**Worksheet - Electric Potential in Uniform Electric Fields**

1. Find the Electric Field strength of the uniform field below:



1. A proton at rest is accelerated between two parallel plates with a potential difference of 300V as shown below. What is the maximum speed of the proton?



1. A voltmeter measures the potential difference between two large parallel plates to be 50.0 volts. The plates are 3.0 cm apart. What is the magnitude of the electric field strength between the plates?
2. Two large parallel metal plates are 5.0 cm apart. The magnitude of the electric field between them is 800. N/C.
	1. What is the potential difference between the plates?
	2. What work is done when one electron is moved from the positive to the negative plate?
3. The magnitude of the electric field strength between two parallel plates is 4.0 x 103 N/C. The plates are connected to a battery with an electric potential difference of 12 V. What is the plate separation?
4. The electric field between two charged parallel plates separated by a distance of 1.8 cm has a uniform value of 2.4 x 104 N/C. Find the potential difference between the plates. How much kinetic energy would be gained by a deuteron in accelerating from the positive plate to the negative plate? (A deuteron is a particle with one proton and one neutron.)
5. A potential difference of 10, 000 V exists between two parallel plates which are separated by 10 cm. An electron is released from the negative plate at the same instant a proton is released from a positive plate.
	1. What is the kinetic energy of each particle as they reach the opposite sides? (Joules)
	2. With what velocity does each of the particles hit the opposite plates?
	3. What is the electric field strength between the plates? (Hint: think about the distance between the plates)
	4. What is the acceleration of each particle?
6. A CRT is used with an accelerating voltage of 750 V to accelerate electrons before they pass through deflecting plates, to which a deflecting voltage of 50.0 V is applied.
	1. What speed do the electrons reach?
	2. When the electrons travel through the deflecting plates, which are separated by a distance of 2.0 cm, what is the electric field strength between the plates?
	3. What is the force that will deflect electrons as they pass through the plates?
	4. At what rate will the electrons accelerate as they pass through the plates?
	5. The plates have a length of 5.0 cm. For what length of time will the electrons be between the plates?
	6. What is the deflection in the y-direction of the electrons as they pass through the plates?
7. A proton is placed in an electric field between two parallel plates. If the plates are 6.0 cm apart and have a potential difference of 75 V, how much work is done against the electric field when the proton is moved 3.0 cm parallel to the plates?
8. In question 14, how much work is done against the electric field in moving the proton 3.0 cm perpendicular to the plates?

Answers:

1. 10,000 V/m (N/C)
2. 2.4 x 105 m/s
3. 1700 V/m (N/C)
4. See below.
	1. 40. V
	2. 6.4 x 10-18 J
5. 3.0 x 10-3 m
6. 432 V, 6.92 x 10-17 J
7. See below.
	1. 1.6 x 10-15 J for both!
	2. 5.9 x 107 m/s for the electron, 1.4 x 106 m/s for the proton
	3. 1.0 x 105 V/m (or J/C)
	4. -1.8 x 1016 m/s2 for the electron, 9.6 x 1012 m/s2 for the proton
8. a. 1.6 x 107 m/s b. 2.5 x 103 N/C c. 4.0 x 10-16 N d. 4.4 x 1014 m/s2 e. 3.1 x 10-9 s f. 2.1 mm (0.0021 m)
9. 0 J
10. 6.0x10-18 J