1. **SSM** ***REASONING AND SOLUTION*** Combining Equations 19.1 and 19.3, we have

$$W_{AB} = \text{EPE}_A - \text{EPE}_B = q_0 (V_A - V_B) = (+1.6\times 10^{-19}\ \text{C})(0.070\ \text{V}) = \boxed{1.1\times 10^{-20}\ \text{J}}$$

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2. ***REASONING AND SOLUTION***

a. The change in the electric potential energy is

$$\text{EPE}_A - \text{EPE}_B = W_{AB} = \boxed{5.80\times 10^{-3}\ \text{J}}$$

b. The potential difference between the points is

$$V_A - V_B = \frac{\text{EPE}_A - \text{EPE}_B}{q} = \frac{5.80\times 10^{-3}\ \text{J}}{1.80\times 10^{-4}\ \text{C}} = \boxed{32.2\ \text{V}}$$

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3. ***REASONING AND SOLUTION***

a. According to Equation 19.4, the work done by the electric force as the electron goes from point *A* (the cathode) to point *B* (the anode) is

$$W_{AB} = -q(V_B - V_A) = -(-1.6\times 10^{-19}\ \text{C})(+125\,000\,\text{V}) = \boxed{+2.00\times 10^{-14}\ \text{J}}$$

b. The only force that acts on the electron is the conservative electric force. Therefore, the total energy of the electron is conserved as it moves from point *A* to point *B*:

$$\underbrace{\tfrac{1}{2}mv_A^2 + \text{EPE}_A}_{\text{Total energy at point } A} = \underbrace{\tfrac{1}{2}mv_B^2 + \text{EPE}_B}_{\text{Total energy at point } B}$$

Since the electron starts from rest, $v_A = 0$ m/s. The electric potential V is related to the electric potential energy EPE by $V = \text{EPE}/q$ (see Equation 19.3). With these changes, the equation above gives the kinetic energy of the electron at point *B* (the anode) to be

$$\tfrac{1}{2} m v_B^2 = -\text{EPE}_B + \text{EPE}_A$$

$$= -q\left(V_B - V_A\right) = -\left(-1.60 \times 10^{-19}\ \text{C}\right)\left(125\,000\ \text{V}\right) = \boxed{2.00 \times 10^{-14}\ \text{J}}$$

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11. **SSM** ***REASONING AND SOLUTION*** The electric potential V at a distance r from a point charge q is given by Equation 19.6, $V = kq/r$. Solving this expression for q, we find that

$$q = \frac{rV}{k} = \frac{(0.25\ \text{m})(+130\ \text{V})}{9.0 \times 10^{9}\ \text{N}\cdot\text{m}^2/\text{C}^2} = \boxed{+3.6 \times 10^{-9}\ \text{C}}$$

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12. ***REASONING*** The electric potential at a distance r from a point charge q is given by $V = kq/r$ (Equation 19.6). The total electric potential due to the two charges is the algebraic sum of the individual potentials.

SOLUTION Using Equation 19.6, we find that the total electric potential due to the two charges is

$$V = \frac{kq_1}{r} + \frac{kq_2}{r} = \frac{k}{r}\left(q_1 + q_2\right)$$

The distance r is one-half the distance between the charges, so $r = \frac{1}{2}\left(1.20\ \text{m}\right)$ for both charges.

14. ***REASONING*** The potential at a distance r from a point charge q is given by Equation 19.6 as $V = kq/r$. Therefore, the potential difference between the locations B and A can be written as

$$V_B - V_A = \frac{kq}{r_B} - \frac{kq}{r_A}$$

We can use this relation to find the charge q.

SOLUTION Solving the equation above for q yields

$$q = \frac{V_B - V_A}{k\left(\dfrac{1}{r_B} - \dfrac{1}{r_A}\right)} = \frac{45.0\ \text{V}}{\left(8.99 \times 10^{9}\ \dfrac{\text{N}\cdot\text{m}^2}{\text{C}^2}\right)\left(\dfrac{1}{4.00\ \text{m}} - \dfrac{1}{3.00\ \text{m}}\right)} = \boxed{-6.0 \times 10^{-8}\ \text{C}}$$
