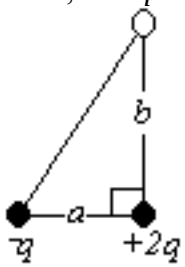
1. The electric potential at a certain point is space is 12 V. What is the electric potential energy of a –3.0 μC charge placed at that point?
   A) +4 μJ
   B) –4 μJ
   C) +36 μJ
   D) –36 μJ
   E) zero μJ

2. A completely ionized beryllium atom (net charge = +4*e*) is accelerated through a potential difference of 6.0 V. What is the increase in kinetic energy of the atom?
   A) zero eV
   B) 0.67 eV
   C) 4.0 eV
   D) 6.0 eV
   E) 24 eV

3. Two point charges are located at two of the vertices of a right triangle, as shown in the figure. If a third charge $-2q$ is brought from infinity and placed at the third vertex, what will its electric potential energy be? Use the following values: $a = 0.15$ m; $b = 0.45$ m, and $q = 2.0 \times 10^{-5}$ C.



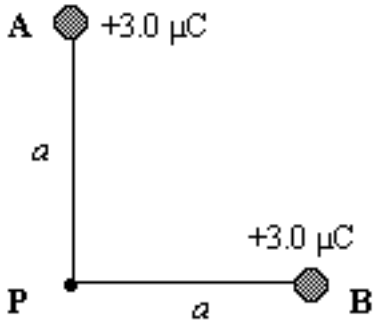
   A) –17 J
   B) –12 J
   C) –2.8 J
   D) +8.5 J
   E) +14 J

4. A capacitor is initially charged to 2 V. It is then connected to a 4 V battery. What is the ratio of the final to the initial energy stored in the capacitor?
   A) 2
   B) 4
   C) 6
   D) 8
   E) 10

5. A parallel plate capacitor has plates of area 2.0×10^{-3} m^2 and plate separation 1.0×10^{-4} m. Determine the capacitance of this system if air fills the volume between the plates.
   A) 1.1×10^{-10} F
   B) 1.8×10^{-10} F
   C) 3.2×10^{-10} F
   D) 4.4×10^{-10} F
   E) 5.3×10^{-10} F

Use the following to answer questions 6-8:

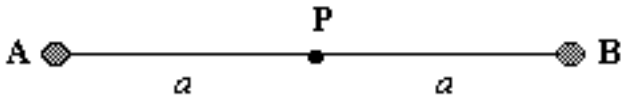
Two positive charges are located at points **A** and **B** as shown in the figure. The distance from each charge to the point **P** is a = 2.0 m.



6. Determine the magnitude of the electric field at the point **P**.
   A) 3.38×10^{3} V/m
   B) 6.75×10^{3} V/m
   C) 9.55×10^{3} V/m
   D) 1.35×10^{4} V/m
   E) 2.70×10^{4} V/m

7. Determine the electric potential at the point **P**.
   A) 1.35×10^{4} V
   B) 1.89×10^{4} V
   C) 2.30×10^{4} V
   D) 2.70×10^{4} V
   E) 3.68×10^{4} V

8. Suppose that the charges are rearranged as shown in this figure.



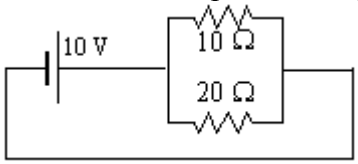
Which one of the following statements is true for this new arrangement?
A) The electric field will be zero, but the electric potential remains unchanged.
B) Both the electric field and the electric potential are zero at **P**.
C) The electric field will remain unchanged, but the electric potential will be zero.
D) The electric field will remain unchanged, but the electric potential will decrease.
E) Both the electric field and the electric potential will be changed and will be non-zero.

9. Determine the length of a copper wire that has a resistance of 0.172 Ω and cross-sectional area of 1×10^{-4} m^2. The resistivity of copper is 1.72×10^{-8} Ω • m.
A) 0.1 m
B) 10 m
C) 100 m
D) 1000 m
E) 10 000 m

10. A 40-W and a 60-W light bulb are designed for use with the same voltage. What is the ratio of the resistance of the 60-W bulb to the resistance of the 40-W bulb?
A) 1.5
B) 0.67
C) 2.3
D) 0.44
E) 3.0

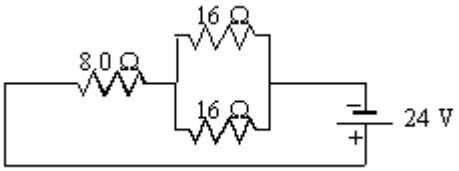
11. A computer monitor uses 2.0 A of current when it is plugged into a 120 V outlet. The monitor is never turned off. What is the yearly cost of operating the monitor if the cost of electricity is $0.12/kWh?
A) $14
B) $21
C) $98
D) $170
E) $250

12. What is the total power dissipated in the two resistors in the circuit shown?



A) 10 W
B) 15 W
C) 33 W
D) 67 W
E) 670 W

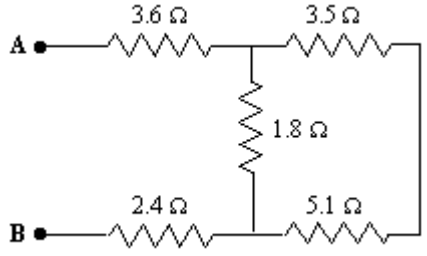
13. Three resistors are connected in a circuit as shown. Using Kirchhoff's rules, determine the current in one of the 16-Ω resistors.



A) 0.50 A
B) 0.75 A
C) 1.0 A
D) 1.3 A
E) 2.0 A

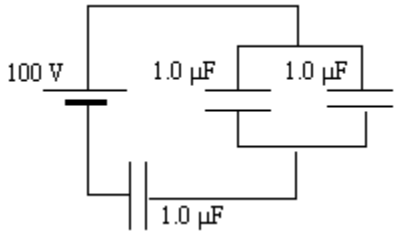
Use the following to answer question 14:

Five resistors are connected as shown in the diagram. The potential difference between points **A** and **B** is 25 V.



14. How much energy is dissipated in the 1.8-Ω resistor in 4.0 seconds?
    A) 18 J
    B) 28 J
    C) 55 J
    D) 64 J
    E) 93 J

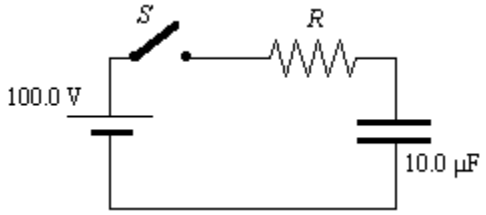
15. What is the equivalent capacitance of the combination of capacitors shown in the circuit?



    A) 0.37 μF
    B) 3.3 μF
    C) 4.6 μF
    D) 0.67 μF
    E) 2.1 μF

Use the following to answer question 16:

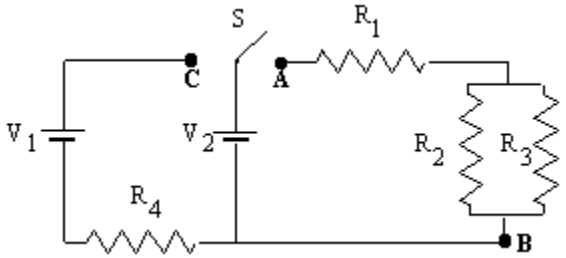
The figure shows a simple RC circuit consisting of a 100.0-V battery in series with a 10.0-μF capacitor and a resistor. Initially, the switch S is open and the capacitor is uncharged. Two seconds after the switch is closed, the voltage across the resistor is 37 V.



16. Determine the numerical value of the resistance *R*.
    A) 0.37 Ω
    B) 2.70 Ω
    C) 5.0×10^4 Ω
    D) 2.0×10^5 Ω
    E) 4.3×10^5 Ω

Use the following to answer question 17:

The figure shows a circuit. The switch S can be closed on either point **A** or **C**, but not both at the same time. Use the following quantities:



17. Determine the current through R_1 when the switch **S** is closed on **A**.
    A) 1 A
    B) 2 A
    C) 3 A
    D) 6 A
    E) 12 A

18. A charged particle is fired from a gun with a velocity of 5.2×10^4 m/s at an angle of 35° with respect to a 0.0045-T magnetic field. If the magnetic field exerts a force of 0.0026 N on the particle, determine the magnitude of the charge.
    A) 11 μC
    B) 15 μC
    C) 19 μC
    D) 23 μC
    E) 27 μC

19. An proton is fired eastward. In which direction will it be deflected?
    A) north
    B) south
    C) down
    D) up
    E) none of these

20. An electron gun fires an electron toward a target in a lab room in which a magnetic field exists. The electron is deflected to the left. What is the direction of the magnetic field?

A) downward, toward the floor
B) upward, toward the ceiling
C) leftward
D) rightward
E) none of these

Answer Key

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