41. (a) Let $\ell = 0.15\,\text{m}$ be the length of the rectangle and $w = 0.050$ m be its width. Charge q_1 is a distance ℓ from point A and charge q_2 is a distance w, so the electric potential at A is

$$V_A = \frac{1}{4\pi\varepsilon_0}\left[\frac{q_1}{\ell}+\frac{q_2}{w}\right] = (8.99\times10^9\,\text{N}\cdot\text{m}^2/\text{C}^2)\left[\frac{-5.0\times10^{-6}\,\text{C}}{0.15\,\text{m}}+\frac{2.0\times10^{-6}\,\text{C}}{0.050\text{ m}}\right]$$
$$= 6.0\times10^4\,\text{V}.$$

(b) Charge q_1 is a distance w from point b and charge q_2 is a distance ℓ, so the electric potential at B is

$$V_B = \frac{1}{4\pi\varepsilon_0}\left[\frac{q_1}{w}+\frac{q_2}{\ell}\right] = (8.99\times10^9\,\text{N}\cdot\text{m}^2/\text{C}^2)\left[\frac{-5.0\times10^{-6}\,\text{C}}{0.050\text{ m}}+\frac{2.0\times10^{-6}\,\text{C}}{0.15\,\text{m}}\right]$$
$$= -7.8\times10^5\,\text{V}.$$

(c) Since the kinetic energy is zero at the beginning and end of the trip, the work done by an external agent equals the change in the potential energy of the system. The potential energy is the product of the charge q_3 and the electric potential. If U_A is the potential energy when q_3 is at A and U_B is the potential energy when q_3 is at B, then the work done in moving the charge from B to A is

$$W = U_A - U_B = q_3(V_A - V_B) = (3.0\times10^{-6}\text{ C})(6.0\times10^4\text{ V} + 7.8\times10^5\text{ V}) = 2.5\text{ J}.$$

(d) The work done by the external agent is positive, so the energy of the three-charge system increases.

(e) and (f) The electrostatic force is conservative, so the work is the same no matter which path is used.