

Physics 115A Answers to assigned questions from chapter 17, Giancoli

1. a) Yes
 b) Not necessarily. A force may be exerted to do positive work on the charge for the rest of the path. In that case, the work done against the field and by the field will add to zero.

2. No. If equipotentials crossed, there would be two different potentials at the crossing point, and hence, that point could not lie on an equipotential line of surface. Because equipotentials are always perpendicular to lines of force (fields), they cannot cross since lines of force do not cross. (See Question 19 in Chapter 16, which asks why lines of force cannot cross.)

4. a) The resultant field will vanish at the midpoint, since the two field vectors add to zero there.
 b) We assume here that the potential is taken to be zero at an infinite distance from all charges. The potential is a scalar and since both potentials are positive, their sum is nonzero at any finite distance from the charges.

6. A negative charge will move toward a region of higher potential, whereas a positive charge will move toward a region of lower potential. In both cases the *potential energy* will decrease. Since $PE = Q V$, for negative Q , we have $(-)(+) = (-)$ while for positive Q , we have $(+)(-) = (-)$.

7. a) The electric potential at a point is electric potential energy per unit charge. The electric field at a point is electric force per unit charge.
 b) Since the electric potential is potential energy per unit charge, the electric potential energy of a charge must equal the charge times the electric potential. (Recall that reference potential is arbitrary and only potential differences are meaningful.)

8. No. Consider the dipole in Fig. 16-29 (a). The potential at the midpoint of the line joining the charges is zero. The field is not.

9. If potential is constant, the electric field $\vec{E} = 0$, since $E = \Delta V / d = 0$.

12. a) V would be 10 volts lower at other point.
 b) E would remain the same everywhere, since it depends only on the voltage DIFFERENCE between points.

13. The two plates acquire equal and opposite charges because any imbalance would be quickly eliminated. Suppose the positive plate had a slightly greater charge than the negative. Electrons from the negative battery terminal would be attracted towards the positive plate, but could not get across the space between the plates. Therefore, it would increase the charge on the negative plate until the net charge on the two plates was zero. A similar thing would happen if the negative plate had excess charge. This will be true even if the two plates are of different sizes and shapes.

14. It means that while C depends on the geometry, it does not depend on Q or V , and in fact, *is* the proportionality constant relating the two: $Q = CV$.