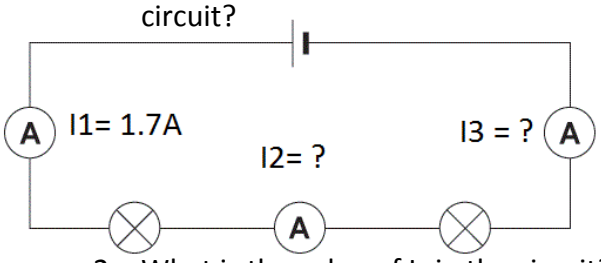
Electric Circuits Practice Exercises

Electric Current

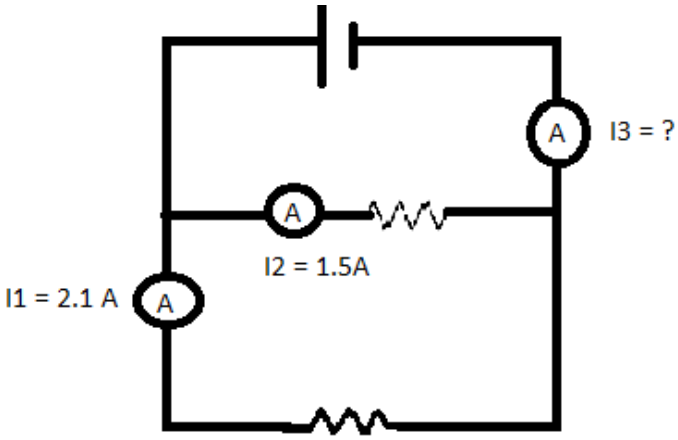
1. A current of 3.60A flows for 15.3 s through a conductor. Calculate the number of electrons that pass through a point of the conductor during this time.
2. How long would it take 2.0×10^{20} electrons to pass through a point in a conductor if the current was 10.0A?
3. Calculate the current through a conductor if a charge of 5.60C passes through a point in the conductor in 15.4s.
4. What potential difference is required across a conductor to produce a current of 8.00A if there is a resistance in the conductor of 12.0Ω?
5. What is the heat energy produced in a conductor in 25.0s if there is a current of 11.0A and a resistance in the conductor of 7.20Ω?
6. A particular conductor produces 1.50×10^2 J of heat in 5.50 s. If the current through the conductor is 10.0A, what is the resistance of the conductor?
7. What is the current through a 4.00×10^2 W electric appliance when it is connected to a 1.20×10^2 V power line?
8. a) When an electric appliance is connected to a 1.20×10^2 V power line, there is a current through the appliance of 18.3A. What is the resistance of the appliance?
   b) What is the average amount of energy given to each electron by the power line?
9. a) What potential difference is required across an electrical appliance to produce a current of 20.0A when there is a resistance in the appliance of 6.00 Ω?
   b) How many electrons pass through the electrical appliance every minute?
10. If electricity cost $ 0.060 per kilowatt hour, what does it cost to operate a 1.0×10^3 W appliance for 5.0h?
11. A student forgets to turn off a 6.00×10^2 W block heater of a car when the weather turns warm. If 14 h goes by before he shuts it off, how much energy is used by the heater?
12. A 45 kg object is lifted vertically at a constant speed to a height of 9.0 m by a 7.5×10^2W electric motor. If this motor is 25% efficient in converting electric energy to mechanical energy, how long does the motor take to life the object?

Electric Circuits

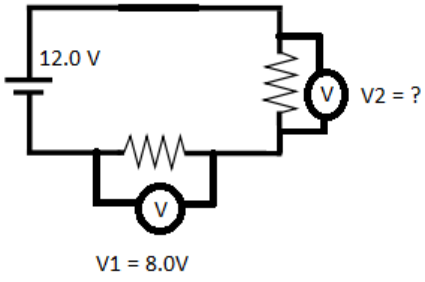
1. What are the values for I_2 and I_3 in the circuit?



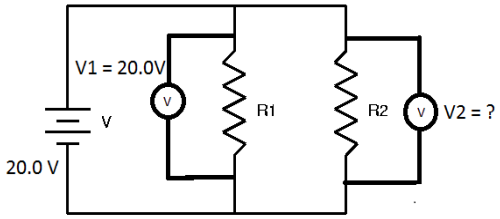
2. What is the value of I_3 in the circuit?



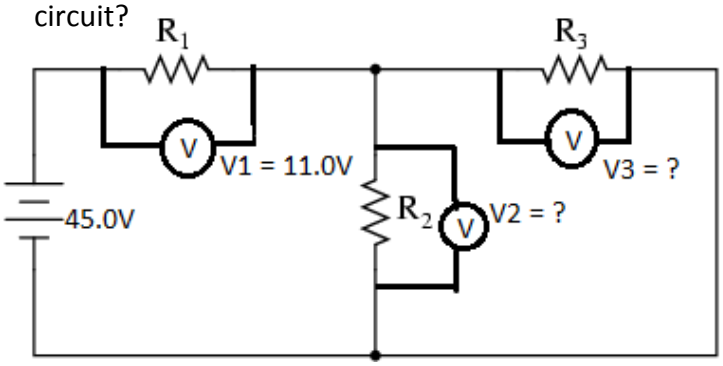
3. What is the value of V_2 in the circuit?



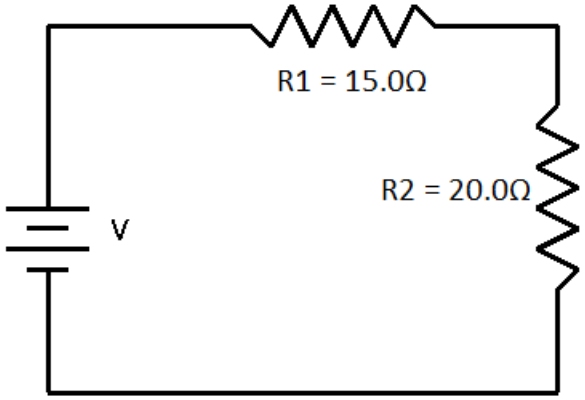
4. What is the value of V_2 in the circuit?



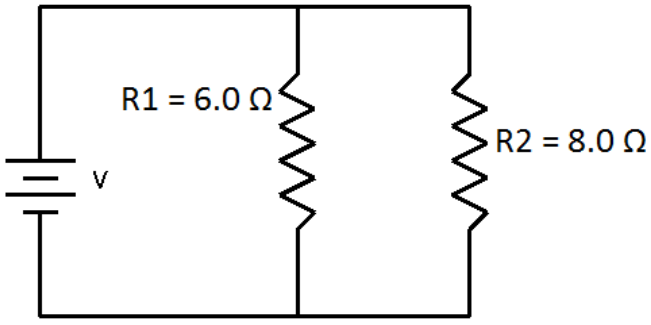
5. What are the values of V_2 and V_3 in the circuit?



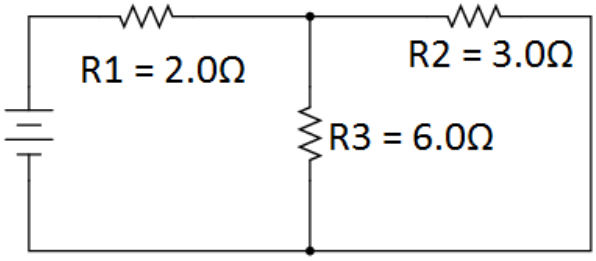
6. What is the total resistance in the circuit?



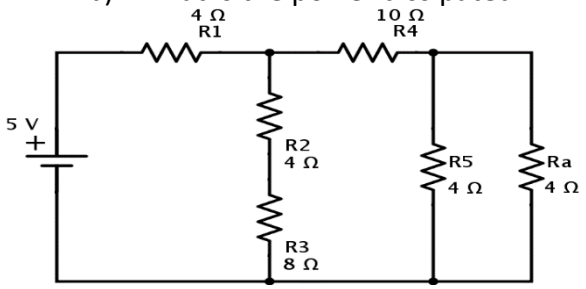
7. What is the total resistance in the circuit?



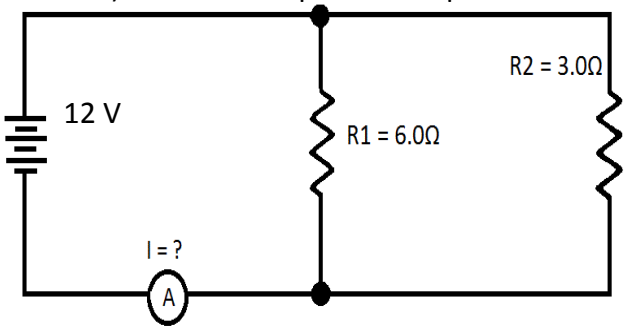
8. What is the total resistance in the circuit?



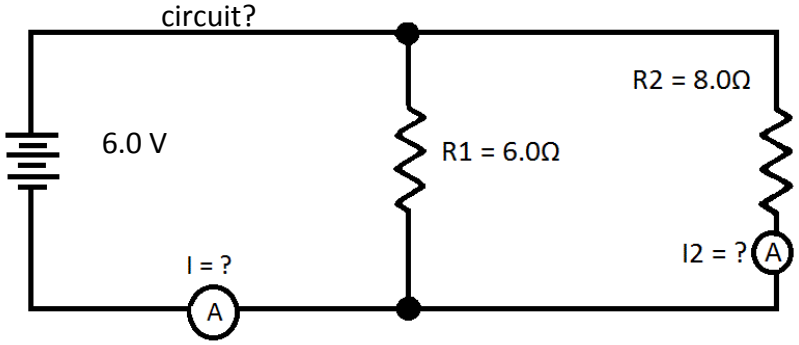
9. What is the total resistance in a circuit containing three resistors in series? The values of these resistors are 9.0Ω, 3.0Ω and 12.0Ω.
10. What is the total resistance in a circuit containing three resistors in parallel? The values of these resistors are 2.0Ω, 4.0Ω and 8.0Ω.
11. The total resistance in a circuit containing three resistors in parallel is 2.0Ω. If the values of two of these resistors are 4.5Ω and 9.0Ω, what is the value of the third resistor?
12. The total resistance in a circuit containing three resistors in series is 12.0Ω. If the values of two of these resistors are 6.0Ω and 4.0Ω, what is the value of the third resistor?
13. a) What are the values of the current in R1 and R2 in the circuit?
    b) What is the power dissipated in R1?



14. a) What is the value of I in the circuit?
    b) What is the power dissipated in R1?

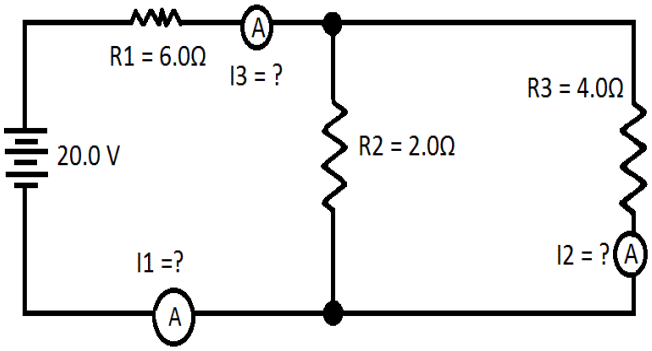


15. a) What are the values of I and I2 in the circuit?

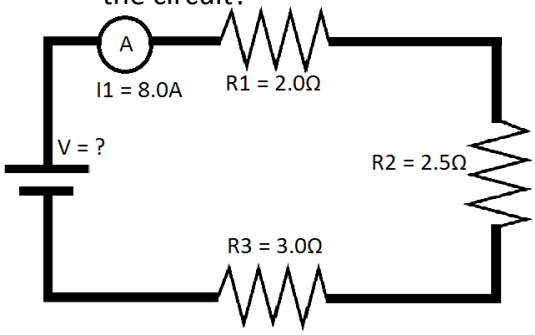


b) What is the total power dissipated in the circuit?

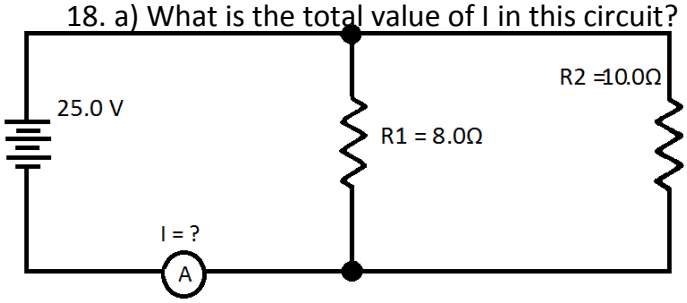
16. a) What are the values of I1, I2 and I3 in this circuit?
    b) What is the total power dissipated in the circuit?



17. a) What is the potential difference supplied by the power source in the circuit?
    b) What is the total power dissipated by the circuit?



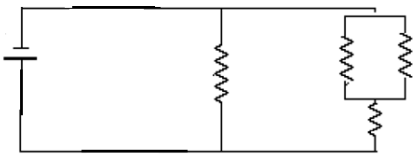
18. a) What is the total value of I in this circuit?



b) What is the total power dissipated in the circuit?

19. In electric heating coil will consume 6.0 × 10^2 W of power when it is connected to a 120V outlet. A greenhouse operator has two such coils, and she wants to construct a single heater using the two coils to keep her small greenhouse at a temperature of 50.0°C during the winter months. For how many hours must this heater (two coils) operate per day if an average of 1.5×10^7 J of energy are required each winter day to maintain the desired temperature given that the coils are connected
    a) In series?
    b) In parallel?
    c) Which of the two arrangements is the most cost-efficient? Explain your answer.

20. A creative physics student has four 12Ω heating coils. She constructs a water heater by placing the four coils in a circuit, as shown below.



If this heater operates from a 120V power line and is used to heat 200kg of water (specific heat capacity= 4.18×10^3 J/kg · C) that is at an original temperature of 15 °C, what will the temperature of the water be after 4.0h? (In addition to the formulas at the back of this book, you will have to use $\Delta E = mc\,\Delta T$ to solve this problem. ΔE = energy used, m = mass, c= specific heat capacity, ΔT = temperature change.)

Electromotive Force (EMF)

1. A flashlight battery of emf 1.5V has an internal resistance of 0.50Ω. If there is a current of 1.0 A through the battery, what is the terminal voltage of the battery?
2. What is the emf of a battery that has a terminal voltage of 5.0V when a current of 1.2A flows through the battery? The battery has an internal resistance of 0.72Ω.
3. A battery that has an emf of 24V and an internal resistance of 0.25Ω is being charged at a rate of 24A. What is the voltage required to do this?

Answers

Electric Current

1. 3.4x1020
2. 3.2 s
3. 0.36 A
4. 96 V
5. 22000 J
6. 0.27 Ohms
7. 3.3 A
8. 6.6 Ohms, 1.9x10-17 J
9. 120 V, 7.5x1021 electrons
10. $0.30
11. 8.4 kWh
12. 21 s

Electric Circuits

1.1.7A all
2. 3.6A
3. 4 V
4. 20 V
5. 34 V both
6. 35 Ohms
7. 3.43 Ohms
8. 4 Ohms
9. 24 Ohms
10. 1.14 Ohms
11. 6 Ohms
12. 2 Ohms
13. 0.5 A, 0.25 A
14. 6 A, 24 W
15. 1.75 A, 10.5 W
16. 2.72 A, 0.91 A, 2.72 A, 54.5 W
17. 60 V, 480 W
18. 5.63 A, 141 W
19. 13.9 h, 3.47 h, equal (same total energy)
20. 49.4 degrees

Electromotive Force

1. 1.0 V
2. 5.9 V
3. 30 V