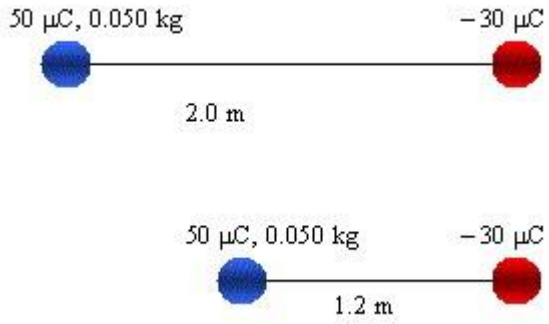
Physics 12

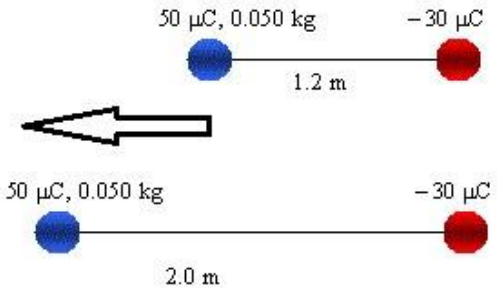
WS 6.4: Electric Fields and Parallel Plates

Unit 6: Electrostatics

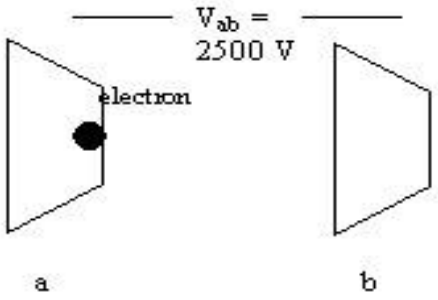
1. A 50 µC charged sphere of mass 0.050 kg is stationary and 2.0 m away from a fixed -30 µC charged sphere. The 50 µC charged sphere released and allowed to accelerate towards the fixed charge. When it is 1.2 m away, what is the speed of this sphere?



2. A 50 µC charged sphere of mass 0.050 kg is 1.2 m away from a -30 µC charged sphere. The 50 µC charged sphere is moved **at a steady speed** to a point 2.0 m away. What is the change in **potential energy** of this sphere?

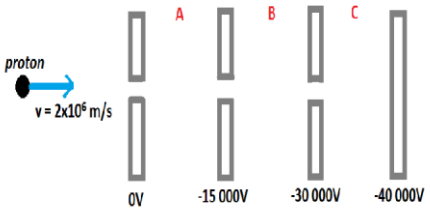


3. An electron is accelerated by a voltage of 2500 V between plates a and b, as shown. You may assume the plate b is at a higher potential than plate a. What is the electron's change in energy when reaching plate b if it starts from rest? What is the electron's speed when reaching plate b?

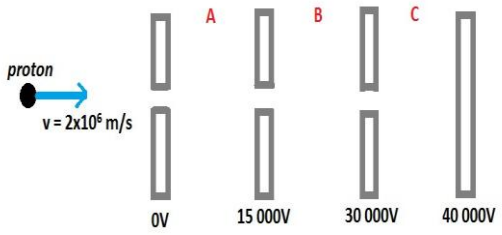


4. A proton moving at 3.0 x 10^4 m/s is accelerated through a potential difference of -200V, what is its final velocity?

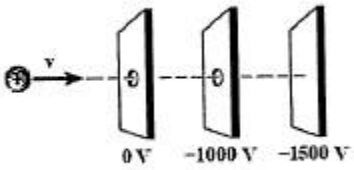
5. A proton is moving at a speed of 2x10^6 m/s towards a series of charged parallel plates as shown below. What is the final velocity of the proton upon striking the -40000V plate on the right?



6. A proton is moving at a speed of $2x10^6$ m/s towards a series of charged parallel plates as shown below. In what section (A, B, or C) will the proton stop?



7. A proton is travelling at a speed of 4×10^5 m/s moves into a series of charged parallel plates as shown below.
    a. What is the impact speed on the third plate?



    b. The same proton is fired again at the same speed towards a very large, fixed nucleus (parallel plates removed) and comes to rest 0.15 nm away from the atom. What is the charge of the atom?

c. What might this nucleus be? (use the periodic table)

d. Why can you not use high-school kinematics to get the answer above for this situation?

Answers: 1: *13 m/s* ***| 2:*** *4.5 J* ***| 3:*** *3.0 x 10^{7} m/s* ***| 4:*** *2.0 x 10^{5} m/s* ***| 5:*** *3.4 x 10^{6} m/s* ***| 6:*** *21000 V (section B)* ***| 7: a)*** *6.7 x 10^{5} m/s,* ***b)*** *1.42 x 10^{-17} C,* ***c)*** *atomic # ~88 = radium,* ***d)*** *forces, therefore accelerations, are not constant and therefore requires calculus.*