CHAPTER 17

1. We find the work done by an external agent from the work-energy principle:
   $W = \Delta\text{KE} + \Delta\text{PE} = 0 + q(V_b - V_a)$
   $= (-8.6 \times 10^{-6}\text{ C})(+75\text{ V} - 0) =$ $\boxed{-6.5 \times 10^{-4}\text{ J (done by the field).}}$

2. We find the work done by an external agent from the work-energy principle:
   $W = \Delta\text{KE} + \Delta\text{PE} = 0 + q(V_b - V_a)$
   $= (1.60 \times 10^{-19}\text{ C})[(-50\text{ V}) - (+100\text{ V})] =$ $\boxed{-2.40 \times 10^{-17}\text{ J (done by the field);}}$
   $W = q(V_b - V_a)$
   $= (+1\text{ e})[(-50\text{ V}) - (+100\text{ V})] =$ $\boxed{-150\text{ eV.}}$

3. Because the total energy of the electron is conserved, we have
   $\Delta\text{KE} + \Delta\text{PE} = 0$, or
   $\Delta\text{KE} = -q(V_B - V_A) = -(-1.60 \times 10^{-19}\text{ C})(21{,}000\text{ V}) =$ $\boxed{3.4 \times 10^{-15}\text{ J;}}$
   $\Delta\text{KE} = -(-1\text{ e})(21{,}000\text{ V}) =$ $\boxed{21\text{ keV.}}$

4. Because the total energy of the electron is conserved, we have
   $\Delta\text{KE} + \Delta\text{PE} = 0;$
   $\Delta\text{KE} + q(V_B - V_A) = 0;$
   $3.45 \times 10^{-15}\text{ J} + (-1.60 \times 10^{-19}\text{ C})(V_B - V_A)$; which gives $V_B - V_A =$ $\boxed{2.16 \times 10^3\text{ V.}}$
   $\boxed{\text{Plate } B}$ is at the higher potential.

5. For the uniform electric field between two large, parallel plates, we have
   $E = \Delta V/d = (220\text{ V})/(5.2 \times 10^{-3}\text{ m}) =$ $\boxed{4.2 \times 10^4\text{ V/m.}}$

6. For the uniform electric field between two large, parallel plates, we have
   $E = \Delta V/d;$
   $640\text{ V/m} = \Delta V/(11.0 \times 10^{-3}\text{ m})$, which gives $\Delta V =$ $\boxed{7.04\text{ V.}}$

7. Because the total energy of the helium nucleus is conserved, we have
   $\Delta\text{KE} + \Delta\text{PE} = 0;$
   $\Delta\text{KE} + q(V_B - V_A) = 0;$
   $65.0\text{ keV} + (+2\text{e})(V_B - V_A)$; which gives $V_B - V_A =$ $\boxed{-32.5\text{ kV.}}$

8. For the uniform electric field between two large, parallel plates, we have
   $E = \Delta V/d;$
   $3 \times 10^6\text{ V/m} = (100\text{ V})/d$, which gives $d =$ $\boxed{3 \times 10^{-5}\text{ m.}}$

9. We use the work-energy principle:
   $W = \Delta\text{KE} + \Delta\text{PE} = \Delta\text{KE} + q(V_b - V_a);$
   $25.0 \times 10^{-4}\text{ J} = 4.82 \times 10^{-4}\text{ J} + (-7.50 \times 10^{-6}\text{ C})(V_b - V_a)$, which gives $V_b - V_a = -269\text{V}$, or
   $\boxed{V_a - V_b = 269\text{ V.}}$