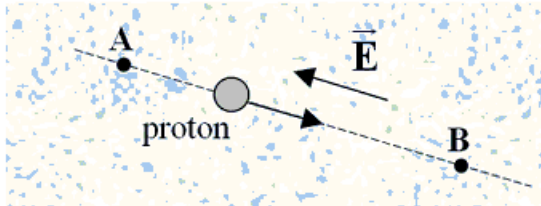
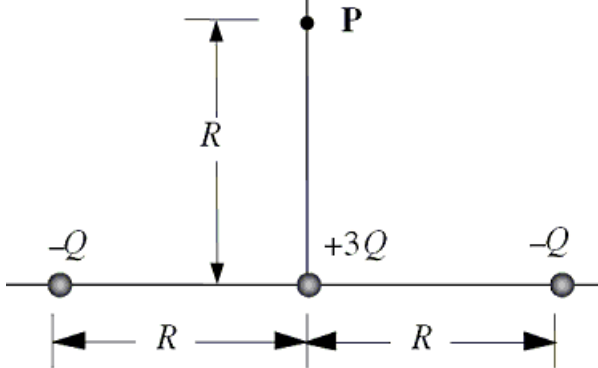


1. Two positive point charges are separated by a distance R . If the distance between the charges is reduced to $R/2$, what happens to the total electric potential energy of the system?
- A) The total electric potential energy is doubled.
 - B) The total electric potential energy remains the same.
 - C) The total electric potential energy increases by a factor of 4.
 - D) The total electric potential energy is reduced to one-half of its original value.
 - E) None of these

2. A proton moves in a constant electric field \vec{E} from point A to point B. The magnitude of the electric field is 6.4×10^4 N/C; and it is directed as shown in the drawing, the direction opposite to the motion of the proton. If the distance from point A to point B is 0.50 m, what is the change in the proton's electric potential energy, in joules?



- A) -2.4×10^{-15}
 - B) -3.2×10^{-15}
 - C) $+1.2 \times 10^{-15}$
 - D) $+5.1 \times 10^{-15}$
 - E) None of these
3. Three point charges $-Q$, $-Q$, and $+3Q$ are arranged along a line as shown in the sketch.

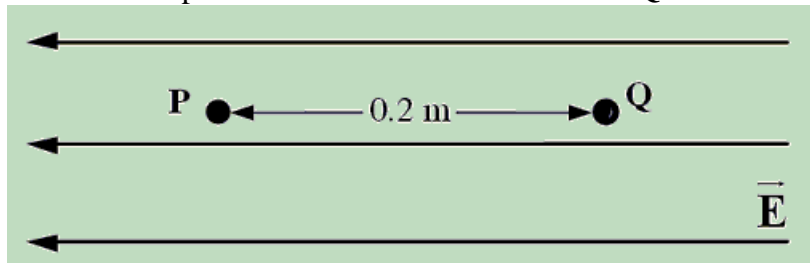


What is the approximate electric potential at the point P?

- A) $+kQ/R$
- B) $-2kQ/R$
- C) $-1.6kQ/R$
- D) $+1.6kQ/R$
- E) None of these

Use the following to answer questions 4-5:

P and **Q** are points within a uniform electric field that are separated by a distance of 0.2 m as shown. The potential difference between **P** and **Q** is 75 V.

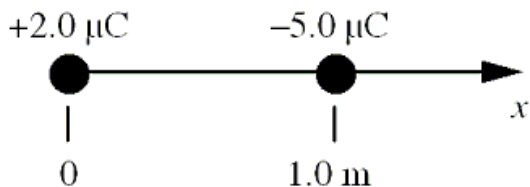


4. Determine the magnitude of this electric field.
 - A) 15 V/m
 - B) 75 V/m
 - C) 375 V/m
 - D) 750 V/m
 - E) None of these

5. How much work is required to move a $+150 \mu\text{C}$ point charge from **P** to **Q**?
 - A) 0.011 J
 - B) 0.056 J
 - C) 75.000 J
 - D) 140.500 J
 - E) None of these

6. A parallel plate capacitor with plates of area A and plate separation d is charged by a battery until the potential difference between its plates is V . The battery is then removed and the plate separation is decreased to $d/2$. Which of the following statements is false?
 - A) The capacitance increases.
 - B) The electric field between the plates does not change.
 - C) The capacitor's potential energy decreases.
 - D) The final potential difference is $V/2$.
 - E) The charge on each plate decreases.

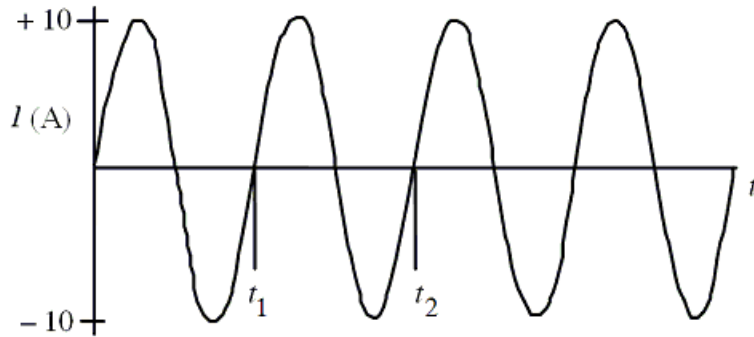
7. Two point charges are arranged along the x axis as shown in the figure. At which of the following values of x is the electric potential equal to zero?



- A) $+0.05 \text{ m}$
 B) $+0.29 \text{ m}$
 C) $+0.40 \text{ m}$
 D) $+0.54 \text{ m}$
 E) None of these
8. A 4-A current is maintained in a simple circuit with a total resistance of 2Ω . How much energy is delivered in forty five seconds?
 A) 1440 J
 B) 96 J
 C) 360 J
 D) 720 J
 E) None of these
9. A resistor dissipates 1.5 W when it is connected to a battery with a potential difference of 12 V. What is the resistance of the resistor?
 A) 0.13Ω
 B) 220Ω
 C) 18Ω
 D) 96Ω
 E) None of these
10. When a hair dryer is in use, the current passing through it may be represented as $I = (17.7 \text{ A}) \sin(120\pi t)$. The resistance through which this current passes is 7 ohms. What is the RMS voltage for this circuit?
 A) 104.5 V
 B) 87.6 V
 C) 118.3 V
 D) 133.4 V
 E) None of these

Use the following to answer question 11:

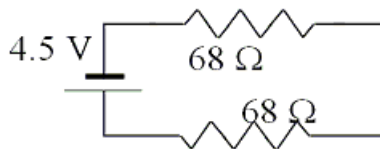
The figure shows variation of the current through the heating element with time in an iron when it is plugged into a standard 120 V, 60 Hz outlet.



11. What is the RMS value of the current in this circuit?

- A) 1.4 A
- B) 7.1 A
- C) 11 A
- D) 14 A
- E) None of these

12. A 4.5-V battery is connected to two resistors connected as shown in the drawing. Determine the power output by the battery.

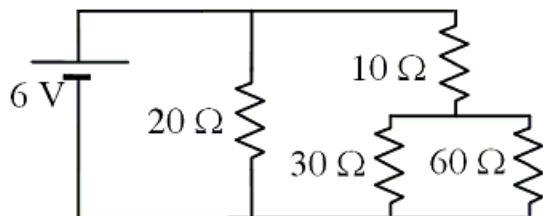


- A) 0.033 W
- B) 0.090 W
- C) 0.15 W
- D) 0.60 W
- E) None of these

13. Three resistors, $4.0\text{-}\Omega$, $8.0\text{-}\Omega$, $16\text{-}\Omega$, are connected in parallel in a circuit. What is the equivalent resistance of this combination of resistors?
- A) $30\ \Omega$
 - B) $10\ \Omega$
 - C) $2.3\ \Omega$
 - D) $2.9\ \Omega$
 - E) None of these

Use the following to answer question 14:

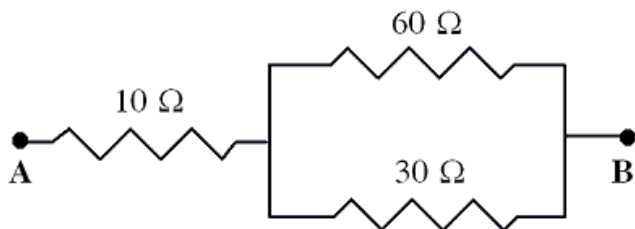
Four resistors and a 6-V battery are arranged as shown in the circuit diagram.



14. Determine the current through the 10-ohm resistor.
- A) $0.30\ \text{A}$
 - B) $0.10\ \text{A}$
 - C) $0.50\ \text{A}$
 - D) $0.20\ \text{A}$
 - E) None of these

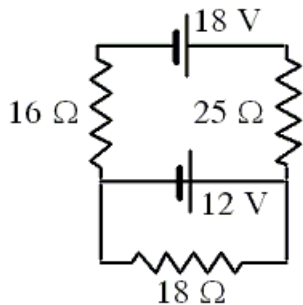
Use the following to answer question 15:

Three resistors are placed in a circuit as shown. The potential difference between points **A** and **B** is $30\ \text{V}$.



15. What is the current through the 30-Ω resistor?
 A) 0.3 A
 B) 0.5 A
 C) 0.7 A
 D) 1.0 A
 E) None of these

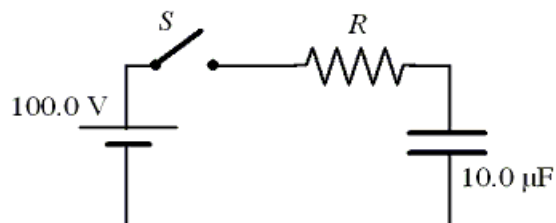
16. Three resistors and two batteries are connected as shown in the circuit diagram. What is the magnitude of the current through the 12-V battery?



- A) 0.15 A
 B) 0.82 A
 C) 0.30 A
 D) 0.52 A
 E) None of these

Use the following to answer question 17:

The figure shows a simple RC circuit consisting of a 100-V battery in series with a 10.0-μF capacitor and a resistor ($R = 100,000$ ohm). Initially, the switch S is open and the capacitor is uncharged.



17. How much charge (in micro-coulombs) is on the capacitor 2.0 s after the switch is closed?
- A) 865
 - B) 567
 - C) 435
 - D) 356
 - E) None of these
18. A electron is traveling horizontally toward you in this room is deflected upward by a magnetic field. What is the direction of the magnetic field? (Note: electrons are negatively charged.)
- A) downward
 - B) upward
 - C) to your right
 - D) to your left
 - E) None of these
19. A particle with a mass of 6.64×10^{-27} kg and a charge of $+3.20 \times 10^{-19}$ C is accelerated from rest through a potential difference of 2.45×10^6 V. The particle then enters a uniform 1.60 T magnetic field, traveling perpendicular to the magnetic field. What is the magnitude of the magnetic force exerted on the particle?
- A) zero newtons
 - B) 1.14×10^{-10} N
 - C) 6.55×10^{-10} N
 - D) None of these
 - E) 7.87×10^{-12} N
20. A proton is moving with a speed of 3.5×10^5 m/s when it encounters a magnetic field of 0.60 T. The magnetic force on the electron is 2.9×10^{-14} N. What angle (in degrees) does the direction of the magnetic field make with respect to the direction of motion of the electron?
- A) 25
 - B) 30
 - C) 45
 - D) 60
 - E) None of these

Answer Key

1. A
2. D
3. D
4. C
5. A
6. E
7. B
8. A
9. D
10. B
11. B
12. C
13. C
14. D
15. C
16. D
17. A
18. D
19. E
20. D