1) Conceptual questions. Circle or write the correct answer to each question.

(a) In a certain region of space the electric potential is known to be a constant 120 volts. The electric field in this region is:

\[ E = -\nabla V \Rightarrow \text{If } V = \text{const, } E = 0 \]

1) positive  
2) zero  
3) negative  
4) Can’t be determined from the given information

(b) You need to replace a capacitor with one that can store more energy. Which will give you a greater energy increase?

1) A capacitor with twice the capacitance but the same voltage as the old one  
2) A capacitor with the same capacitance but twice the voltage as the old one  
3) Both of the new capacitors store the same amount of energy.

\[ U = \frac{1}{2} C (\Delta V)^2 \]

(c) Silver and iron wires of the same length and diameter carry the same current. Compare the voltages across these wires, given that silver has a greater conductivity than iron.

1) The voltage difference across the silver wire is larger.  
2) The voltage difference across the iron wire is larger.  
3) The voltage difference across both wires are identical.  
4) We don’t have enough information to compare these voltages.

(d) The graph shows the x-component of the electric field as a function of position on the x-axis. If the electric potential at the origin is 30.0 V, what is the electric potential at x = 3 m?

\[ \Delta V = -\int E \cdot dx = - \int E_x dx = -150 \text{ V} \]

So \( \Delta V = -150 \text{ V} = V(3) - V(0) \Rightarrow V(3) = V(0) - 150 \text{ V/m} \)

So \( V(3) = 30 \text{ V} - 150 \text{ V} = -120 \text{ V} \)