PEARSON NEW INTERNATIONAL EDITION

Student Workbook for College Physics: A Strategic Approach Volume 2

Knight Jones Field Andrews

Second Edition

ALWAYS LEARNING

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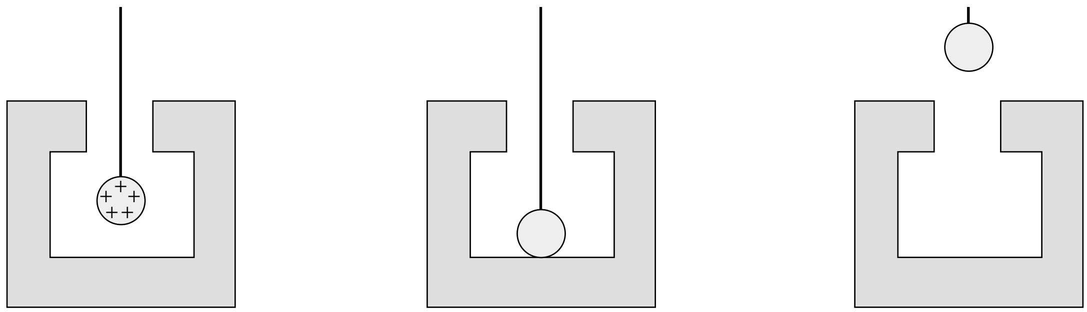
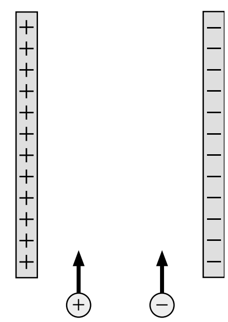
36. An insulating thread is used to lower a positively charged metal ball into a metal container. Initially, the container has no net charge. Use plus and minus signs to show the charge distribution on the inner and outer surfaces of the container and any charge on the ball. (The ball's charge is already shown in the first frame.)



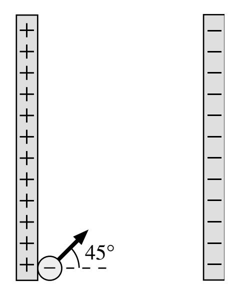
Ball hasn't touched — Ball has touched — Ball has been withdrawn

7 Forces and Torques in Electric Fields

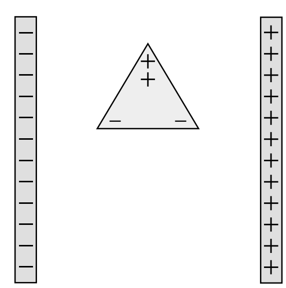
37. Positively and negatively charged particles, with equal masses and equal quantities of charge, are shot into a capacitor in the directions shown.
    a. Use solid lines to draw their trajectories on the figure if their initial velocities are fast.
    b. Use dotted lines to draw their trajectories on the figure if their initial velocities are slow.



38. An electron is launched from the positive plate at a 45° angle. It does not have sufficient speed to make it to the negative plate. Draw its trajectory on the figure.



39. Three charges are placed at the corners of a triangle. The + + charge has twice the quantity of charge of the two − charges; the net charge is zero.
    a. Draw the force vectors on each of the charges.
    b. Is the triangle in equilibrium? ____________ If not, draw the equilibrium orientation directly beneath the triangle that is shown.
    c. Once in the equilibrium orientation, will the triangle move to the right, move to the left, rotate steadily, or be at rest? Explain.

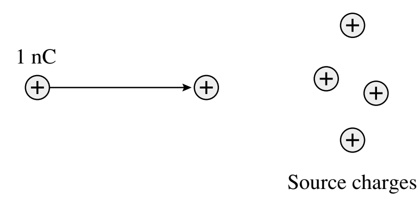


Student Workbook for Electric Potential

1 Electric Potential Energy and Electric Potential

1. A force does 2 μJ of work to push charged particle A toward a set of fixed source charges. Charged particle B has twice the charge of A. How much work must the force do to push B through the same displacement? Explain.

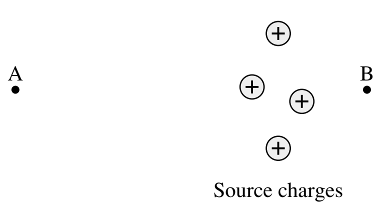
2. A 1 nC charged particle is pushed toward a set of fixed source charges, as shown. In the process, the particle gains 1 μJ of electric potential energy.
   a. How much work was done to push the particle through this displacement? Explain.



   b. Through what potential difference did the particle move?

3. Charged particle A is placed at a point in space where the electric potential is V. Its electric potential energy at that point is U_A. Particle A is removed and replaced by charged particle B, whose potential energy at the same point is U_B. If the charge of B is three times the charge of A, what is the ratio U_B/U_A? Explain.

4. Which point, A or B, has the higher electric potential? Why?



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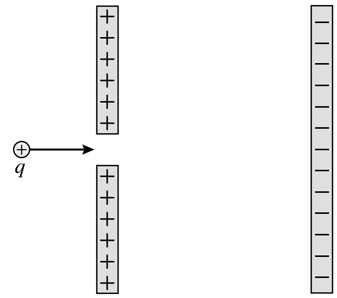
2 Sources of Electric Potential

3 Electric Potential and Conservation of Energy

5. A positive charge q is fired through a small hole in the positive plate of a capacitor. Does q speed up or slow down inside the capacitor? Answer this question twice:



a. First using the concept of force.

b. Second using the concept of energy.

6. Charge q is fired toward a stationary positive point charge.

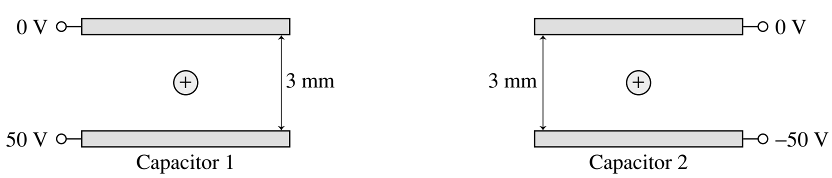
a. If q is a positive charge, does it speed up or slow down as it approaches the stationary charge? Answer this question twice:

i. Using the concept of force.

ii. Using the concept of energy.

b. Repeat part a for q as a negative charge.

7. The figure shows two capacitors, each with a 3 mm separation. A proton is released from rest in the center of each capacitor.

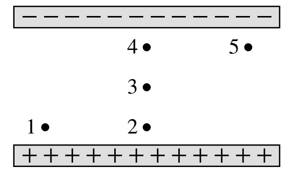


a. Draw an arrow on each proton to show the direction it moves.

b. Which proton reaches a capacitor plate first? Or are they simultaneous? ______________

4 Calculating the Electric Potential

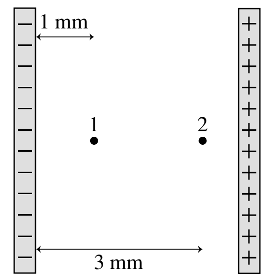
8. Rank in order, from largest to smallest, the electric potentials V_1 to V_5 at points 1 to 5.



Order:

Explanation:

9. The figure shows two points inside a capacitor. Let $V = 0$ V at the negative plate.



a. What is the ratio V_2/V_1 of the electric potentials at these two points? Explain.

b. What is the ratio E_2/E_1 of the electric field strengths at these two points? Explain.

10. A capacitor with plates separated by distance d is charged to a potential difference ΔV_C. All wires and batteries are disconnected, and then the two plates are pulled apart (with insulated handles) to a new separation of distance $2d$.

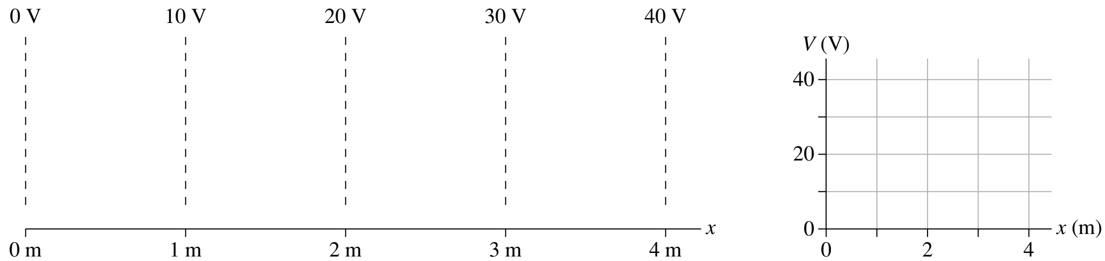
a. Does the capacitor charge Q change as the separation increases? If so, by what factor? If not, why not?

b. Does the electric field strength E change as the separation increases? If so, by what factor? If not, why not?

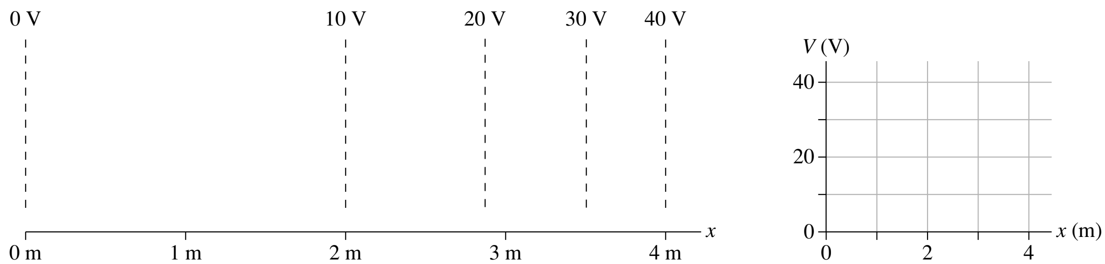
c. Does the potential difference ΔV_C change as the separation increases? If so, by what factor? If not, why not?

11. Each figure shows a contour map on the left and a set of graph axes on the right. Draw a graph of V versus x. Your graph should be a straight line or a smooth curve.

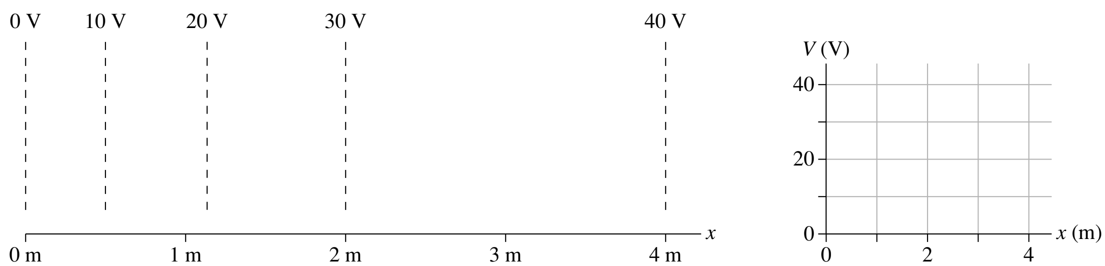
a.



b.

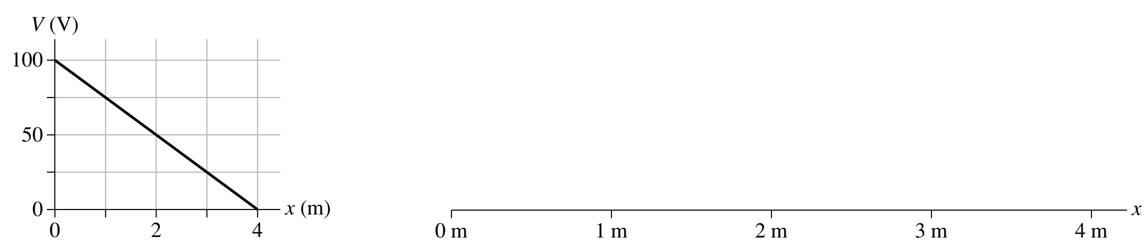


c.



12. Each figure shows a V-versus-x graph on the left and an x-axis on the right. Assume that the potential varies with x but not with y. Draw a contour map of the electric potential. There should be a uniform potential difference between equipotential lines, and each equipotential line should be labeled.

a.



b.