12. As a result of the first action, both sphere *W* and sphere *A* possess charge $\frac{1}{2}q_A$, where q_A is the initial charge of sphere *A*. As a result of the second action, sphere *W* has charge

$$\frac{1}{2}\left(\frac{q_A}{2}-32e\right).$$

As a result of the final action, sphere *W* now has charge equal to

$$\frac{1}{2}\left[\frac{1}{2}\left(\frac{q_A}{2}-32e\right)+48e\right].$$

Setting this final expression equal to +18*e* as required by the problem leads (after a couple of algebra steps) to the answer: $q_A = +16e$.