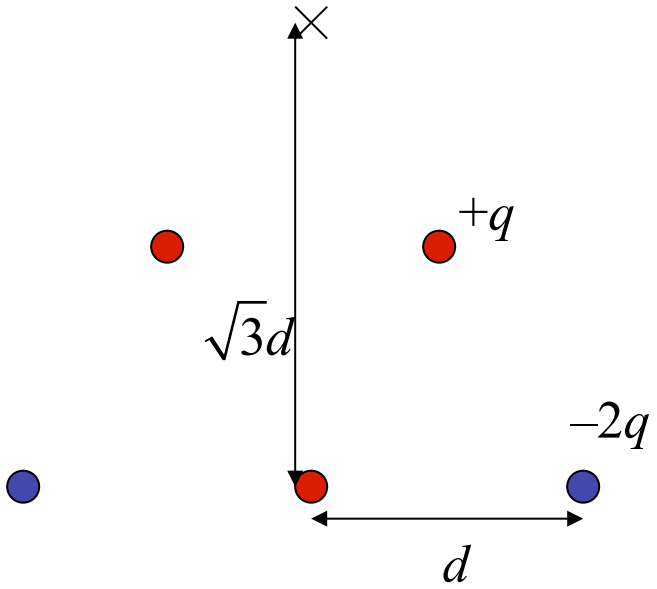
6 – to + pairs: $U=k(–2q)(q)/(d)= –2kq^2/d$

3 – to + pairs:
$U=k(–2q)(q)/(\sqrt{3}d)= –(2/\sqrt{3})kq^2/d$

$$U = (6 +3 –12 –6/\sqrt{3})\ kq^2/d = –(3 +2\sqrt{3})\ kq^2/d$$

Review: Potential

Charges -2q at 2 corners of equilateral triangle, +q at centers of sides. Side length 2d. What's V at 3rd apex?



For V calculation, ***ignore pre-existing pairs***.
5 terms needed.

2 – charges: $V=k(-2q)/(2d) = -kq/d$

2 + close: $V=k(q)/(d) = kq/d$

1 + far: $V=k(q)/(\sqrt{3}d) = (1/\sqrt{3})kq/d$

$V = (1/\sqrt{3})\ kq/d$ (others cancel)