Electric Field & Electric Potential Energy Worksheet

1) A small positive charge is moved closer to a positively charged object. The PE of the small positive charge...
   a) increases  
   b) decreases  
   c) stays the same.

2) A small negative charge is moved further away from a negatively charged object. The work done on the small negative charge is …
   a) positive  
   b) negative  
   c) zero.

3) A small positive charge is moved from 3 cm away from a positively charged object to a location that is 3 cm away on the other side of the object. The work done on the small positive charge is …
   b) positive  
   b) negative  
   c) zero.

4) A proton is moved 5 cm closer to the negative plate in an oppositely charged parallel plate arrangement. Ignoring any changes in gravitational energy and if the strength of the field inside the plates is 600 N/C, find…
   a) the work done in moving the proton.  
   b) the sign of the work done in moving the proton.  
   c) the PE gained/lost by the proton.  
   d) Was it gained or lost?

5) An electron is sitting 10 cm away from a small object of charge -5µC. Find…
   a) the force that the electron experiences. Is it attractive or repulsive?  
   b) the strength of the electric field at this point.  
   c) the potential energy stored in the field at this point.

6) An electron is sitting 10 cm away from a small object of charge -5nC (1nC = 1E-9C). It is let go and it moves away from the charged object. When it reaches a distance of 15 cm away, find its speed.

7) An oil droplet of mass 5.4E-17kg is suspended between two horizontal, oppositely charged parallel plates. The positive plate is at the top and the negative plate is at the bottom. If the electric field between the plates is 4000 N/C, find the charge on the oil droplet.

8) Think back to problem #7. The mass is suspended when the electric field strength is 4000 N/C. Assume that the electric field is instantly increased to 5000 N/C. Find the speed that the oil droplet will hit the top plate, which is 20 cm above it. You will have to use a free-body diagram of the droplet, as well as think about work and energy and their relationship.
9) A small object has an excess of $5.00 \times 10^9$ electrons. An electron is placed in the field near this object and has $2.307E-18$ Joules of PE. Find…

a) the distance from the center of the small object to the electron.
b) the strength of the electric field at this point.

10) In the back end of a Cathode Ray Tube (CRT), a heater causes electrons to break free of a negatively charged plate (the cathode) and then rush toward the positively charged plate (the anode). If the electric field between the plates is maintained at a constant strength of $E = 215,083$ N/C, and if the distance between the plates is 5 cm, find the speed at which an electron will pass through the positive plate, heading toward the computer/TV screen. Assume the electron initially starts at rest and neglect gravity’s effects.

11) In the front end of a Cathode Ray Tube (CRT) arrangement, an electron is fired toward a computer screen. It enters midway between two parallel plates with an initial speed of $6.15E7$ m/s and its vertical deflection when it finally leaves the plates is $4.7$ mm. Find the magnitude of the electric field between the plates.

$m_e = 9.11E - 31$ kg  
$m_p = 1.67E - 27$ kg

$\Delta PE = qEd \quad \Delta V = Ed \quad \text{(for Uniform Fields ONLY!)}$

$PE = \frac{kqQ}{d} \quad V = \frac{kQ}{d} \quad \text{(near a point charge ONLY!)}$

$V = \frac{PE}{q} \quad \Delta V = \frac{\Delta PE}{q} \quad \Delta PE = q\Delta V \quad \text{(use for both situations)}$