How Are Voltage, Current, & Resistance Related to Electric Power?

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Introduction

- Current = the rate at which charge flows
- Voltage = difference in the charge between two points
- Resistance = the tendency of the material to resist current or flow of charge

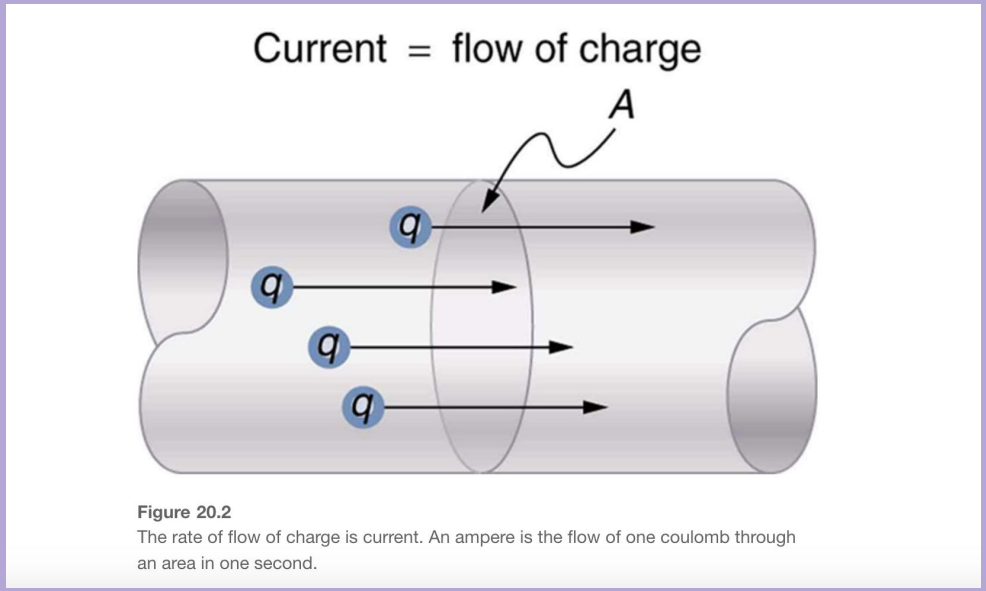
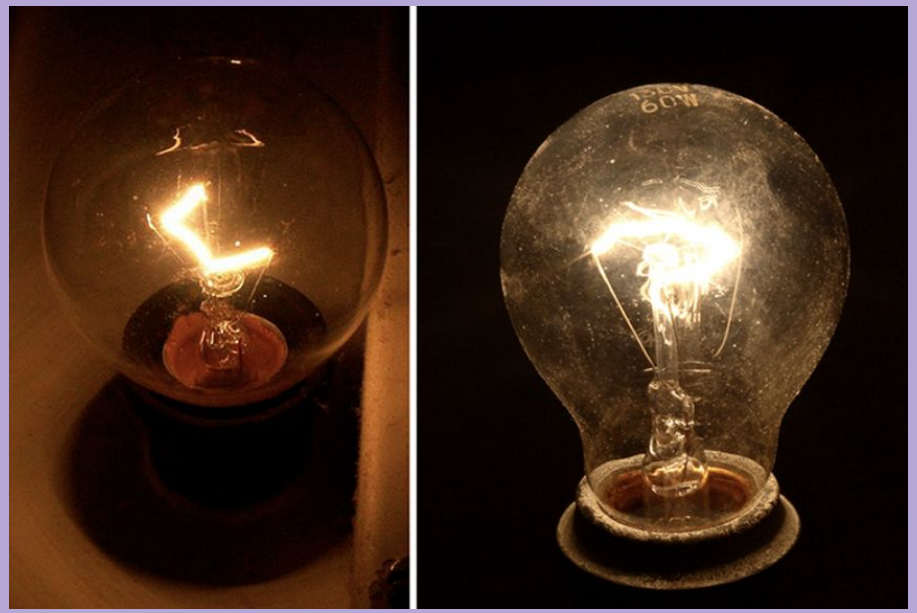


Figure 20.2
The rate of flow of charge is current. An ampere is the flow of one coulomb through an area in one second.

Introduction (cont.)

- Electric power = product of current times voltage
- Electric energy depends on both voltage involved and charge moved



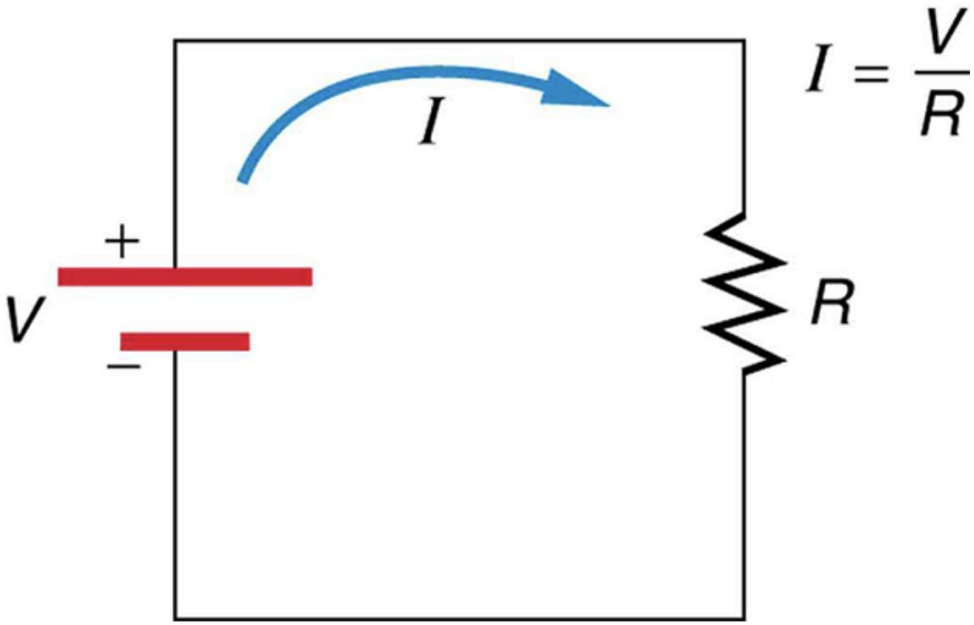


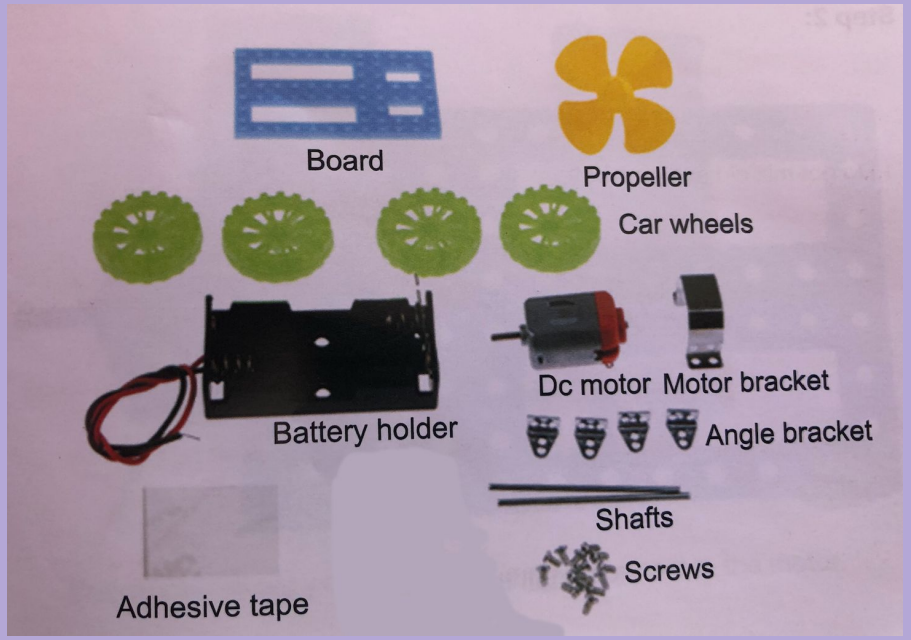
Figure 20.8
A simple electric circuit in which a closed path for current to flow is supplied by conductors (usually metal wires) connecting a load to the terminals of a battery, represented by the red parallel lines. The zigzag symbol represents the single resistor and includes any resistance in the connections to the voltage source.

Experiment

- In this experiment, I will be creating a mini wind-powered car to better understand the way electric energy, current, and voltage travel to power the car forward.
- I will also calculate the approximate electric power needed to move the car forward.

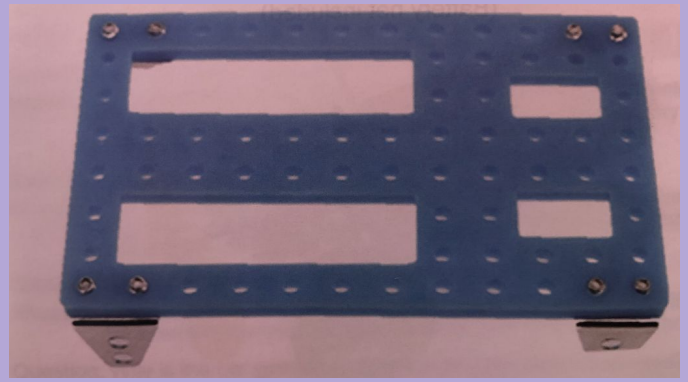
Materials

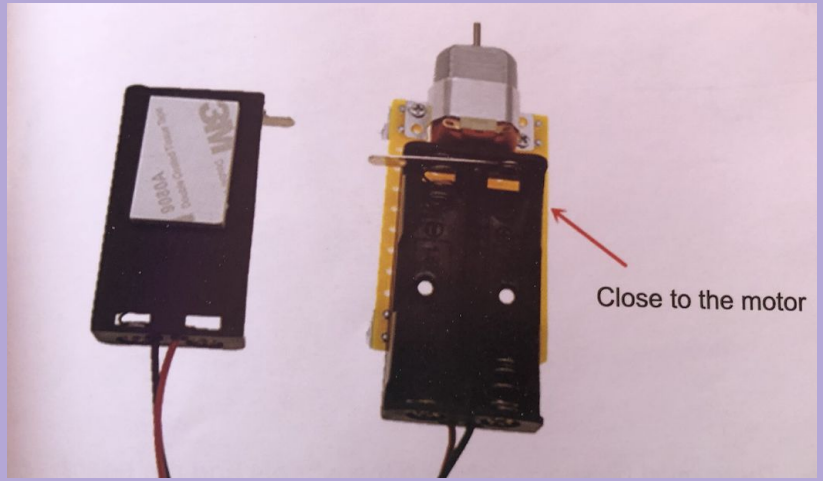
- Board (1)
- Propeller (1)
- Car wheels (4)
- Battery Holder (1)
- DC motor (1)
- Motor bracket (1)
- Angle bracket (4)
- Shafts (2)
- Screws (10)
- Adhesive double sided tape (1 small piece)

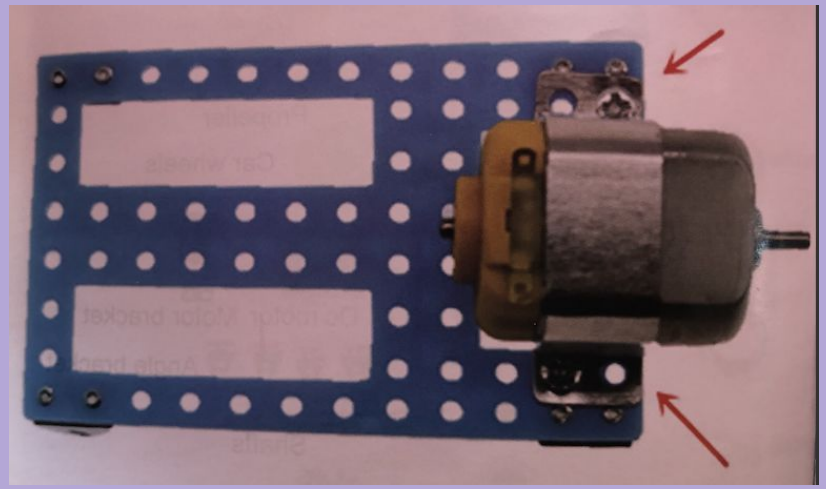


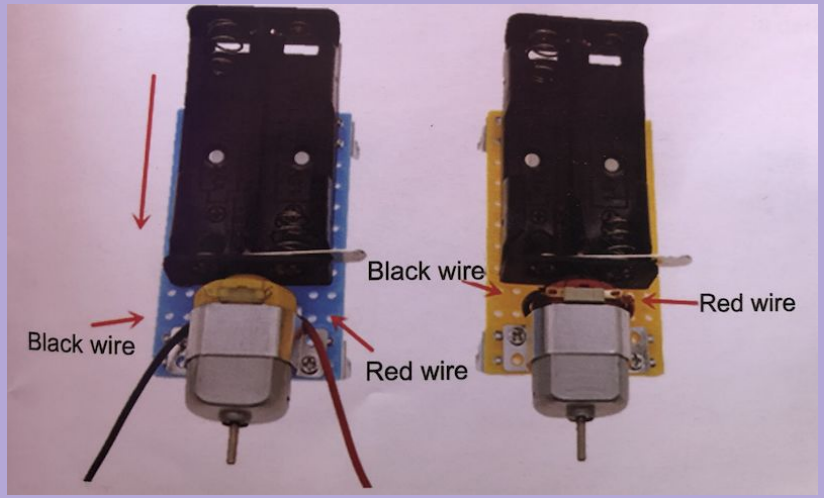
Methods

- Screw in the 4 angle brackets in each corner of the board
- Place the DC motor in the motor bracket and screw the motor bracket in place on the board
- Stick the adhesive tape to the back of the battery holder and stick the battery holder to the board under the DC motor
- Take the rubber stoppers off the red and black wires and twist the loose ends
- Connect the red wire to one side of the motor bracket and the black wire to the other side
- Insert the shafts though the angle brackets on the bottom and put the wheels on each side
- Insert two AA batteries into the battery holder and the car is ready!

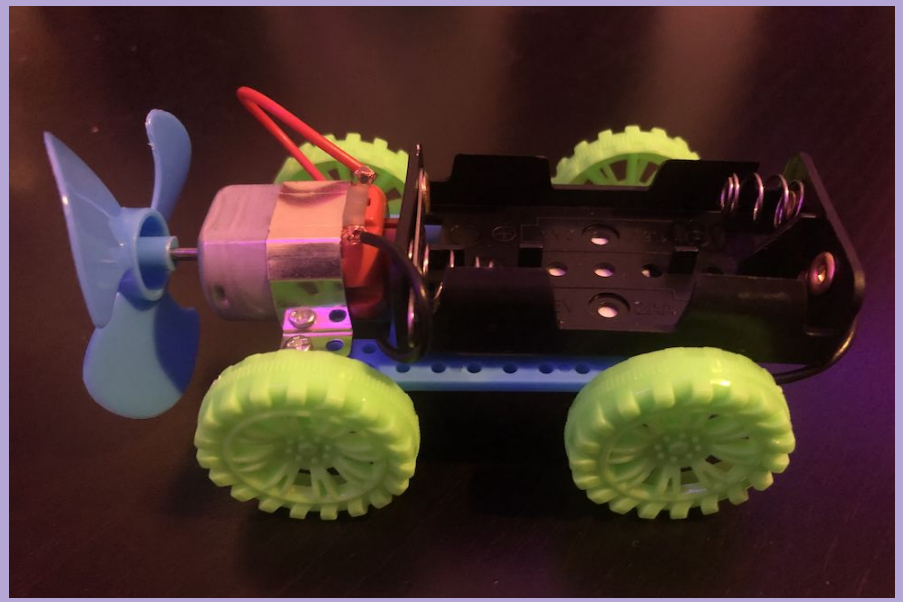


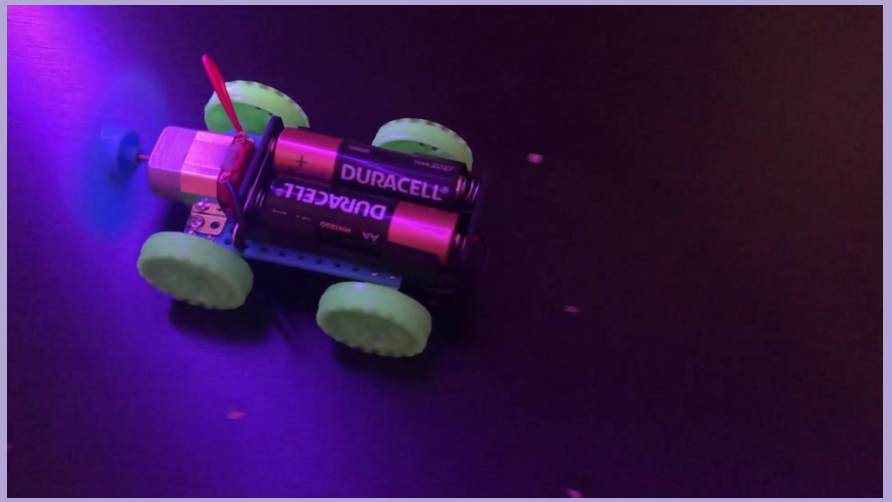

Close to the motor



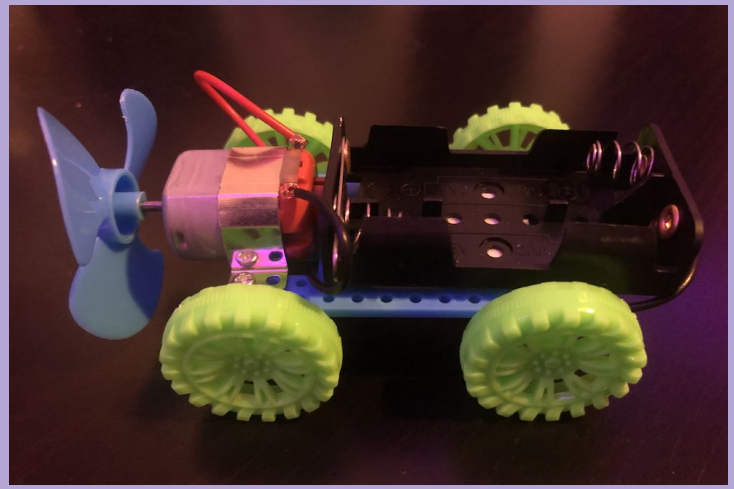

Black wire
Red wire
Black wire
Red wire

My Car





- The red and black wires used for the car act as conductors and connect to the positive and negative terminals of the battery
- The current from the battery flows through the wires to the DC motor where the electric energy is converted to wind energy
- The propeller rotates with the help of the DC motor and batteries which pushes the car forward



Calculations

- Finding the electric power of my car
  - Equation: $P = IV$
    - P = power; units: Watts
    - I = current; can be found using $I = q/t$
      - Q = charge moved
      - T = time
    - V = voltage
  - $P = (0.05\ A + 0.05\ A)(1.5\ V + 1.5\ V)$
  - $P = (0.1)(3)$
  - $P = 0.3\ W$

Calculations (cont.)

- Relationship of power to resistance
  - Combine Ohm's law ($V = IR$) and $P = IV$ to create new equation, $P = V^2/R$
  - $P = (3\ V / 1.8\ \Omega)$
  - $P = 1.67\ W$

Conclusion

- By calculating the electric power it took to move the car forward, we can see that not much power is needed for this action.
- But, when calculating the power with resistance in mind, then more power is needed to move the car forward.
- Overall, creating the car helped me understand how batteries, circuits, and conductors work together to give energy. Doing this also showed me the relationship between voltage, current, and resistance.

Thank you!