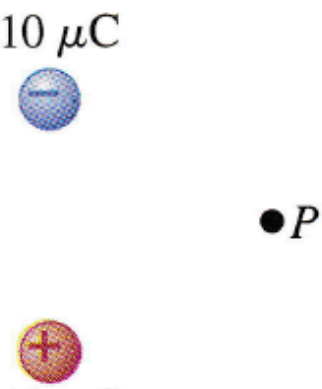
Multiple-Choice Problems

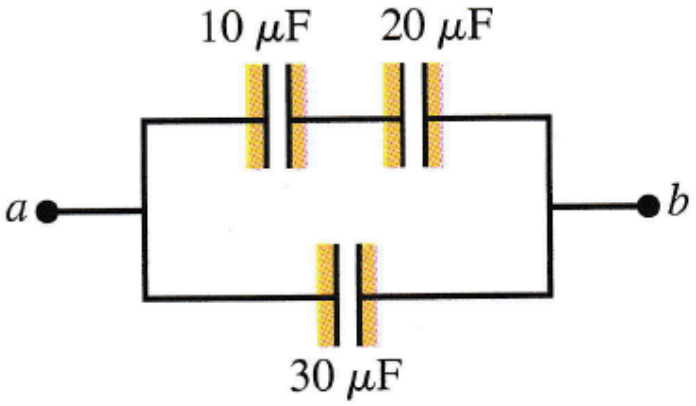
1. A surface will be an *equipotential* surface if (there may be more than one correct choice)
   A. the electric field is zero at all points on it.
   B. the electric field is tangent to the surface at all points.
   C. the electric field is perpendicular to the surface at all points.

2. In Figure 18.34, point P is equidistant from both point charges. At that point (there may be more than one correct choice),
   A. the electric field points directly to the right.
   B. the electric field is zero.
   C. the potential (relative to infinity) is zero.
   D. the potential (relative to infinity) points upward.



▲ FIGURE 18.34 Multiple-choice problem 2.

3. For the capacitor network shown in Figure 18.35, a constant potential difference of 50 V is maintained across points a and b by a battery. Which of the following statements about this network is correct? (There may be more than one correct choice.)



▲ **FIGURE 18.35** Multiple-choice problem 3.

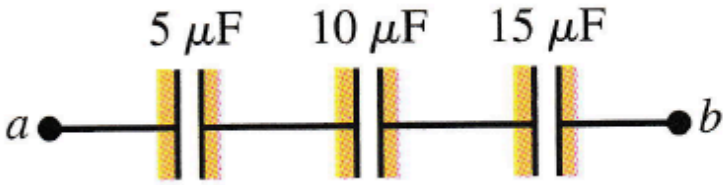
A. The 10 μF and 20 μF capacitors have equal charges.
B. The charge on the 20 μF capacitor is twice the charge on the 10 μF capacitor.
C. The potential difference across the 10 μF capacitor is the same as the potential difference across the 20 μF capacitor.
D. The equivalent capacitance of the network is 60 μF.

4. A parallel-plate capacitor having circular plates of radius R and separation d is held at a fixed potential difference by a battery. If the plates are moved closer together while they are held at the same potential difference (there may be more than one correct choice),
A. the amount of charge on each of them will increase.
B. the amount of charge on each of them will decrease.
C. the amount of charge on each of them will stay the same.
D. the energy stored in the capacitor increases.

5. A parallel-plate capacitor having circular plates of radius R and separation d is charged to a potential difference by a battery. It is then *removed* from the battery. If the plates are moved closer together (there may be more than one correct choice),
   A. the amount of charge on each of them will increase.
   B. the amount of charge on each of them will decrease.
   C. the amount of charge on each of them will stay the same.
   D. the energy stored in the capacitor increases.

6. Two electrons close to each other are released from rest and are completely free to move. After being released (there may be more than one correct choice),
   A. their kinetic energies gradually decrease to zero as they move apart.
   B. their kinetic energies increase as they move apart.
   C. their electrical potential energy gradually decreases to zero as they move apart.
   D. their electrical potential energy increases as they move apart.
   E. their speeds gradually decrease to zero as they move apart.

7. The capacitor network shown in Figure 18.36 is connected across a fixed potential difference of 25 V. Which statements about this network must be true? (There may be more than one correct choice.)



▲ **FIGURE 18.36** Multiple-choice problem 7.

A. The potential difference is the same across each capacitor.
B. The charge is the same on each capacitor.
C. The equivalent capacitance of the network is 30 μF.
D. The equivalent capacitance of the network is less than 30 μF.

8. If the potential (relative to infinity) due to a point charge is V at a distance R from this charge, the distance at which the potential (relative to infinity) is $2V$ is

A. $4R$. B. $2R$. C. $R/2$. D. $R/4$.

9. If the electrical potential energy of two point charges is U when they are a distance d apart, their potential energy when they are twice as far apart will be

A. $U/4$. B. $U/2$. C. $2U$. D. $4U$.

10. An electron is released between the plates of a charged parallel-plate capacitor very close to the right-hand plate. Just as it reaches the left-hand plate, its speed is v. If the distance between the plates were *halved* without changing the electric potential difference between them, then the speed of the electron when it reached the left-hand plate would be

A. $2v$. B. $v\sqrt{2}$. C. v.
D. $v/\sqrt{2}$. E. $v/2$.

11. The plates of a parallel-plate capacitor are connected across a battery of fixed potential difference and that produces a uniform electric field E between the plates. If the plates are pulled twice as far apart, but are kept connected to the battery, the electric field between the plates will be

A. $4E$. B. $2E$. C. E.
D. $E/2$. E. $E/4$.

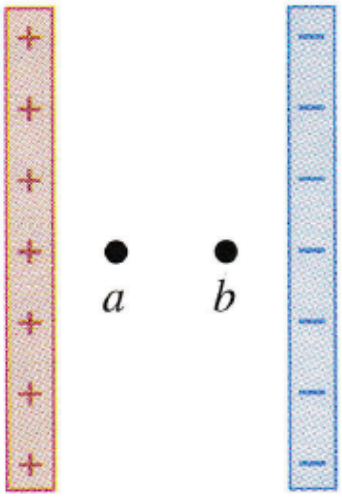
12. At a point P a distance d from a point charge, the potential relative to infinity is V and the electric-field magnitude is E. If you now move to a point S at which the potential is $V/2$, the electric-field magnitude at S will be

A. $E/4$. B. $E/2$. C. $2E$. D. $4E$.

13. When a certain capacitor carries charge of magnitude Q on each of its plates, it stores energy U. In order to store twice as much energy, how much charge should it have on its plates?

A. $\sqrt{2}Q$. B. $2Q$. C. $4Q$. D. $8Q$.

14. Two large metal plates carry equal and opposite charges spread over their surfaces, as shown in Figure 18.37. Which statements about these plates is correct? (There may be more than one correct choice.)



▲ **FIGURE 18.37** Multiple-choice problem 14.

A. The electrical potential at point a is higher than the potential at point b.

B. The electrical potential at point a is equal to the potential at point b.

C. The electric field strength at point a is equal to the field strength at point b.

D. If a positive point charge is released at point a, it will move with constant velocity toward point b.

15. The electric potential (relative to infinity) due to a single point charge Q is +400 V at a point that is 0.90 m to the right of Q. The electric potential (relative to infinity) at a point 0.90 m to the left of Q is

A. −400 V. B. +200 V. C. +400 V.

1. A,C
2. C
3. A
4. A, D
5. C
6. B, C
7. B, D
8. C
9. B
10. C
11. D
12. A
13. A
14. A, C
15. C