1. During a particular thunderstorm, the electric potential difference between a cloud and the ground is *V*cloud - *V*ground = 1.90 108 V, with the cloud being at the higher potential. What is the change in an electron's electric potential energy when the electron moves from the ground to the cloud?
2. Point *A* is at a potential of +290 V, and point *B* is at a potential of -150 V. An *α*-particle is a helium nucleus that contains two protons and two neutrons; the neutrons are electrically neutral. An *α*-particle starts from rest at *A* and accelerates toward *B*. When the *α*-particle arrives at *B*, what kinetic energy (in electron volts) does it have?
3. In a television picture tube, electrons strike the screen after being accelerated from rest through a potential difference of 27 000 V. The speeds of the electrons are quite large, and for accurate calculations of the speeds, the effects of special relativity must be taken into account. Ignoring such effects, find the electron speed just before the electron strikes the screen.
4. Point A is located 0.20 m away from a charge of -2.70 10-9 C. Point B is located 0.50 m away from the charge. What is the electric potential difference *V*B - *V*A between these two points?
5. An electron and a proton are initially very far apart (effectively an infinite distance apart). They are then brought together to form a hydrogen atom, in which the electron orbits the proton at an average distance of 5.50 10-11 m. What is EPEfinal - EPEinitial, which is the change in the electric potential energy?
6. Location *A* is 3.30 m to the right of a point charge *q*. Location *B* lies on the same line and is 4.20 m to the right of the charge. The potential difference between the two locations is *VB* - *VA* = 45.0 V. What is the magnitude and sign of the charge?
7. Two identical point charges are fixed to diagonally opposite corners of a square that is 1.4 m on a side. Each charge is +3.5 µC. How much work is done by the electric force as one of the charges moves to an empty corner?
8. Two charges are fixed in place with a separation *d*. One charge is positive and has twice (*n* = 2) the magnitude of the other charge, which is negative. The positive charge lies to the left of the negative charge, as in the figure. Relative to the negative charge, locate the two spots on the line through the charges where the total potential is zero.

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| positive distance to the left of -*q*  | 1 multiplied by*d* |
| positive distance to the right of -*q*  | 2 multiplied by*d* |



1. A charge of -1.5 µC is fixed in place. From a horizontal distance of 0.0675 m, a particle of mass 6.75 10-3 kg and charge -2.8 µC is fired with an initial speed of 25.0 m/s directly toward the fixed charge. How far does the particle travel before its speed is zero?
2. Four identical charges (+2.5 µC each) are brought from infinity and fixed to a straight line. The charges are located 0.55 m apart. Determine the electric potential energy of this group.