Quick Quiz (1 of 2)

Three objects are brought close to each other, two at a time. When objects A and B are brought together, they repel. When objects B and C are brought together, they also repel. Which of the following are true?

(a) Objects A and C possess charges of the same sign.

(b) Objects A and C possess charges of opposite sign.

(c) All three objects possess charges of the same sign.

(d) One object is neutral.

(e) Additional experiments must be performed to determine the signs of the charges.

Quick Quiz (2 of 2)

Three objects are brought close to each other, two at a time. When objects A and B are brought together, they repel. When objects B and C are brought together, they also repel. Which of the following are true?

(a) Objects A and C possess charges of the same sign.

(b) Objects A and C possess charges of opposite sign.

(c) All three objects possess charges of the same sign.

(d) One object is neutral.

(e) Additional experiments must be performed to determine the signs of the charges.

Quick Quiz (1 of 2)

Object A has a charge of +2 μC, and object B has a charge of +6 μ C. Which statement is true about the electric forces on the objects?

(a) $\vec{\mathbf{F}}_{AB} = -3\vec{\mathbf{F}}_{BA}$

(b) $\vec{\mathbf{F}}_{AB} = -\vec{\mathbf{F}}_{BA}$

(c) $3\vec{\mathbf{F}}_{AB} = -\vec{\mathbf{F}}_{BA}$

(d) $\vec{\mathbf{F}}_{AB} = 3\vec{\mathbf{F}}_{BA}$

(e) $\vec{\mathbf{F}}_{AB} = \vec{\mathbf{F}}_{BA}$

(f) $3\vec{\mathbf{F}}_{AB} = \vec{\mathbf{F}}_{BA}$

Quick Quiz (2 of 2)

Object A has a charge of +2 μC, and object B has a charge of +6 μ C. Which statement is true about the electric forces on the objects?

(a) $\vec{\mathbf{F}}_{AB} = -3\vec{\mathbf{F}}_{BA}$

(b) $\boxed{\vec{\mathbf{F}}_{AB} = -\vec{\mathbf{F}}_{BA}}$

(c) $3\vec{\mathbf{F}}_{AB} = -\vec{\mathbf{F}}_{BA}$

(d) $\vec{\mathbf{F}}_{AB} = 3\vec{\mathbf{F}}_{BA}$

(e) $\vec{\mathbf{F}}_{AB} = \vec{\mathbf{F}}_{BA}$

(f) $3\vec{\mathbf{F}}_{AB} = \vec{\mathbf{F}}_{BA}$

Quick Quiz (1 of 2)

A test charge of $+3\ \mu C$ is at a point P where an external electric field is directed to the right and has a magnitude of 4×10^6 N/C. If the test charge is replaced with another test charge of $-3\ \mu C$, what happens to the external electric field at P?

(a) It is unaffected.

(b) It reverses direction.

(c) It changes in a way that cannot be determined.

Quick Quiz (2 of 2)

A test charge of $+3\ \mu C$ is at a point P where an external electric field is directed to the right and has a magnitude of 4×10^6 N/C. If the test charge is replaced with another test charge of $-3\ \mu C$, what happens to the external electric field at P?

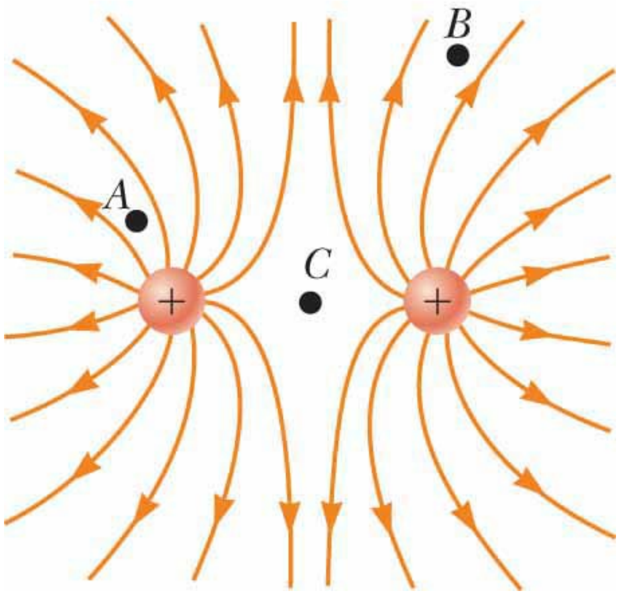
(a) It is unaffected.

(b) It reverses direction.

(c) It changes in a way that cannot be determined.

Quick Quiz (1 of 2)

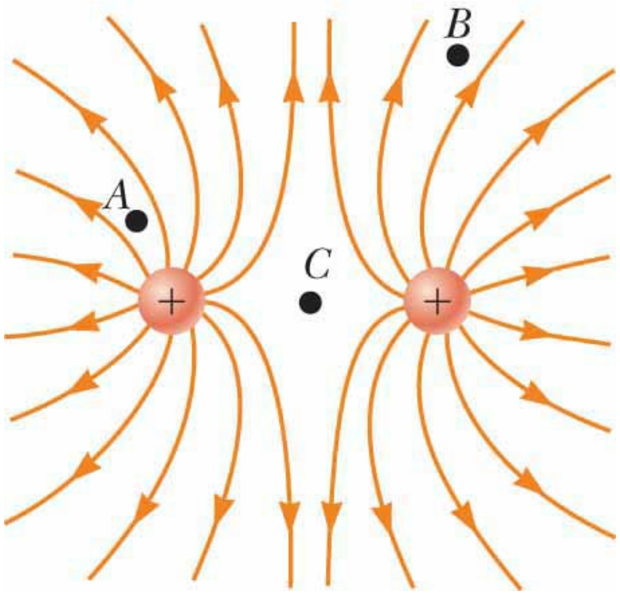
Rank the magnitudes of the electric field at points A, B, and C shown in the figure (greatest magnitude first).



Quick Quiz (2 of 2)

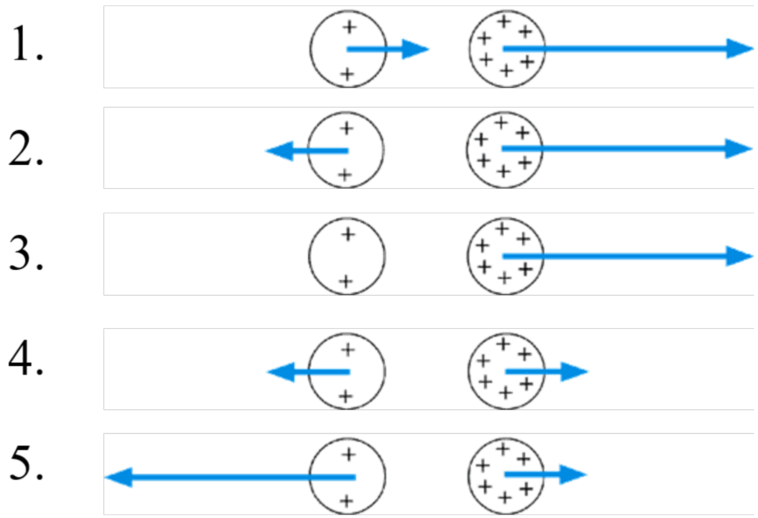
Rank the magnitudes of the electric field at points A, B, and C shown in the figure (greatest magnitude first).

A, B, C



Assessing to Learn (1 of 3)

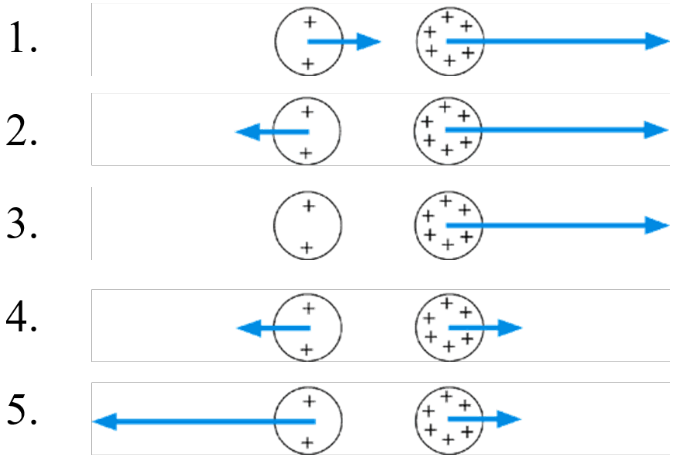
The diagrams below show two uniformly charged spheres. The charge on the right sphere is 3 times as large as the charge on the left sphere. Which force diagram best represents the magnitudes and directions of the electric forces on the two spheres?



Answer: (4)

Assessing to Learn (2 of 3)

The diagrams below show two uniformly charged spheres. The charge on the right sphere is 3 times as large as the charge on the left sphere. Each arrow represents the electric field at the center of one sphere created by the other. Which choice best represents the magnitudes and directions of the electric field vectors created by one sphere at the location of the other sphere?

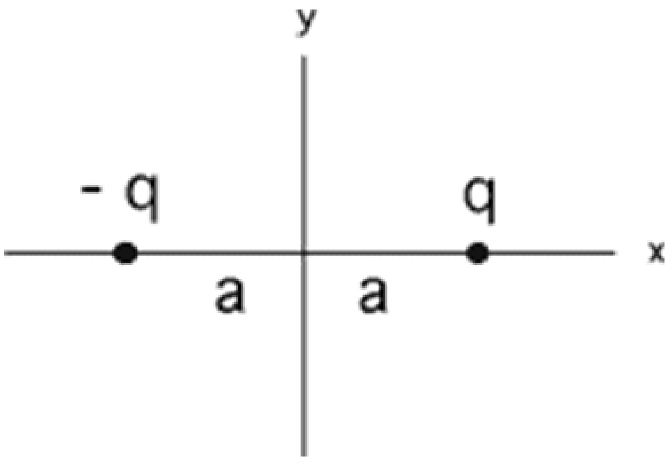


Answer: (5)

Assessing to Learn (3 of 3)

Where, other than at infinity, is the electric field 0 in the vicinity of the dipole shown?

1. Along the *y*-axis.
2. At the origin.
3. At two points, one to the right of (a, 0), the other to the left of (−a, 0).
4. At two points on the *y*-axis, one below the origin, one above the origin.
5. None of the above.



Answer: None of the above.

Quick Quiz (1 of 2)

Suppose a point charge is located at the center of a spherical surface. The electric field at the surface of the sphere and the total flux through the sphere are determined. Now the radius of the sphere is halved. What happens to the flux through the sphere and the magnitude of the electric field at the surface of the sphere?

(a) The flux and field both increase.

(b) The flux and field both decrease.

(c) The flux increases, and the field decreases.

(d) The flux decreases, and the field increases.

(e) The flux remains the same, and the field increases.

(f) The flux decreases, and the field remains the same.

Quick Quiz (2 of 2)

Suppose a point charge is located at the center of a spherical surface. The electric field at the surface of the sphere and the total flux through the sphere are determined. Now the radius of the sphere is halved. What happens to the flux through the sphere and the magnitude of the electric field at the surface of the sphere?

(a) The flux and field both increase.

(b) The flux and field both decrease.

(c) The flux increases, and the field decreases.

(d) The flux decreases, and the field increases.

(e) The flux remains the same, and the field increases.

(f) The flux decreases, and the field remains the same.

Quick Quiz (1 of 2)

If the net flux through a gaussian surface is zero, the following four statements could be true. Which of the statements must be true?

(a) There are no charges inside the surface.

(b) The net charge inside the surface is zero.

(c) The electric field is zero everywhere on the surface.

(d) The number of electric field lines entering the surface equals the number leaving the surface.

Quick Quiz (2 of 2)

If the net flux through a gaussian surface is zero, the following four statements could be true. Which of the statements must be true?

(a) There are no charges inside the surface.

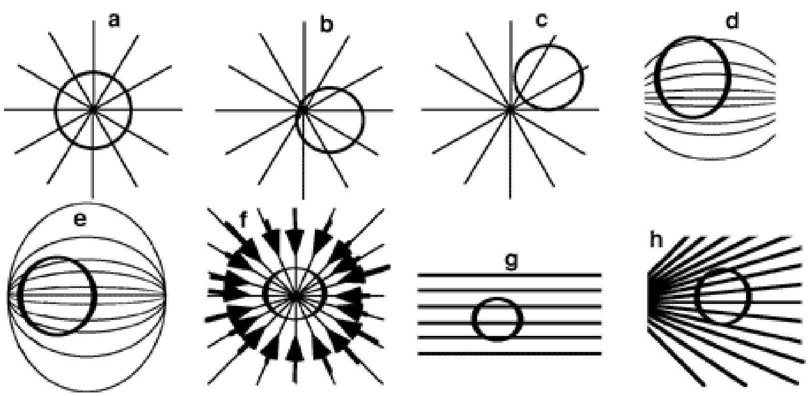
(b) The net charge inside the surface is zero.

(c) The electric field is zero everywhere on the surface.

(d) The number of electric field lines entering the surface equals the number leaving the surface.

Assessing to Learn (1 of 4)

The circles in the picture below are Gaussian surfaces. All other lines are electric field lines. For which cases is the flux *non*-zero?



1. a
2. a, b, and f
3. a, b, e, and f
4. a, b, d, e, and h
5. a and b
6. All but g 7. All of them 8. None of the above
7. Cannot be determined

Answer: a, b, and f

Assessing to Learn (2 of 4)

We construct a closed Gaussian surface in the shape of a spherical balloon. Assume that a small glass bead with total charge Q is in the vicinity of the balloon. Consider the following statements:

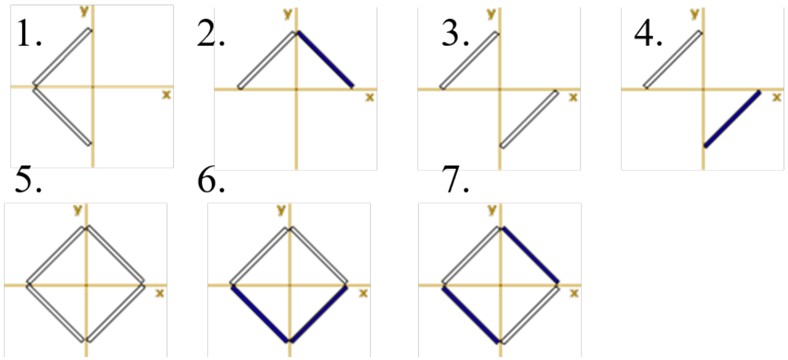
A. If the bead is inside the balloon, the electric flux over the balloon's surface can never be 0.
B. If the bead is outside the balloon, the electric flux over the balloon surface must be 0.
Which of these statements is valid?

1. Only A is valid.
2. Only B is valid.
3. Both A and B are valid.
4. Neither one is valid.

Answer: Both A and B are valid.

Assessing to Learn (3 of 4)

All charged rods have the same length and the same linear charge density (+ or -). Light rods are positively charged, and dark rods are negatively charged. For which arrangement below would the magnitude of the electric field at the origin be largest?



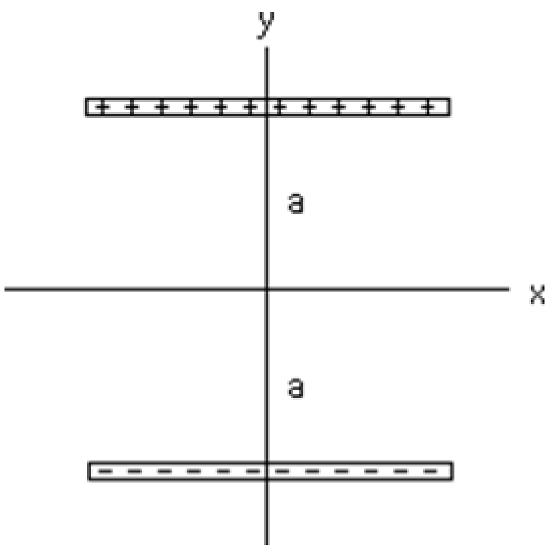
8. Impossible to determine

Answer: (6)

Assessing to Learn (4 of 4)

Two uniformly charged rods are positioned horizontally as shown. The top rod is positively charged and the bottom rod is negatively charged. The total electric field at the origin:

1. is zero.
2. has both a non-zero *x* component and a non-zero *y* component.
3. points totally in the +*x* direction.
4. points totally in the –*x* direction.
5. points totally in the +*y* direction
6. points totally in the –*y* direction.
7. points in a direction impossible to determine without doing a lot of math.



Answer: points totally in the –*y* direction.

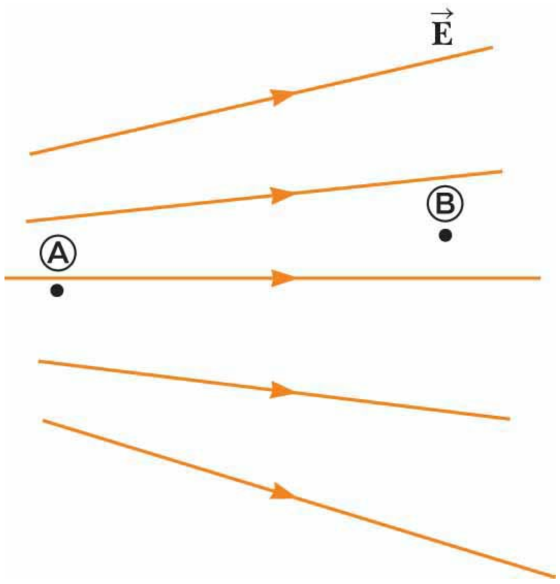
Quick Quiz Part I (1 of 2)

In the figure, two points A and B are located within a region in which there is an electric field. How would you describe the potential difference $\Delta V = V_B - V_A$?

(a) It is positive.

(b) It is negative.

(c) It is zero.



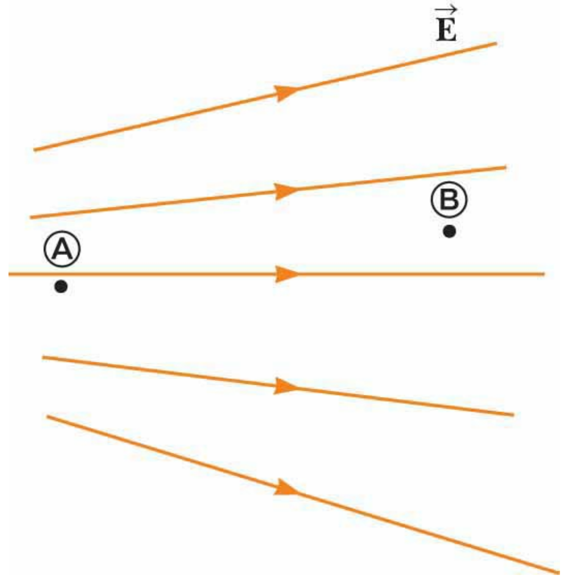
Quick Quiz Part I (2 of 2)

In the figure, two points A and B are located within a region in which there is an electric field. How would you describe the potential difference $\Delta V = V_B - V_A$?

(a) It is positive.

(b) It is negative.

(c) It is zero.



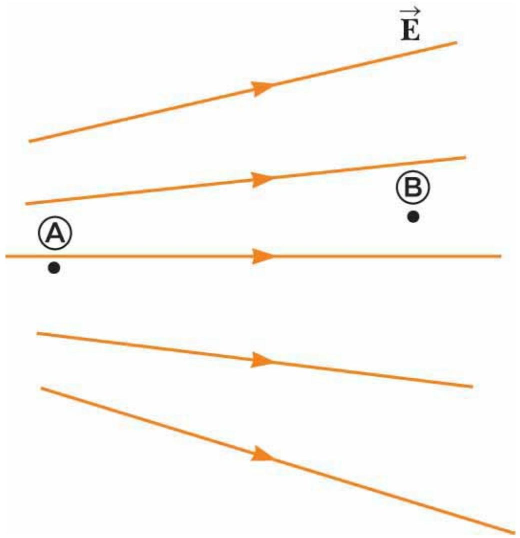
Quick Quiz Part II (1 of 2)

In the figure, two points A and B are located within a region in which there is an electric field. A negative charge is placed at A and then moved to B. How would you describe the change in potential energy of the charge–field system for this process?

(a) It is positive.

(b) It is negative.

(c) It is zero.



Quick Quiz Part II (2 of 2)

In the figure, two points A and B are located within a region in which there is an electric field. A negative charge is placed at A and then moved to B How would you describe the change in potential energy of the charge–field system for this process?

(a) It is positive.

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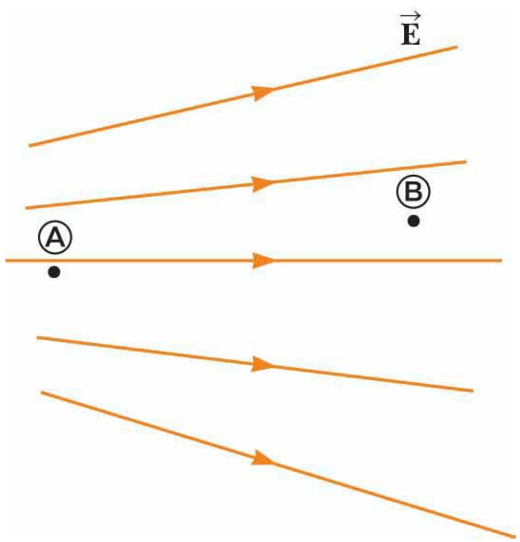
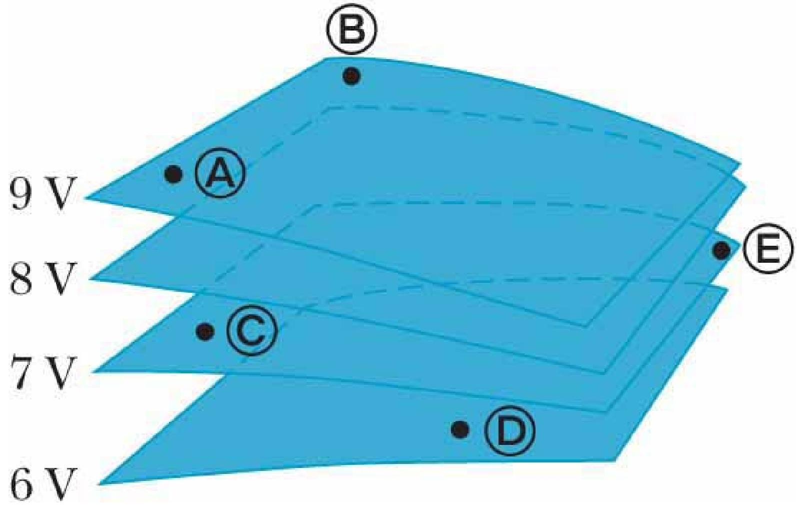


Quick Quiz (1 of 2)

The labeled points in the figure are on a series of equipotential surfaces associated with an electric field. Rank (from greatest to least) the work done by the electric field on a positively charged particle that moves from A to B, from B to C, from C to D, and from D to E.



Quick Quiz (2 of 2)

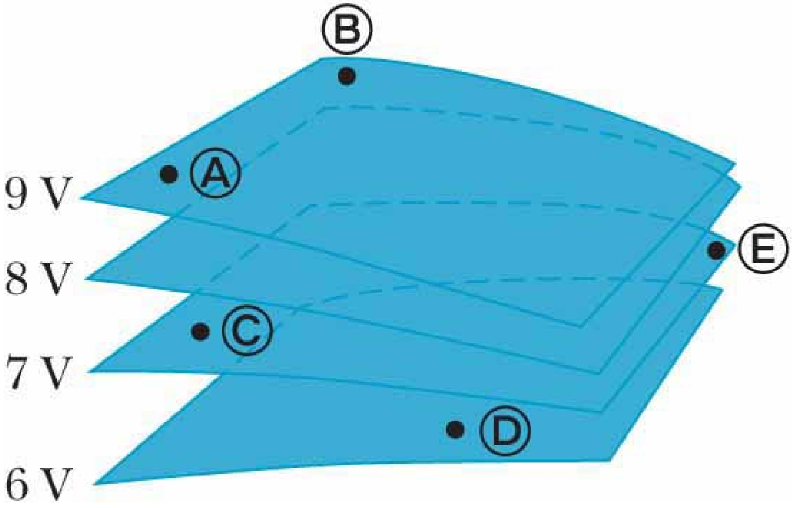
The labeled points in the figure are on a series of equipotential surfaces associated with an electric field. Rank (from greatest to least) the work done by the electric field on a positively charged particle that moves from A to B, from B to C, from C to D, and from D to E.

B to C,

C to D,

A to B,

D to E



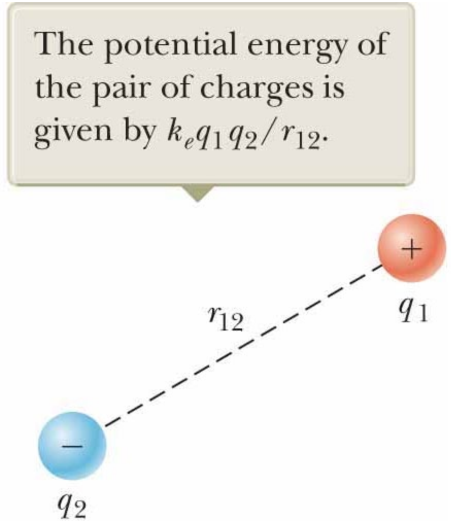
Quick Quiz (1 of 2)

In the figure, take q_2 to be a negative source charge and q_1 to be a second charge whose sign can be changed. If q_1 is initially positive and is changed to a charge of the same magnitude but negative, what happens to the potential at the position of q_1 due to q_2?

(a) It increases.

(b) It decreases.

(c) It remains the same.



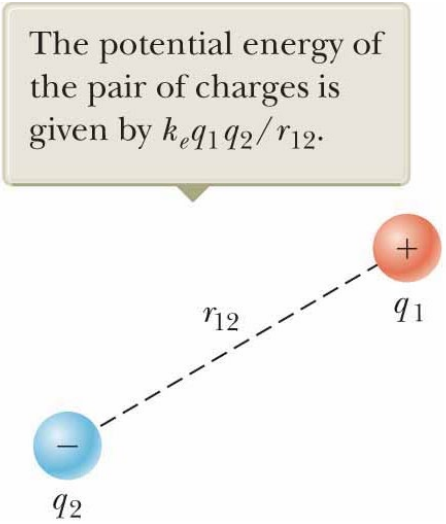
Quick Quiz (2 of 2)

In the figure, take q_2 to be a negative source charge and q_1 to be a second charge whose sign can be changed. If q_1 is initially positive and is changed to a charge of the same magnitude but negative, what happens to the potential at the position of q_1 due to q_2?

(a) It increases.

(b) It decreases.

(c) It remains the same.



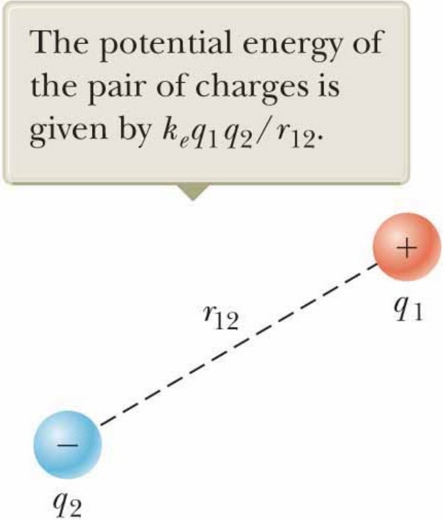
Quick Quiz (1 of 2)

In the figure, take q_2 to be a negative source charge and q_1 to be a second charge whose sign can be changed. When q_1 is changed from positive to negative, what happens to the potential energy of the two-charge system?

(a) It increases.

(b) It decreases.

(c) It remains the same.



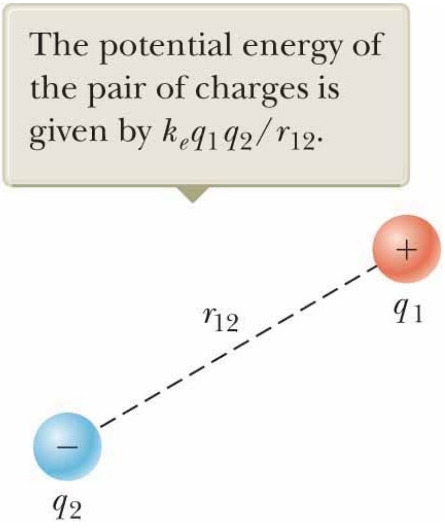
Quick Quiz (2 of 2)

In the figure, take q_2 to be a negative source charge and q_1 to be a second charge whose sign can be changed. When q_1 is changed from positive to negative, what happens to the potential energy of the two-charge system?

(a) It increases.

(b) It decreases.

(c) It remains the same.



Quick Quiz Part I (1 of 2)

In a certain region of space, the electric potential is zero everywhere along the *x* axis. From this information, you can conclude that the *x* component of the electric field in this region is

(a) zero

(b) in the positive *x* direction

(c) in the negative *x* direction

Quick Quiz Part I (2 of 2)

In a certain region of space, the electric potential is zero everywhere along the *x* axis. From this information, you can conclude that the *x* component of the electric field in this region is

(a) zero

(b) in the positive *x* direction

(c) in the negative *x* direction

Quick Quiz Part II (1 of 2)

Suppose the electric potential is +2 V everywhere along the *x* axis. From this information, you can conclude that the *x* component of the electric field in this region is

(a) zero

(b) in the positive *x* direction

(c) in the negative *x* direction

Quick Quiz Part II (2 of 2)

Suppose the electric potential is +2 V everywhere along the *x* axis. From this information, you can conclude that the *x* component of the electric field in this region is

(a) zero

(b) in the positive *x* direction

(c) in the negative *x* direction

Quick Quiz (1 of 2)

A capacitor stores charge Q at a potential difference ΔV. What happens if the voltage applied to the capacitor by a battery is doubled to $2\ \Delta V$?

(a) The capacitance falls to half its initial value, and the charge remains the same.

(b) The capacitance and the charge both fall to half their initial values.

(c) The capacitance and the charge both double.

(d) The capacitance remains the same, and the charge doubles.

Quick Quiz (2 of 2)

A capacitor stores charge Q at a potential difference ΔV. What happens if the voltage applied to the capacitor by a battery is doubled to $2\,\Delta V$?

(a) The capacitance falls to half its initial value, and the charge remains the same.

(b) The capacitance and the charge both fall to half their initial values.

(c) The capacitance and the charge both double.

(d) The capacitance remains the same, and the charge doubles.

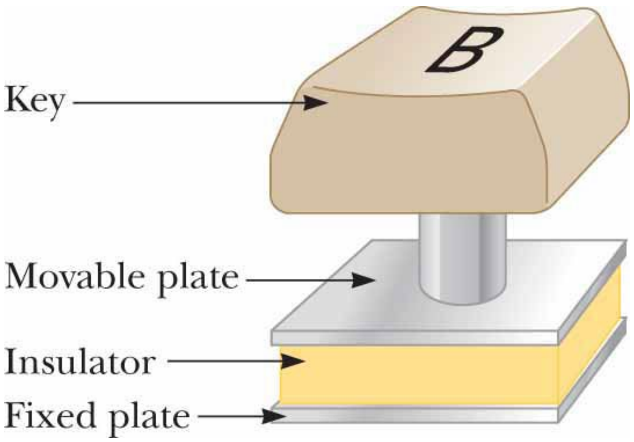
Quick Quiz (1 of 2)

Many computer keyboard buttons are constructed of capacitors as shown in the figure. When a key is pushed down, the soft insulator between the movable plate and the fixed plate is compressed. When the key is pressed, what happens to the capacitance?

(a) It increases.

(b) It decreases.

(c) It changes in a way you cannot determine because the electric circuit connected to the keyboard button may cause a change in ΔV.



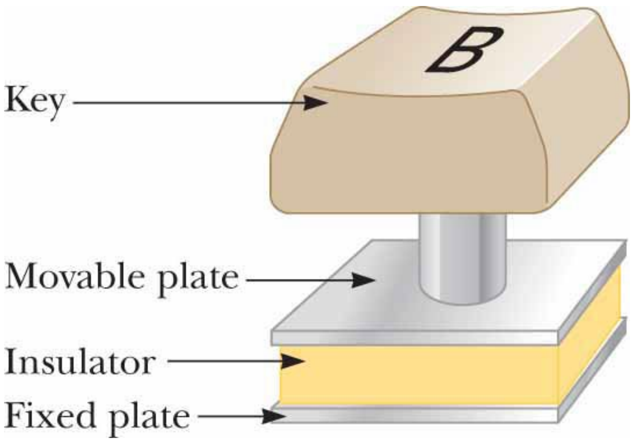
Quick Quiz (2 of 2)

Many computer keyboard buttons are constructed of capacitors as shown in the figure. When a key is pushed down, the soft insulator between the movable plate and the fixed plate is compressed. When the key is pressed, what happens to the capacitance?

(a) It increases.

(b) It decreases.

(c) It changes in a way you cannot determine because the electric circuit connected to the keyboard button may cause a change in ΔV.



Quick Quiz (1 of 2)

Two capacitors are identical. They can be connected in series or in parallel. If you want the smallest equivalent capacitance for the combination, how should you connect them?

(a) in series

(b) in parallel

(c) either way because both combinations have the same capacitance

Quick Quiz (2 of 2)

Two capacitors are identical. They can be connected in series or in parallel. If you want the smallest equivalent capacitance for the combination, how should you connect them?

(a) in series

(b) in parallel

(c) either way because both combinations have the same capacitance

Quick Quiz (1 of 2)

You have three capacitors and a battery. In which of the following combinations of the three capacitors is the maximum possible energy stored when the combination is attached to the battery?

(a) series

(b) parallel

(c) no difference because both combinations store the same amount of energy

Quick Quiz (2 of 2)

You have three capacitors and a battery. In which of the following combinations of the three capacitors is the maximum possible energy stored when the combination is attached to the battery?

(a) series

(b) parallel

(c) no difference because both combinations store the same amount of energy

Quick Quiz (1 of 2)

A cylindrical wire has a radius r and length ℓ. If both r and ℓ are doubled, does the resistance of the wire

(a) increase

(b) decrease

(c) remain the same

Quick Quiz (2 of 2)

A cylindrical wire has a radius r and length ℓ. If both r and ℓ are doubled, does the resistance of the wire

(a) increase

(b) decrease

(c) remain the same

Quick Quiz (1 of 2)

To maximize the percentage of the power from the emf of a battery that is delivered to a device external to the battery, what should the internal resistance of the battery be?

(a) It should be as low as possible.

(b) It should be as high as possible.

(c) The percentage does not depend on the internal resistance.

Quick Quiz (2 of 2)

To maximize the percentage of the power from the emf of a battery that is delivered to a device external to the battery, what should the internal resistance of the battery be?

(a) It should be as low as possible.

(b) It should be as high as possible.

(c) The percentage does not depend on the internal resistance.

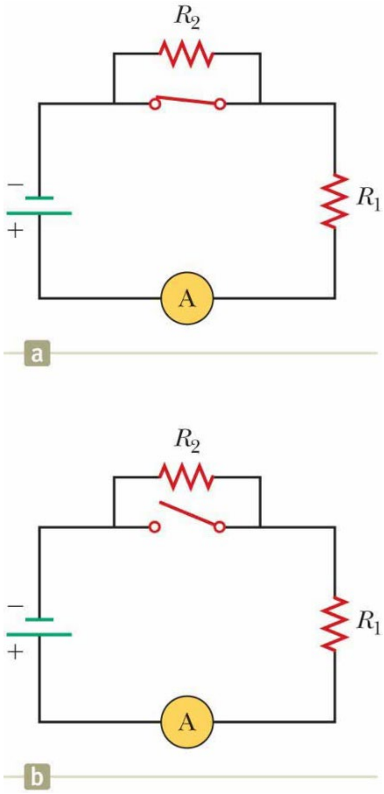
Quick Quiz (1 of 2)

With the switch in the circuit of the top figure closed, there is no current in R_2 because the current has an alternate zero-resistance path through the switch. There is current in R_1, and this current is measured with the ammeter (a device for measuring current) at the bottom of the circuit. If the switch is opened (the bottom figure), there is current in R_2. What happens to the reading on the ammeter when the switch is opened?

(a) The reading goes up.

(b) The reading goes down.

(c) The reading does not change.



Quick Quiz (2 of 2)

With the switch in the circuit of the top figure closed, there is no current in R_2 because the current has an alternate zero-resistance path through the switch. There is current in R_1, and this current is measured with the ammeter (a device for measuring current) at the bottom of the circuit. If the switch is opened (the bottom figure), there is current in R_2. What happens to the reading on the ammeter when the switch is opened?

(a) The reading goes up.

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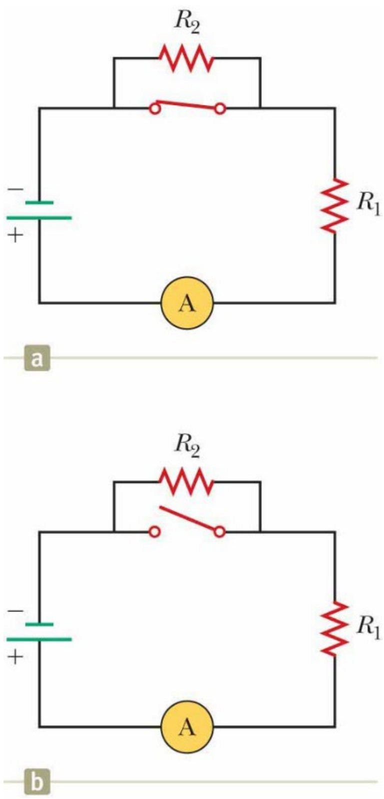

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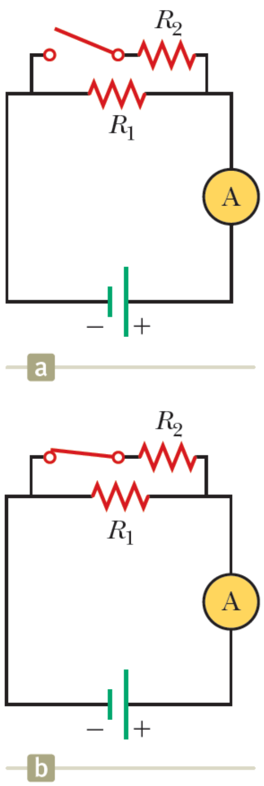
Quick Quiz (1 of 2)

With the switch in the circuit of the top figure is open, there is no current in R_2. There is current in R_1, however, and it is measured with the ammeter at the right side of the circuit. If the switch is closed (the bottom figure), there is current in R_2. What happens to the reading on the ammeter when the switch is closed?

(a) The reading increases.

(b) The reading decreases.

(c) The reading does not change.



Quick Quiz (2 of 2)

With the switch in the circuit of the top figure is open, there is no current in R_2. There is current in R_1, however, and it is measured with the ammeter at the right side of the circuit. If the switch is closed (the bottom figure), there is current in R_2. What happens to the reading on the ammeter when the switch is closed?

(a) The reading increases.

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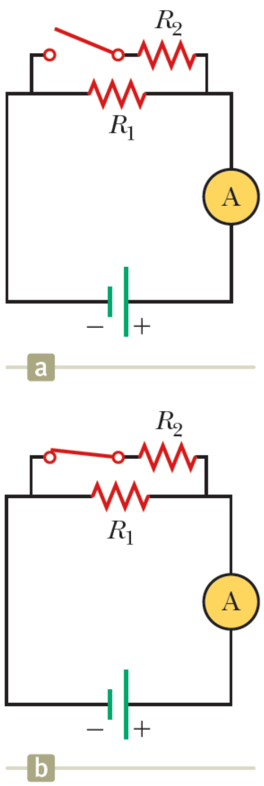


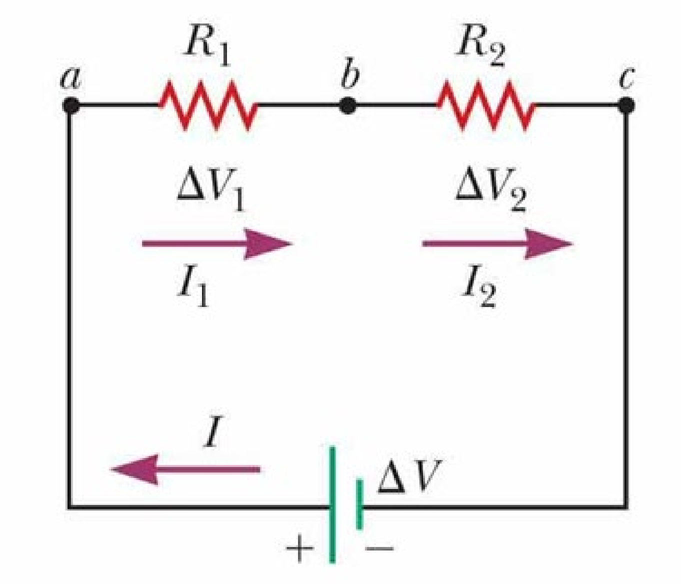
Quick Quiz (1 of 2)

In the figure, a third resistor is added in series with the first two. What happens to the current in the battery?

(a) increases

(b) decreases

(c) remains the same



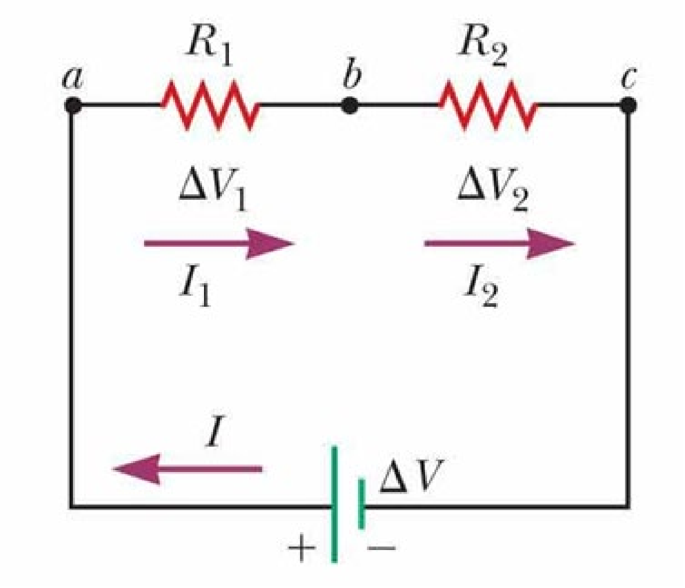
Quick Quiz (2 of 2)

In the figure, a third resistor is added in series with the first two. What happens to the current in the battery?

(a) increases

(b) decreases

(c) remains the same



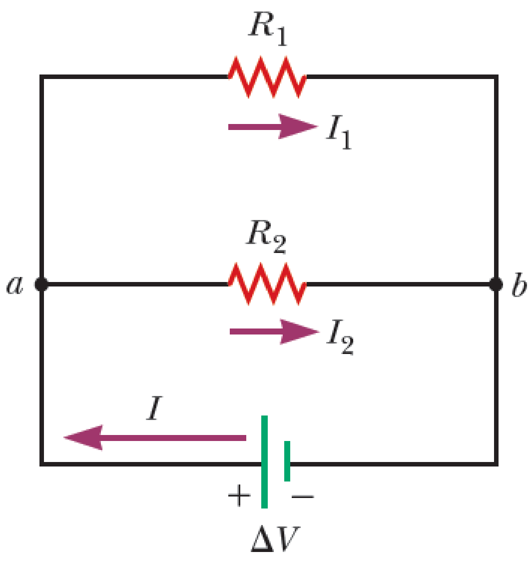
Quick Quiz (1 of 2)

In the figure, a third resistor is added in parallel with the first two. What happens to the current in the battery?

(a) increases

(b) decreases

(c) remains the same



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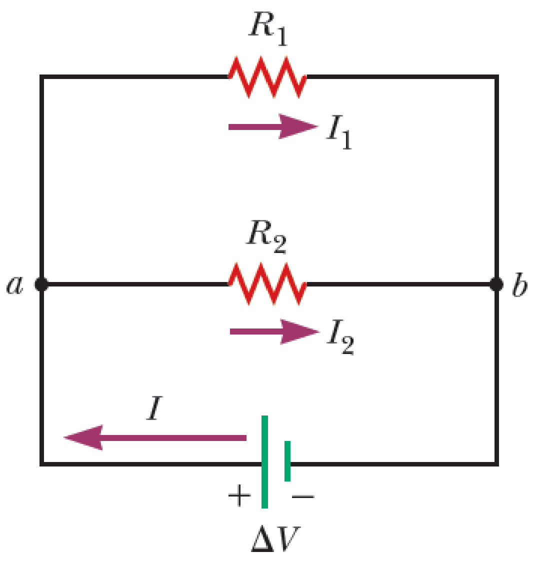
Quick Quiz (2 of 2)

In the figure, a third resistor is added in parallel with the first two. What happens to the current in the battery?

(a) increases

(b) decreases

(c) remains the same



Quick Quiz Part I (1 of 2)

Consider the circuit in the figure and assume the battery has no internal resistance. Just after the switch is closed, what is the current in the battery?

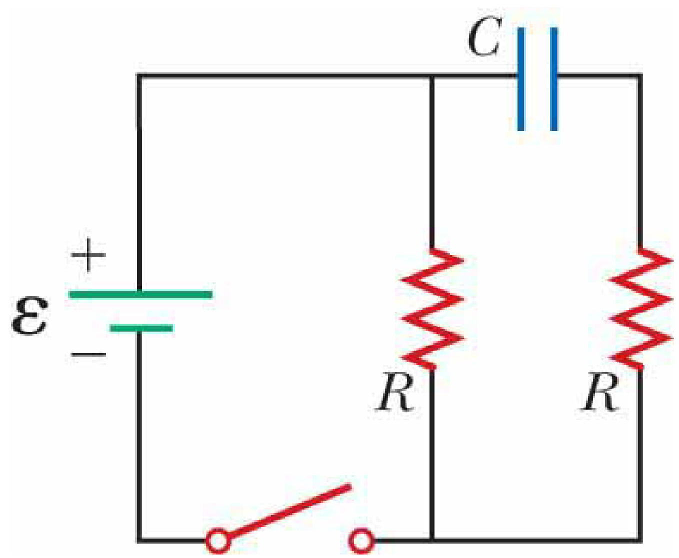
(a) 0

(b) $\varepsilon/2R$

(c) $2\varepsilon/R$

(d) ε/R

(e) impossible to determine



Quick Quiz Part I (2 of 2)

Consider the circuit in the figure and assume the battery has no internal resistance. Just after the switch is closed, what is the current in the battery?

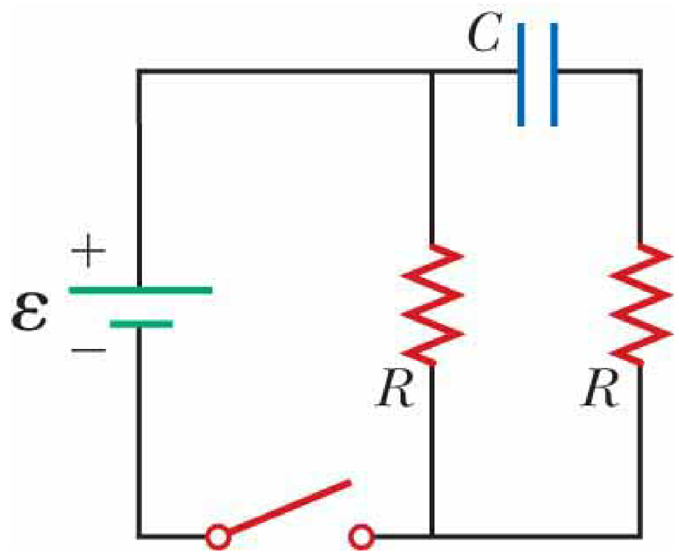
(a) 0

(b) $\varepsilon/2R$

(c) $2\varepsilon/R$

(d) ε/R

(e) impossible to determine



Quick Quiz Part II (1 of 2)

After a very long time, what is the current in the battery?

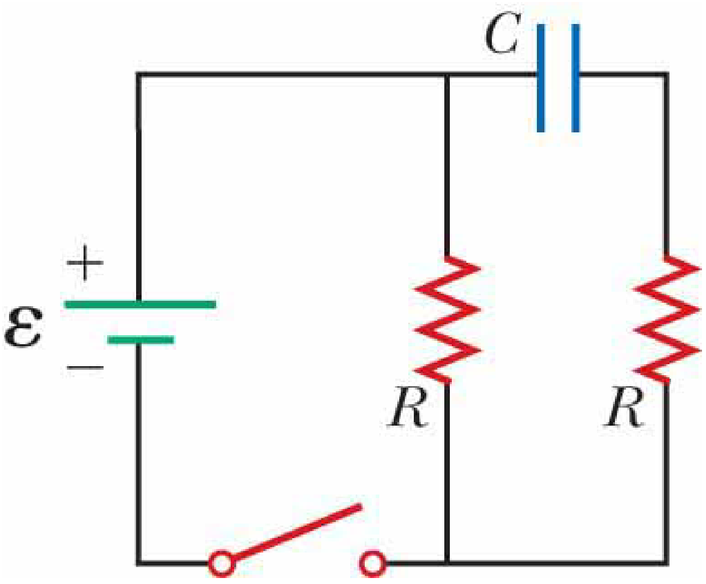
(a) 0

(b) $\varepsilon/2R$

(c) $2\varepsilon/R$

(d) ε/R

(e) impossible to determine



Quick Quiz Part II (2 of 2)

After a very long time, what is the current in the battery?

(a) 0

(b) $\varepsilon/2R$

(c) $2\varepsilon/R$

(d) **$\boldsymbol{\varepsilon/R}$**

(e) impossible to determine