Conceptual Questions

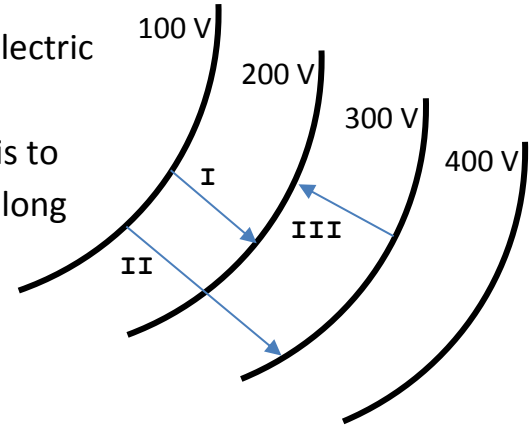
1. Compare the kinetic energy gained by a proton ($q = +e$) to the energy gained by an alpha particle ($q = +2e$) accelerated by the same voltage $\boldsymbol{\Delta V}$. [1]
2. A proton and an electron are released from rest at the midpoint between the plates of a charged parallel plate capacitor. Except for these particles, nothing else is between the plates. Ignore the attraction between the proton and the electron, and decide which particle strikes a capacitor plate first. Why?[2]
3. Does a parallel-plate capacitor (apparatus) have uniform potential as well as field strength? If not, is there any path that a charge can take where the potential is uniform (does not change)? If so, what is the path called?[3]
4. Two parallel plates are placed a distance ***D*** away from each other and a potential difference of $\boldsymbol{\Delta V}$ is applied across them. Point ***A*** is located ***⅔D*** from the positive plate and point ***B*** located on the positive plate. [4]
   a) Which point will have the higher electric field strength? Explain.
   b) Which point will have the higher electric potential? Explain.

Problems

5. How much kinetic energy is gained by an electron that is allowed to move freely through a potential difference of 2.5×10^4 V?[5]

6. A 1.0×10^{-6} C test charge is 40.0 cm from a 3.2×10^{-3} C charged sphere. How much work was required to move it there from a point 1.0×10^2 cm away from the sphere?[6]

7. The provided diagram shows lines along which the electric potential is constant and has the value given.
   a) Find the work that is required if a charge of 5.0 C is to be moved from the 100.0 V line to the 200.0 V line along path ***I***.



[1] Physics 6th Edition, Giancoli, Chapter 17 Questions, #7
[2] Physics, 7th Edition, Cutnell & Johnson, Chapter 19 Conceptual Questions, #16
[3] Physics Book Two, Irwin Publishing, Chapter 8 Conceptual Questions, #29
[4] Almeida, F., Physics Department, Victoria Park C.I.
[5] Physics 12, Nelson Education, Section 7.4 Questions, #8
[6] Physics 12, Nelson Education, Chapter 7 Review, #20

b) How much work would be required if the same charge were moved along path ***II***?

c) If the 5.0 C charge were first to move to the 300.0 V line along path ***II*** and then to the 200.0 V line along path ***III***, how much work would be required then? Compare your answer to that in a). [7]

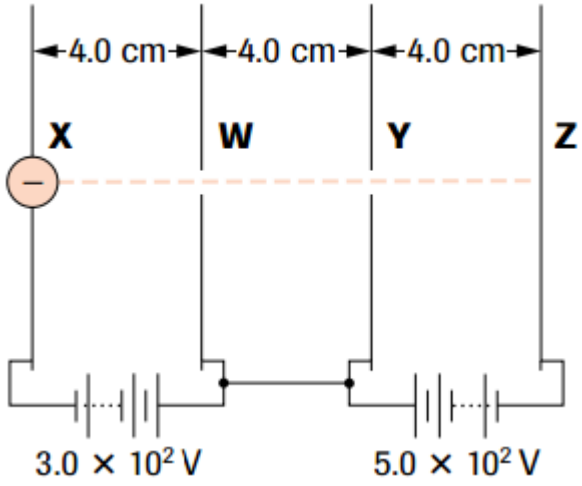
8. An electron is released from rest from the negative plate of a parallel-plate apparatus. [8]

   a) At what speed will the electron hit the positive plate if a 450-V potential difference is applied?

   b) What is the electron's speed one-third of the way between the plates?

9. An electron with a speed of 5.0×10^6 m/s is injected into a parallel plate apparatus through a hole in the positive plate. It moves across the vacuum between the plates, colliding with the negative plate at 1.0×10^6 m/s. What is the potential difference between the plates?[9]

10. Four parallel plates are connected in a vacuum as shown. An electron, essentially at rest, drifts into the hole in plate ***X*** and is accelerated to the right. The vertical motion of the electron continues to be negligible. The electron passes through holes ***W*** and ***Y***, then continues moving toward plate ***Z***. Using the information given in the diagram, calculate[10]



   a) the speed of the electron at hole ***W***.

   b) the distance from plate ***Z*** to the point at which the electron changes direction.

   c) the speed of the electron when it arrives back at plate ***X***.

[7] Physics for the IB Diploma, 4th Edition, Cambridge University Press, Chapter 5.2 Questions, #9
[8] Physics Book Two, Irwin Publishing, Chapter 8 Problems, #91
[9] Fundamentals of Physics: A Senior Course, Martindale, 15.9 Review Problems #38
[10] Physics 12, Nelson Education, Chapter 7 Review, #33