Chapter 16

10. $W = q\Delta V = (-4.0 \times 10^{6}\ \text{C})(-12\ \text{V}) = \boxed{+4.8 \times 10^{-5}\ \text{J}}$.

11. (a) $W = q\Delta V$, ☛ $q = \dfrac{W}{\Delta V} = \dfrac{1.6 \times 10^{-5}\ \text{J}}{6.0\ \text{V}} = 2.7 \times 10^{-6}\ \text{C} = \boxed{2.7\ \mu\text{C}}$.

(b) For a positive charge, it moves from $\boxed{\text{negative to positive}}$, since positive work is done by an external source, or the positive charge has higher potential energy after the move.

15. (a) The electron will accelerate downward, because it is negatively charged.

From the work-energy theorem: $|W| = q\Delta V = eE\Delta x = \Delta K = K - K_o = K = \frac{1}{2}mv^2$,

$$v = \sqrt{\frac{2eE\Delta x}{m}} = \sqrt{\frac{2(1.6 \times 10^{-19}\ \text{C})(1000\ \text{V/m})(0.0010\ \text{m})}{9.11 \times 10^{-31}\ \text{kg}}} = \boxed{5.9 \times 10^{5}\ \text{m/s down}}.$$

(b) Since the field does work, the electron does $\boxed{\text{lose potential energy}}$.

17. (a) The electric potential will change by a factor of 3, because electric potential is inversely proportional to the distance, $V = \dfrac{kq}{r}$. So the answer is $\boxed{(2)\ 3}$.

(b) $V = \dfrac{kq}{r}$, ☛ $r = \dfrac{kq}{V} = \dfrac{(9.0 \times 10^{9}\ \text{N·m}^2/\text{C}^2)(1.0 \times 10^{-6}\ \text{C})}{10 \times 10^{3}\ \text{V}} = \boxed{0.90\ \text{m}}$.

(c) $$\Delta V = \frac{kq}{r_B} - \frac{kq}{r_A} = \frac{(9.0 \times 10^{9}\ \text{N·m}^2/\text{C}^2)(1.0 \times 10^{-6}\ \text{C})}{3(0.90\ \text{m})} - \frac{(9.0 \times 10^{9}\ \text{N·m}^2/\text{C}^2)(1.0 \times 10^{-6}\ \text{C})}{0.90\ \text{m}}$$

$= -6.7 \times 10^{-3}\ \text{V} = \boxed{-6.7\ \text{kV}}$. Since the potential difference is negative, it is a potential decrease.

20. Electric field does work. $W_{elec} = -U_t = -\dfrac{kq_1q_2}{r} = -\dfrac{(9.0 \times 10^{9}\ \text{N·m}^2/\text{C}^2)(-1.4 \times 10^{-6}\ \text{C})^2}{8.0 \times 10^{-3}\ \text{m}} = \boxed{-2.2\ \text{J}}$.

$\boxed{24}$. (a) $W = \Delta U_{A\text{-}C} = q\Delta V = qEd = (-1.60 \times 10^{-19}\ \text{C})(15\ \text{V/m})(0.25\ \text{m}) = -\boxed{6.0 \times 10^{-19}\ \text{J}}$.

(b) $\Delta V_{A\text{-}C} = \dfrac{\Delta U_{A\text{-}C}}{q} = \dfrac{-6.0 \times 10^{-19}\ \text{J}}{-1.60 \times 10^{-19}\ \text{C}} = \boxed{3.8\ \text{V}}$.

(c) Since $\Delta V_{A\text{-}C}$ is positive, $\boxed{\text{point C}}$ is at a higher potential.

27. (a) The distance from the center to the corner is $r = \dfrac{10\ \text{cm}}{\cos 30°} = 11.5\ \text{cm}$.

$$V = \Sigma\frac{kq}{r} = \frac{(9.0 \times 10^{9}\ \text{N·m}^2/\text{C}^2)(4.0 \times 10^{-6}\ \text{C})}{0.115\ \text{m}} + \frac{(9.0 \times 10^{9}\ \text{N·m}^2/\text{C}^2)(4.0 \times 10^{-6}\ \text{C})}{0.115\ \text{m}}$$

$$+ \frac{(9.0 \times 10^{9}\ \text{N·m}^2/\text{C}^2)(-4.0 \times 10^{-6}\ \text{C})}{0.115\ \text{m}} = \boxed{3.1 \times 10^{5}\ \text{V}}.$$

(b) The distance from q_1 to the point is $r = (20\ \text{cm}) \cos 30° = 17.3\ \text{cm}$.

$$V = \Sigma\frac{kq}{r} = \frac{(9.0 \times 10^{9}\ \text{N·m}^2/\text{C}^2)(4.0 \times 10^{-6}\ \text{C})}{0.173\ \text{m}} + \frac{(9.0 \times 10^{9}\ \text{N·m}^2/\text{C}^2)(-4.0 \times 10^{-6}\ \text{C})}{0.10\ \text{m}}$$

$$+ \frac{(9.0 \times 10^{9}\ \text{N·m}^2/\text{C}^2)(4.0 \times 10^{-6}\ \text{C})}{0.10\ \text{m}} + \frac{(9.0 \times 10^{9}\ \text{N·m}^2/\text{C}^2)(5.0 \times 10^{-6}\ \text{C})}{0.112\ \text{m}} = \boxed{2.1 \times 10^{5}\ \text{V}}.$$