Unit 5D

Electric Potential Energy and Electric Potential

Practice Problems

Name:

Date:

Work each of the following problems. SHOW ALL WORK.

1. For a source charge Q and a test charge q separated by a distance r, the electric potential energy of the test charge is kQq / r. If two alpha particles (each with two protons and two neutrons) are 0.5 m apart, what is the electric potential energy of the system?

2. Two protons approach each other from very far away with an initial speed of 500 m/s. How close do they come to each other before turning around?

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3. A 4 V battery is connected to two parallel plates that are separated by a distance of 0.25 mm. Find the magnitude of the electric field created between the plates.

4. A proton starts moving from rest in an electric field of magnitude 6.5×10^5 V/m. The field points in the positive x-direction, and under the influence of the field, the proton moves 0.25 m in that direction.

    a. What is the change in the proton's electric potential as a result of the displacement?
    b. What is the change in the proton's electric potential energy due to the displacement?
    c. What is the speed of the proton after it has moved 0.25 m, beginning from rest?

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5. If 3 C of charge moves through a 12 V potential difference, what is the change in electric potential energy?

6. An electric field of constant strength 6 N/C points in the positive y direction. A proton moves from the origin to the point (0, 2) m. What is the change in the proton's electric potential? What would be the change in electric potential if an electron moved the same way?

7. A particle with charge 1.7 μC moves along an electric field line in a field of strength 35 N/m. If the particle moves 19 m along the line, what is the change in its electric potential and electric potential energy?

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8. A -3 C charge moves through a 2000 V loss of electric potential. Will the charge gain or lose electric potential energy? Will the charge gain or lose kinetic energy?

9. Find the total electric potential energy of the system of charges shown below:

1.1 nC

4 m

3 nC

2 m

4.5 m

8 nC