

BSA Electricity Merit Badge

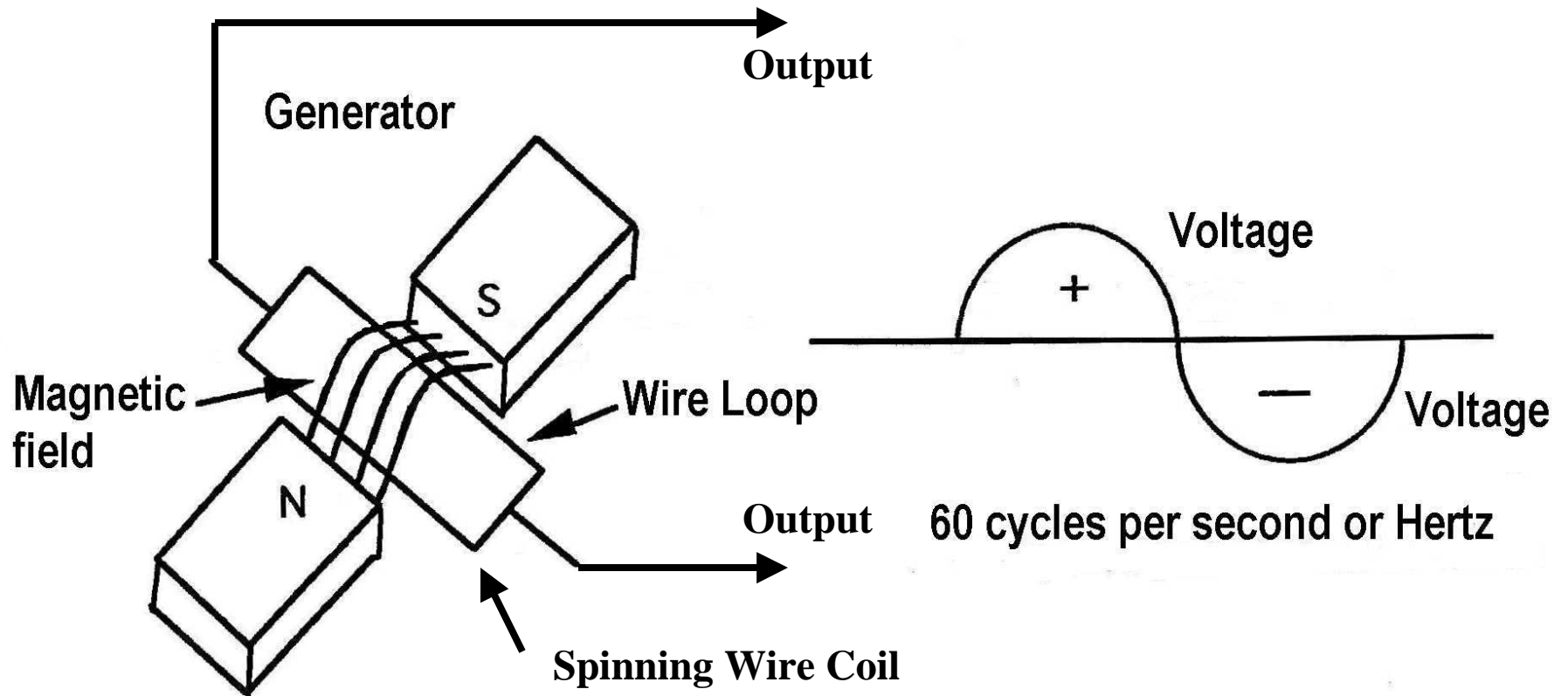
Electricity Merit Badge

AC

Alternating Current

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AC=Alternating Current



When a coil of wire passes through a magnetic field it produces an Alternating Current

1 m
2 m

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AC=Alternating Current

Two types of Electricity

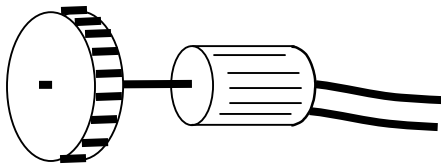
AC = Alternating Current produced from a generator.

DC = Direct Current produced from a battery.

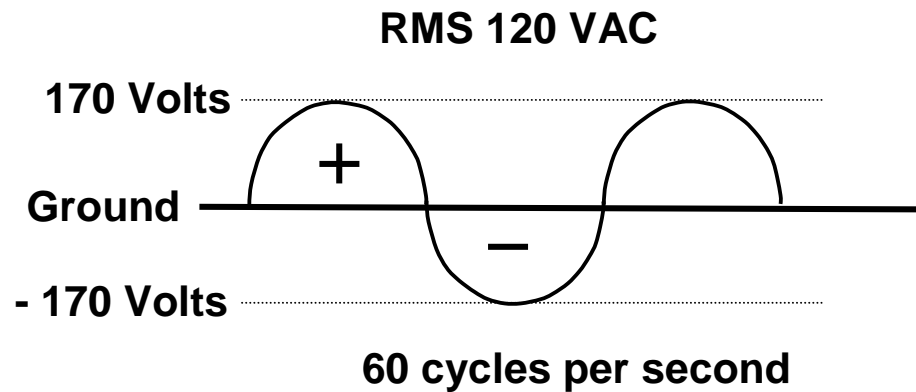
AC = Alternating Current

Water
Wheel

Electric
Generator



Generator contains:
Coil of Wire and Magnets



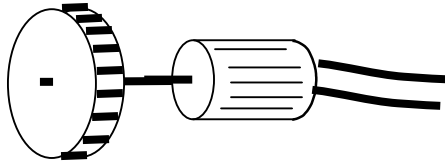
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AC Power / Voltage Generation

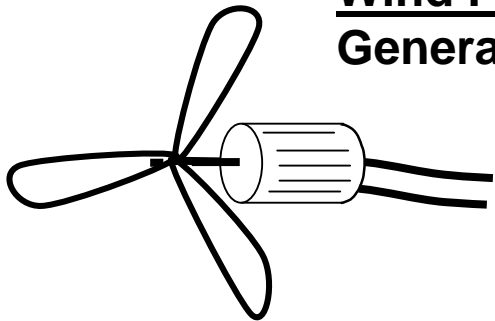
Hydro Power

Water

Wheel Generator

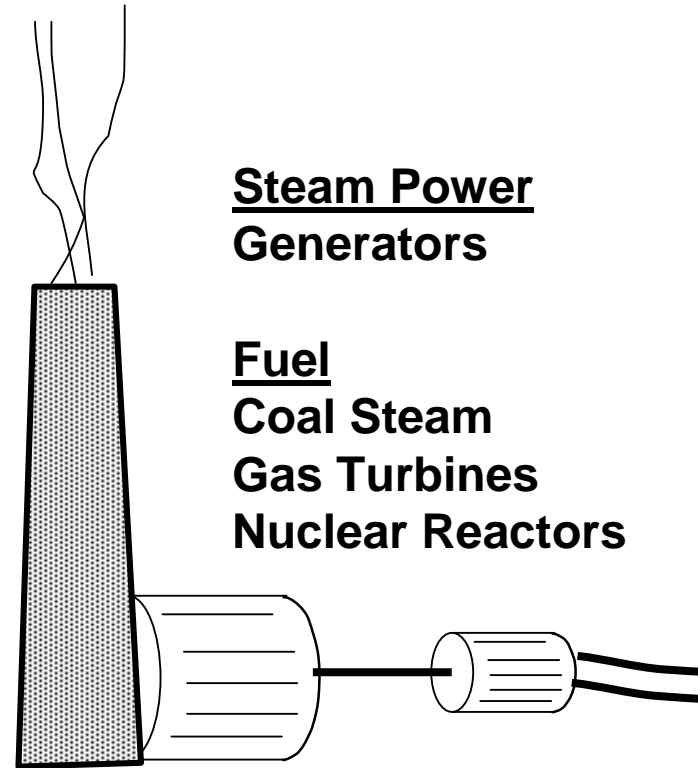


Wind Power Generator



Steam Power Generators

Fuel
Coal Steam
Gas Turbines
Nuclear Reactors

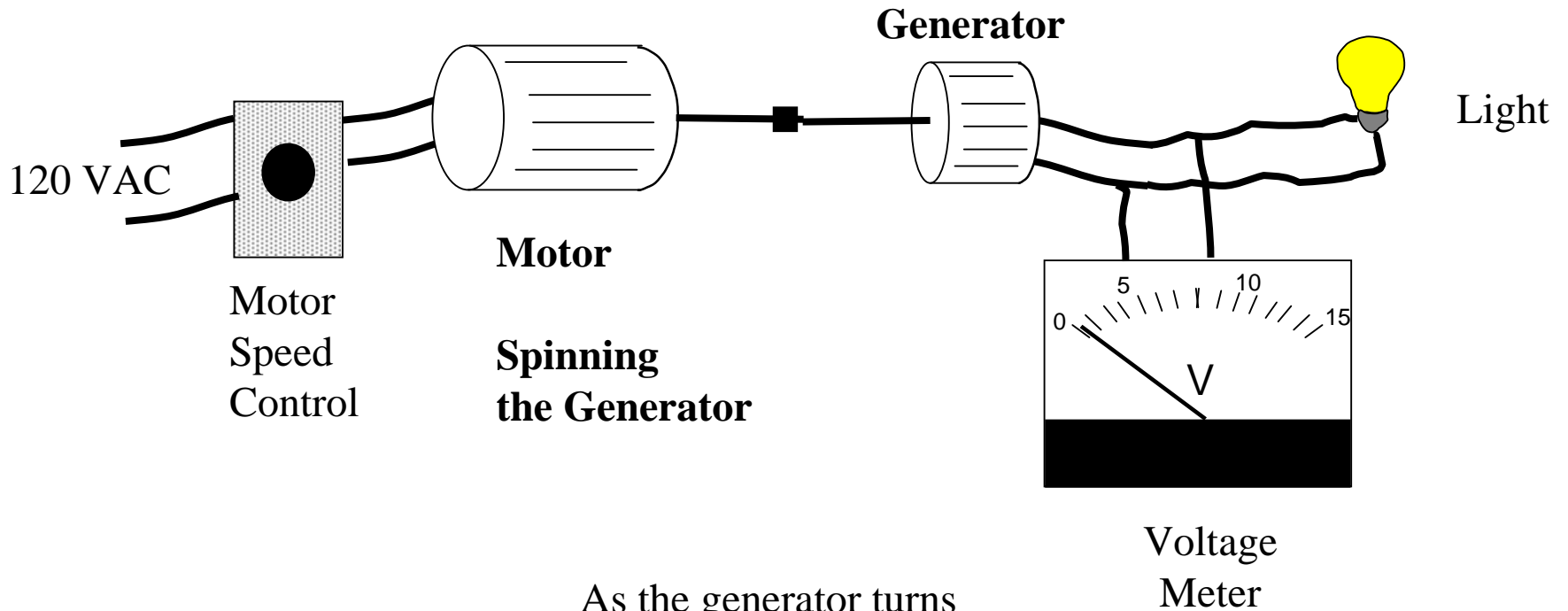


Steam
Engine

Generator

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Generator Demo



**Spinning
the Generator**

As the generator turns
faster the voltage increased

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Electric Generation Plants



Coal, Gas, Oil-fired Steam Power Plant



Hydro (Water) Power Plant



Wind Power Plant



Gas Turbine Combined Cycle Plant

.5 m
7.5 m

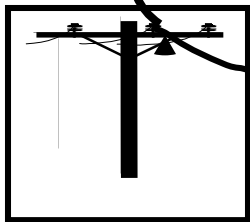
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AC Power / Voltage Generation



500,000 VAC

Sub Station
Transformer



240 VAC



1.5 m
9 m

Power Plants generate Electricity at very high voltage levels to reduce cable size and voltage losses in transporting it long distances to reach customers. It is stepped down through transformers to 240 VAC at the home

440 VAC

240 VAC



Types of Generating Plants

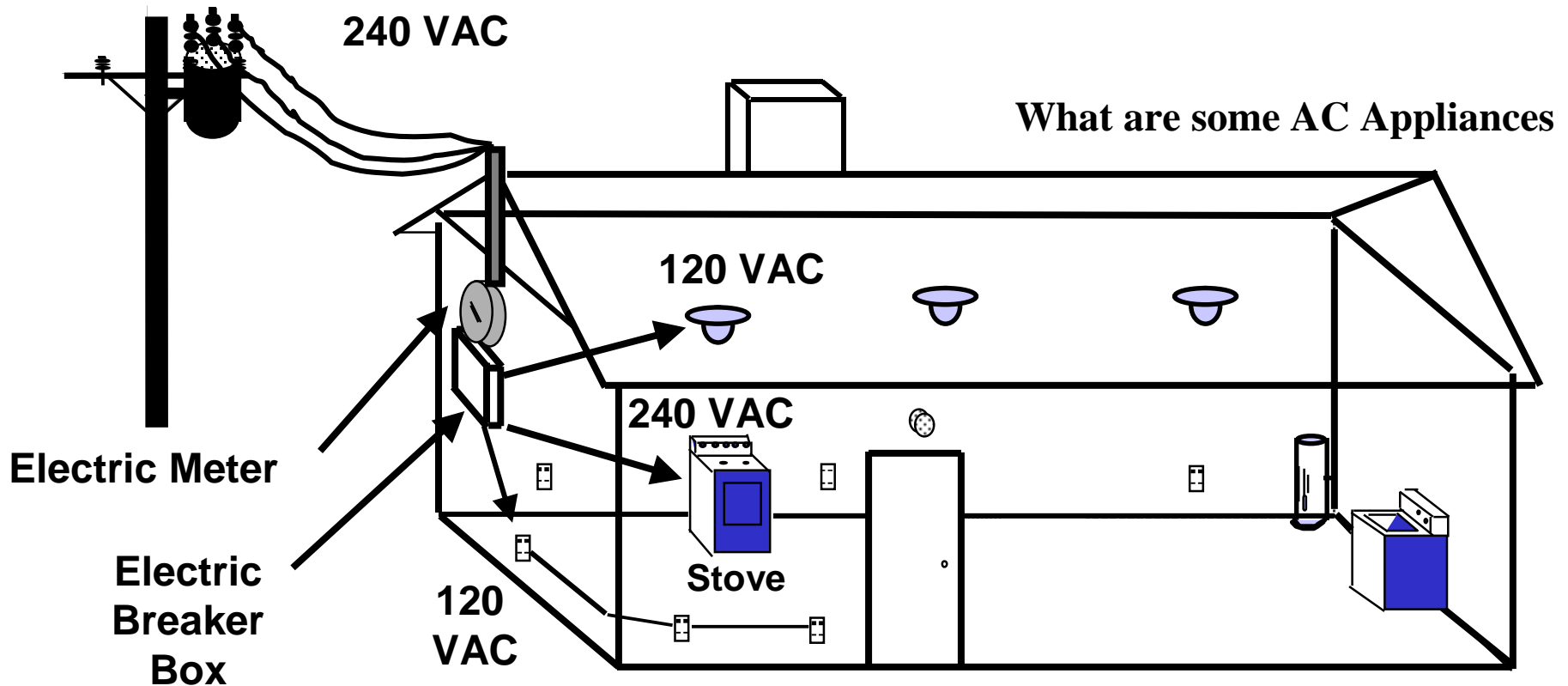
Hydro Generator

Nuclear Generator

Coal Generator

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Circuit Breaker / Fuses



Electricity from the transformer connects first through the electric meter then through the breaker box to protect the house from overload or short conditions. A breaker box can either be a fuse or resettable breaker.

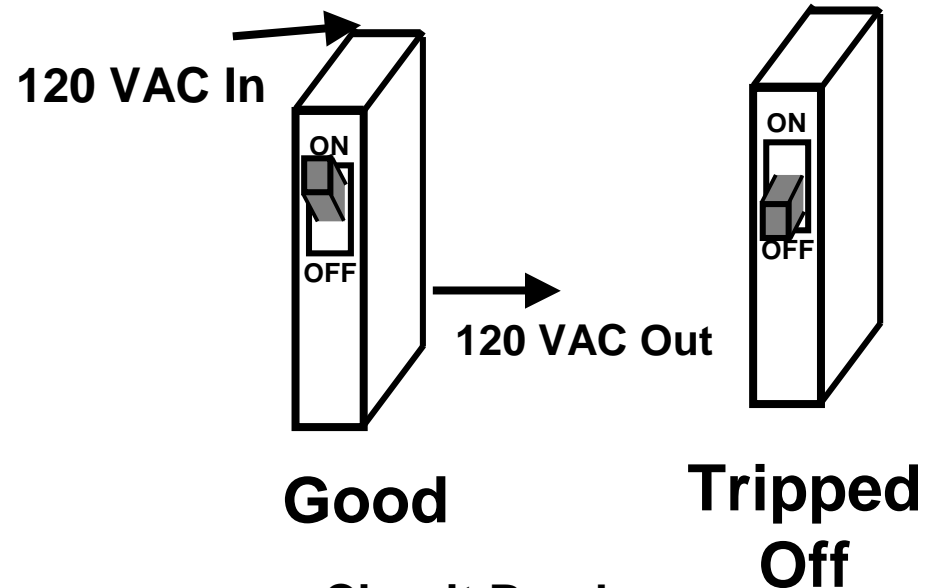
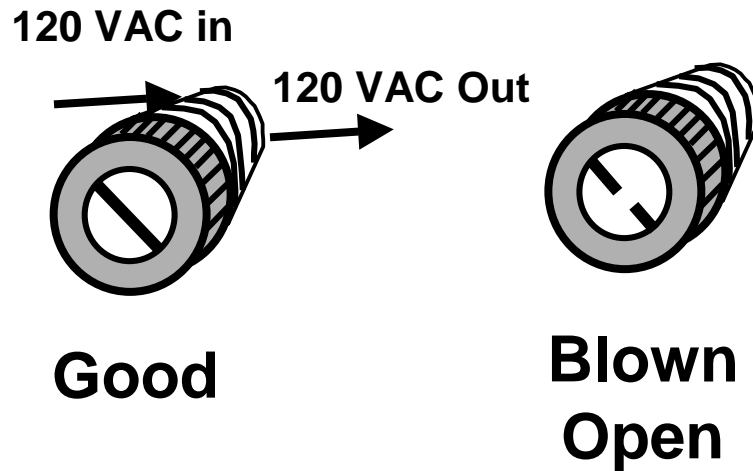
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Circuit Breaker / Fuses

Not re-usable

What's the difference

Re-usable



Fuses

A Fuse is like a light bulb.
It will pass electricity until
it is overloaded, then the metal
fuse link will burn open.

A short circuit will cause an overload

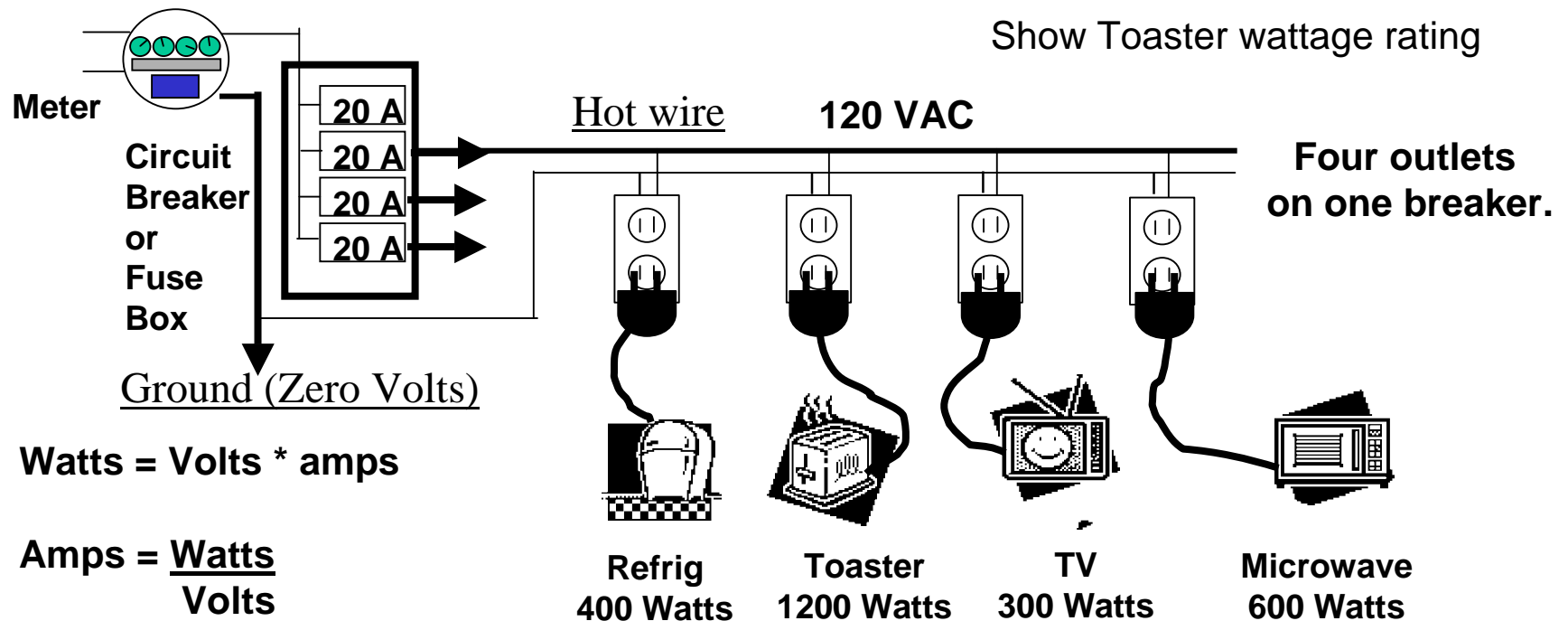
Circuit Breaker

A circuit breaker is like a light switch.
If it is overloaded the switch will
overheat and click open. When
it cools down the switch can be reset.
A short circuit will cause an overload

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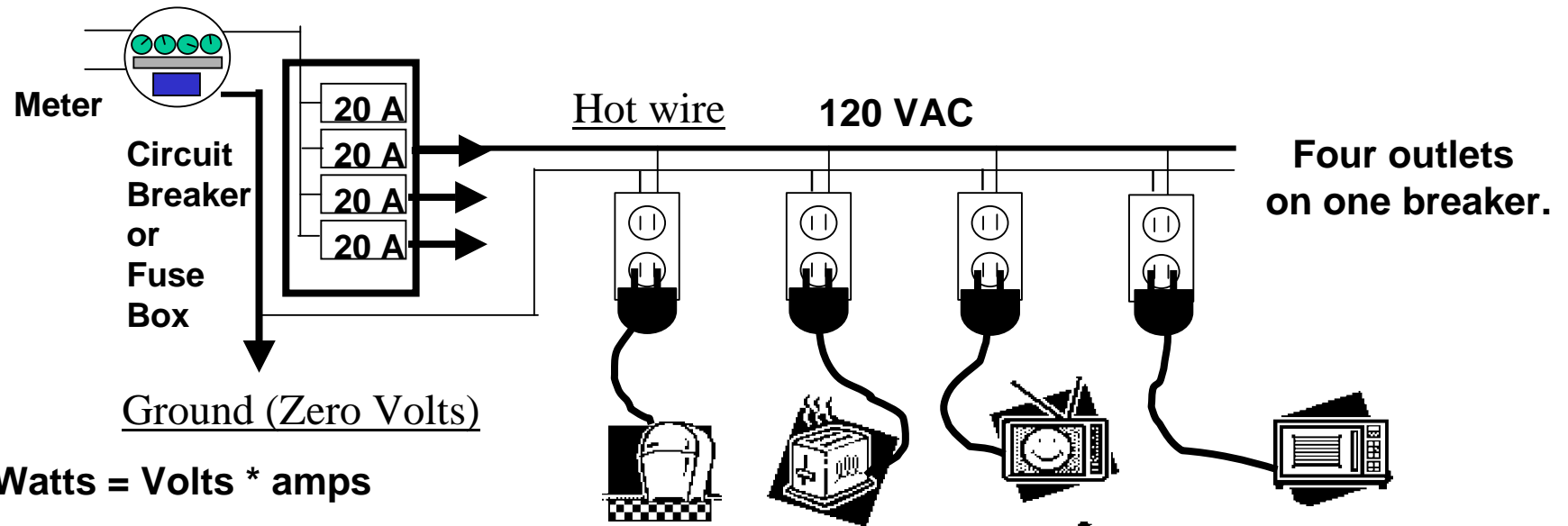
House Wiring

A house is wired with heavy gauge wire to handle 120 Volts AC in order to power high wattage devices that are found in a home. A circuit breaker or fuse is used to protect the wire from getting too hot, and possibly starting a fire. House items are rated in wattage, but the fuse is in amps. How do we know if we are going to overload our fuse or breaker box?



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House Wiring



Watts = Volts * amps

Amps = $\frac{\text{Watts}}{\text{Volts}}$

Refrig
400 Watts

Toaster
1200 Watts

TV
300 Watts

Microwave
600 Watts

Determine if the circuit breaker is overloaded. Calculate total power

Refrig.

Toaster

TV

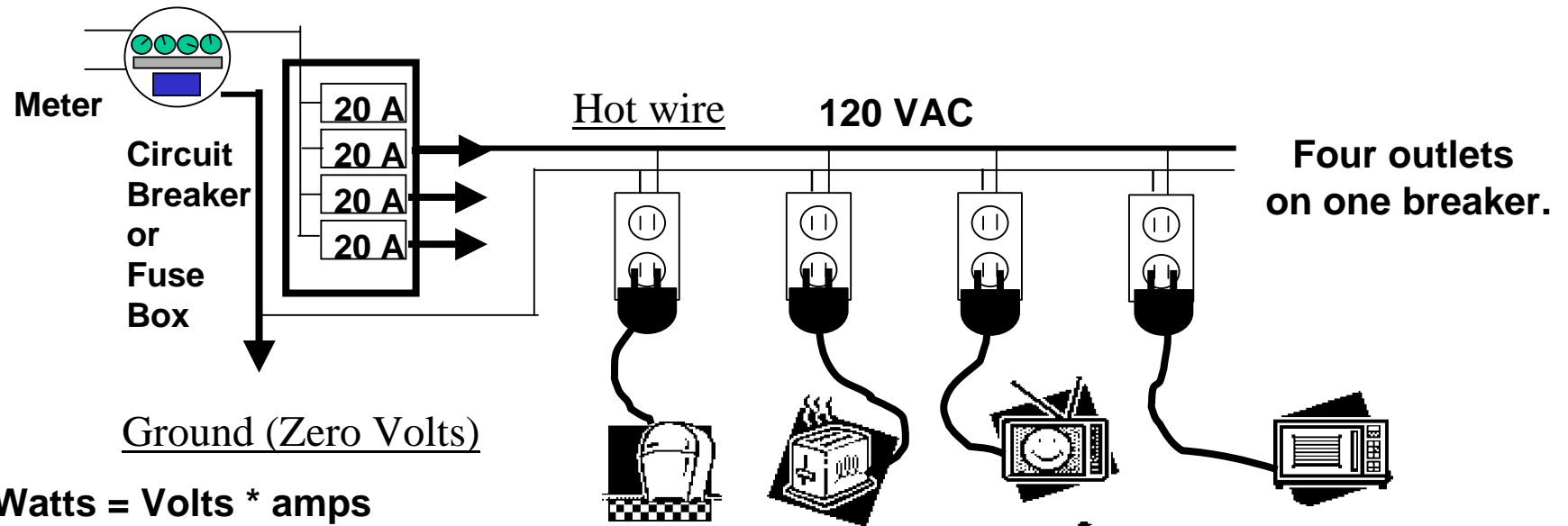
Microwave

Power = _____ + _____ + _____ + _____ = _____ Watts/hour

Amps = $\frac{\text{watts}}{\text{volts}}$ = _____ = _____ amps Overload Yes or No _____

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House Wiring



Watts = Volts * amps

Amps = $\frac{\text{Watts}}{\text{Volts}}$

Refrig
400 Watts

Toaster
1200 Watts

TV
300 Watts

Microwave
600 Watts

Determine if the circuit breaker is overloaded. Calculate total power

Refrig.

Toaster

TV

Microwave

Power = 400 + 1200 + 300 + 600 = 2500 Watts/hour

Amps = $\frac{\text{watts}}{\text{volts}}$ = $\frac{2500}{120}$ = 20.8 amps Overload Yes or No yes

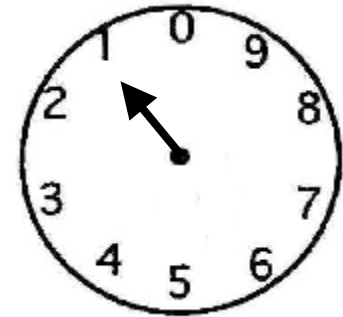
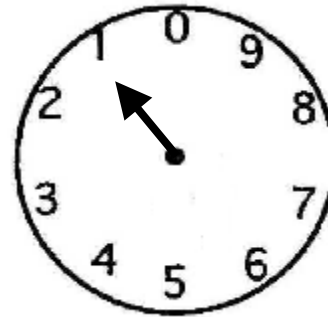
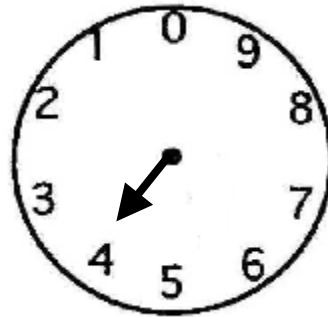
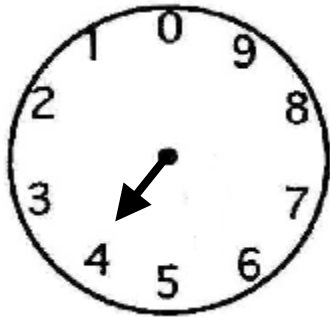
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Electric Meter

2600 watts x 24 hours = 62,400 or 62.4 Kilo watt-hours

62.4 K watts x 30 days = 1872 K watts-hours

Electric reading from previous month 2539



Reading

4

4

1

1

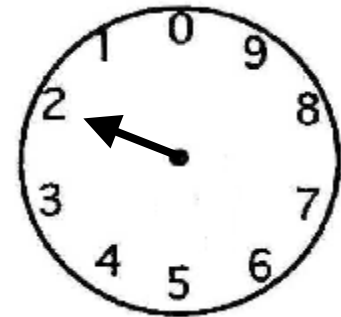
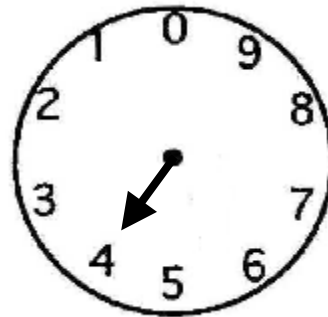
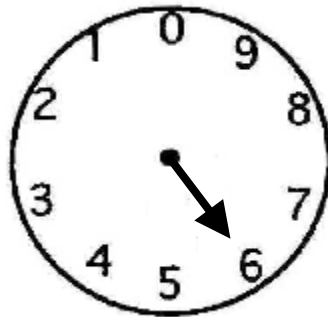
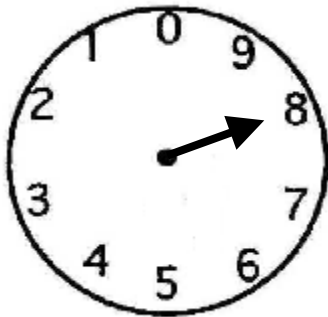
Subtract previous reading from new reading for used.

New Reading	<u>4411</u>			
Previous Reading	<u>2539</u>			
Kilowatt-hour used	<u>1872</u>	X	\$.10	\$ <u>187.20</u>

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Electric Meter

Electric reading from previous month 5324



Reading

Subtract previous reading from new reading for used.

New Reading

Previous Reading

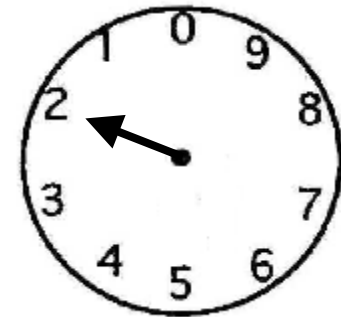
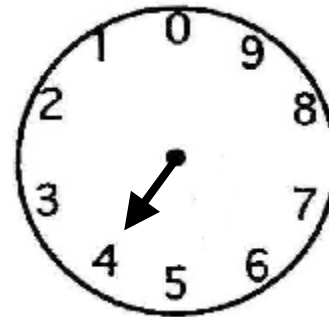
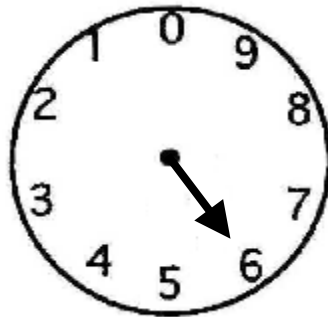
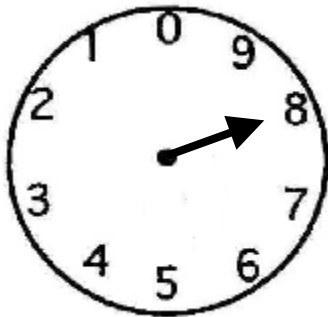
Kilowatt-hour used

X \$.10 \$ _____

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Electric Meter

Electric reading from previous month 5324



Reading

8

6

4

2

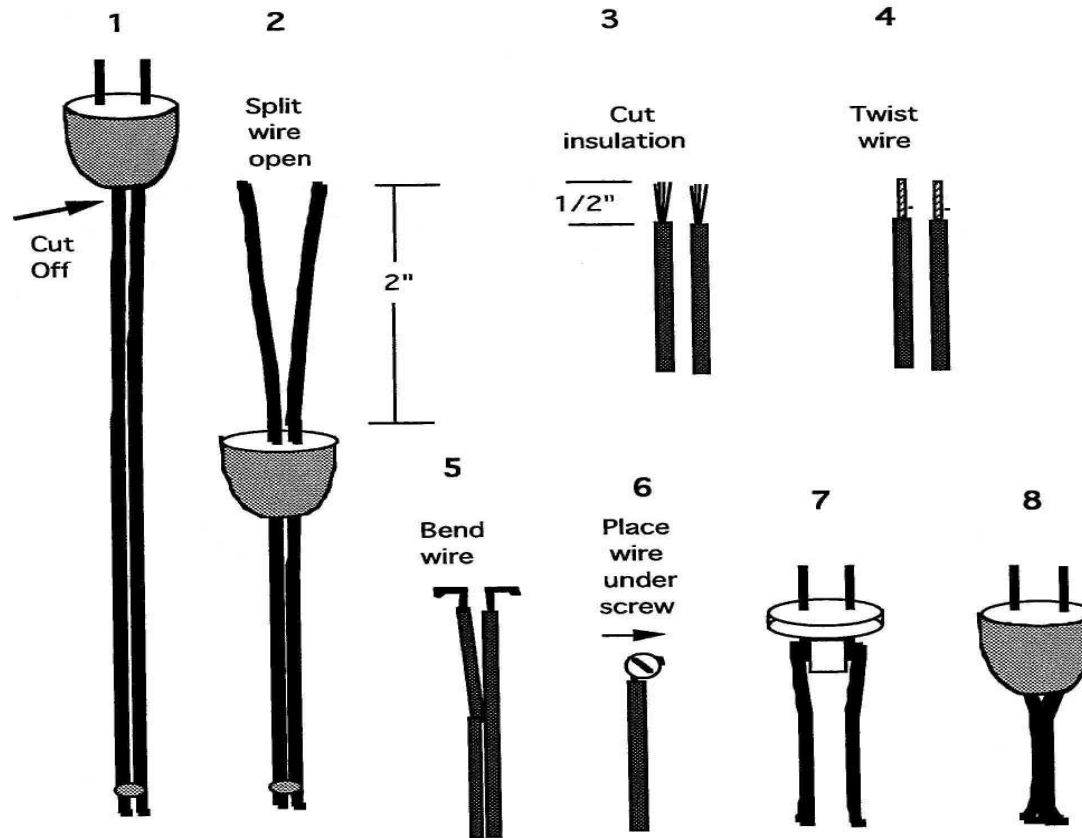
Subtract previous reading from new reading for used.

New Reading	<u>8642</u>			
Previous Reading	<u>5324</u>			
Kilowatt-hour used	<u>3318</u>	X	\$.10	\$ <u>331.80</u>

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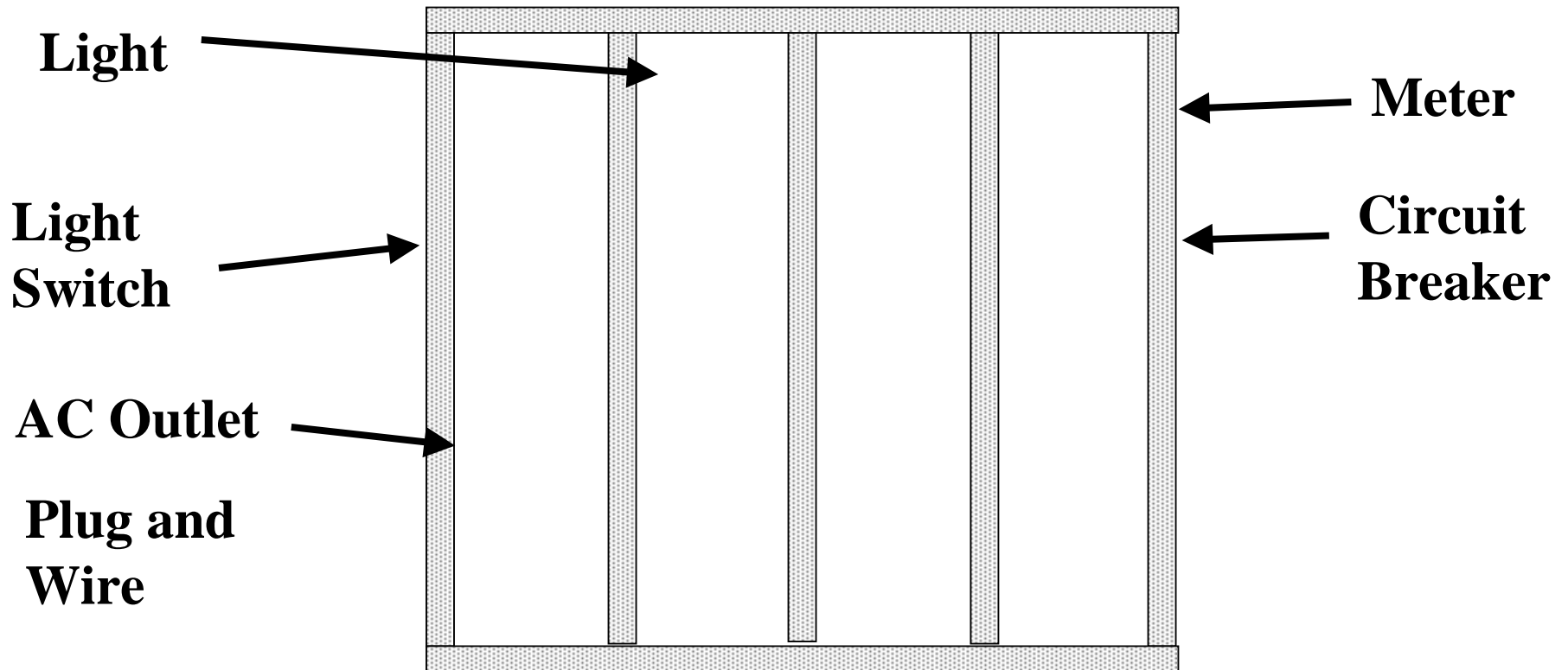
Electric Plus and Wire

Electrical problems are created more often by loose wire connectors than by worn or defective cords. If a cord is actually defective, it must be replaced. This is a good policy always and is a requirement for buildings, because the electrical safety code allows wire to be spliced only inside junction boxes.



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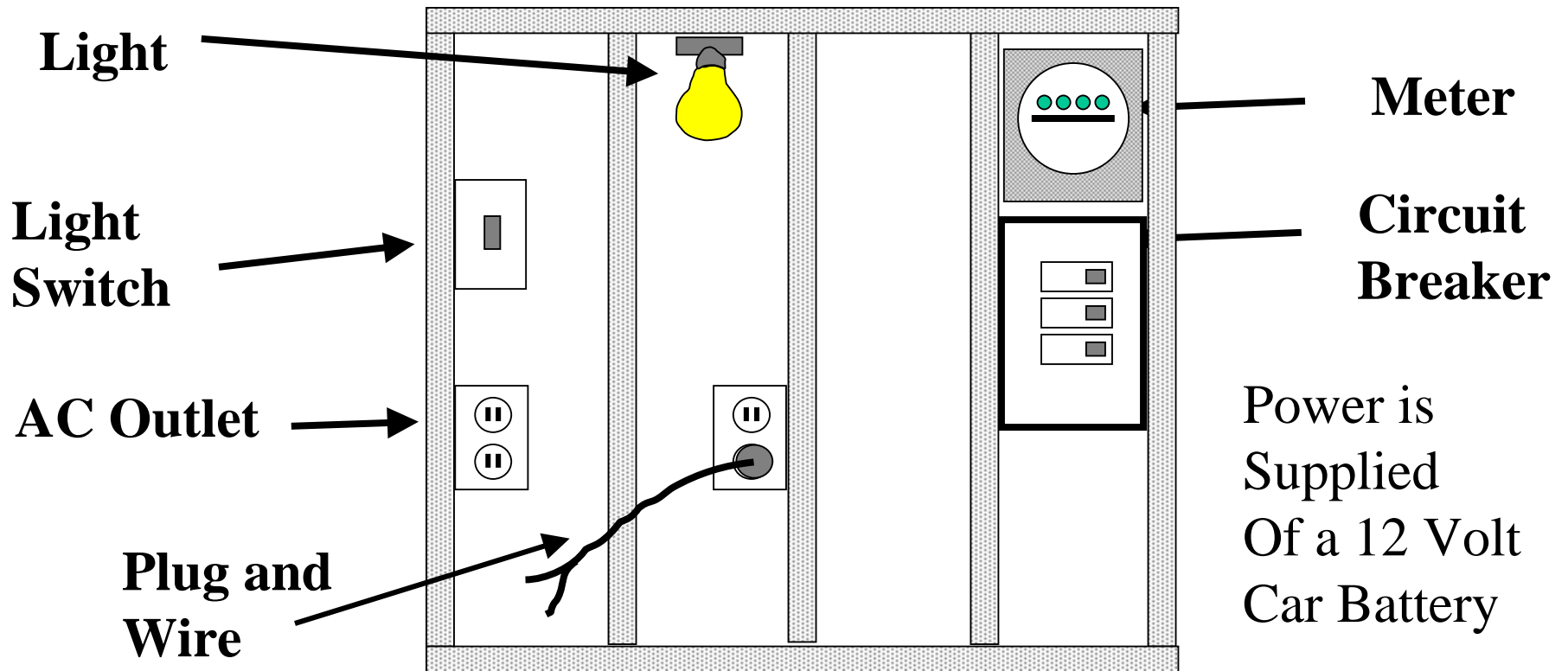
House Wiring Demonstration



Draw in a light, light switch AC outlet with plug in one outlet, Circuit breaker box and meter.

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House Wiring Demonstration



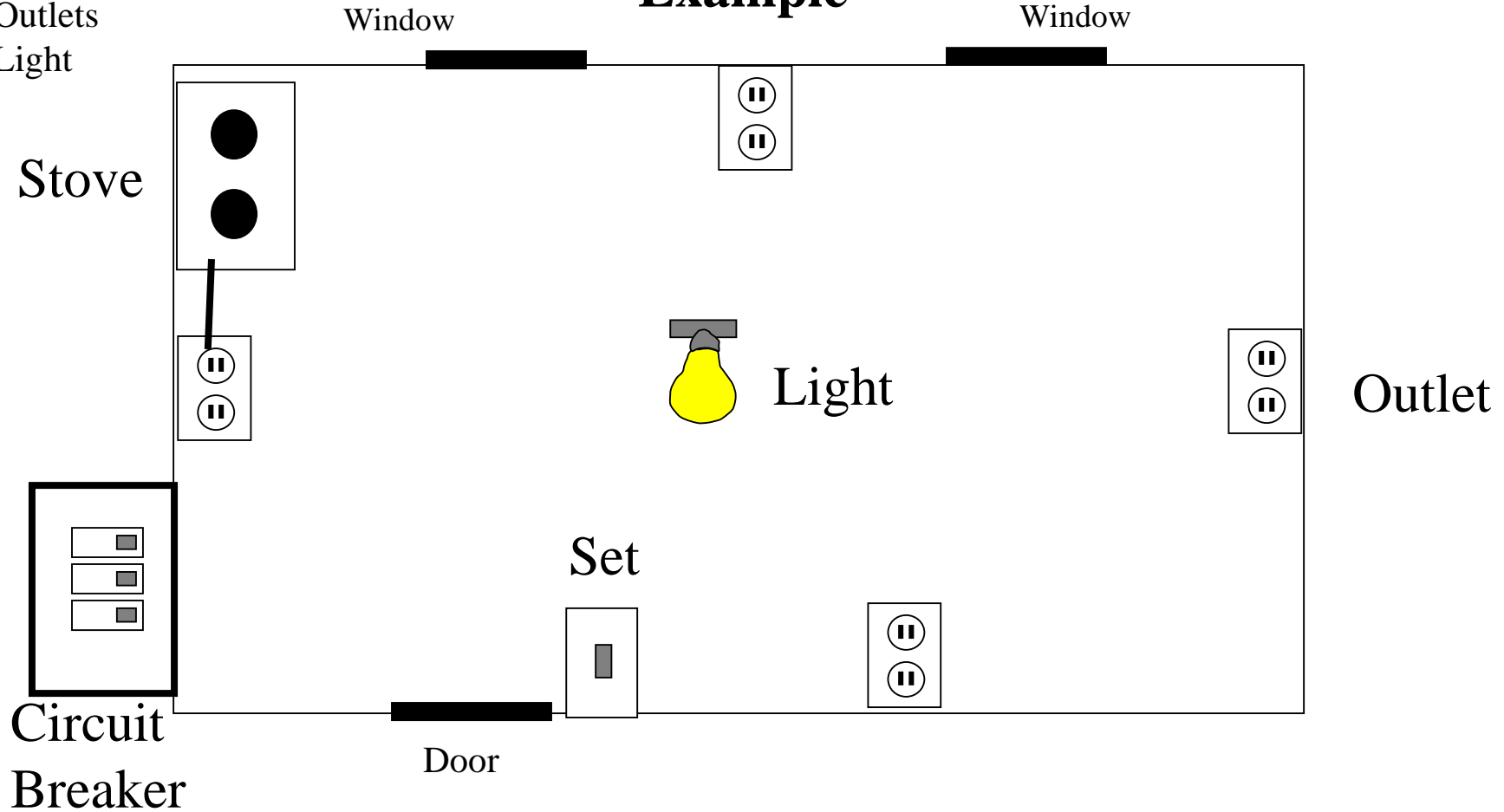
Students Line up and one at a time short out wire then reset the circuit breaker

10 m
45 m

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Electrical Wiring Example

- 1 Stove
- 2 Outlets
- 3 Light



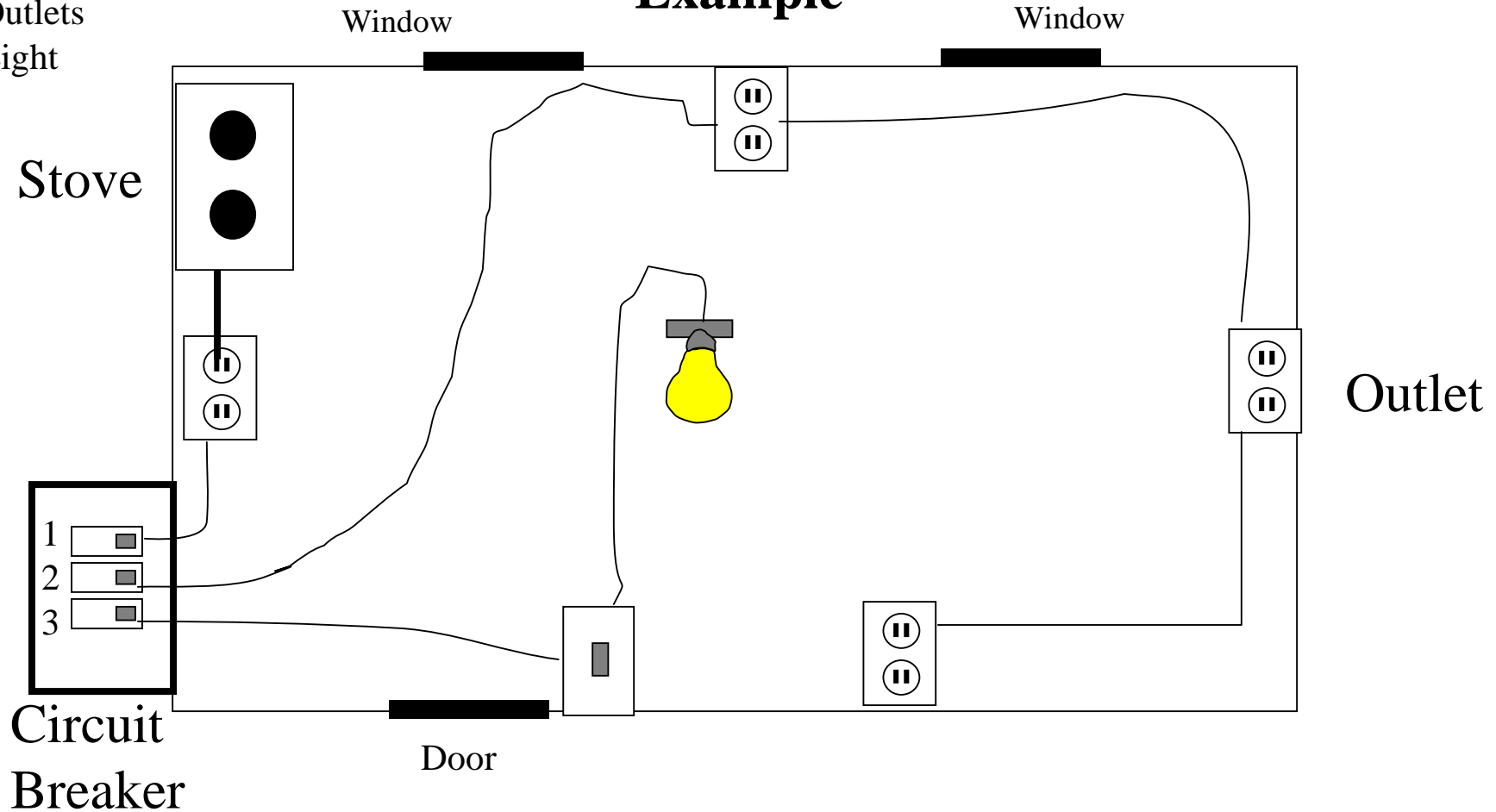
3 m
50 m

In room, draw electrical outlets, switches, and lights. Draw only one side of electricity called the Hot side. Also show doors and windows.

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Electrical Wiring Example

- 1 Stove
- 2 Outlets
- 3 Light

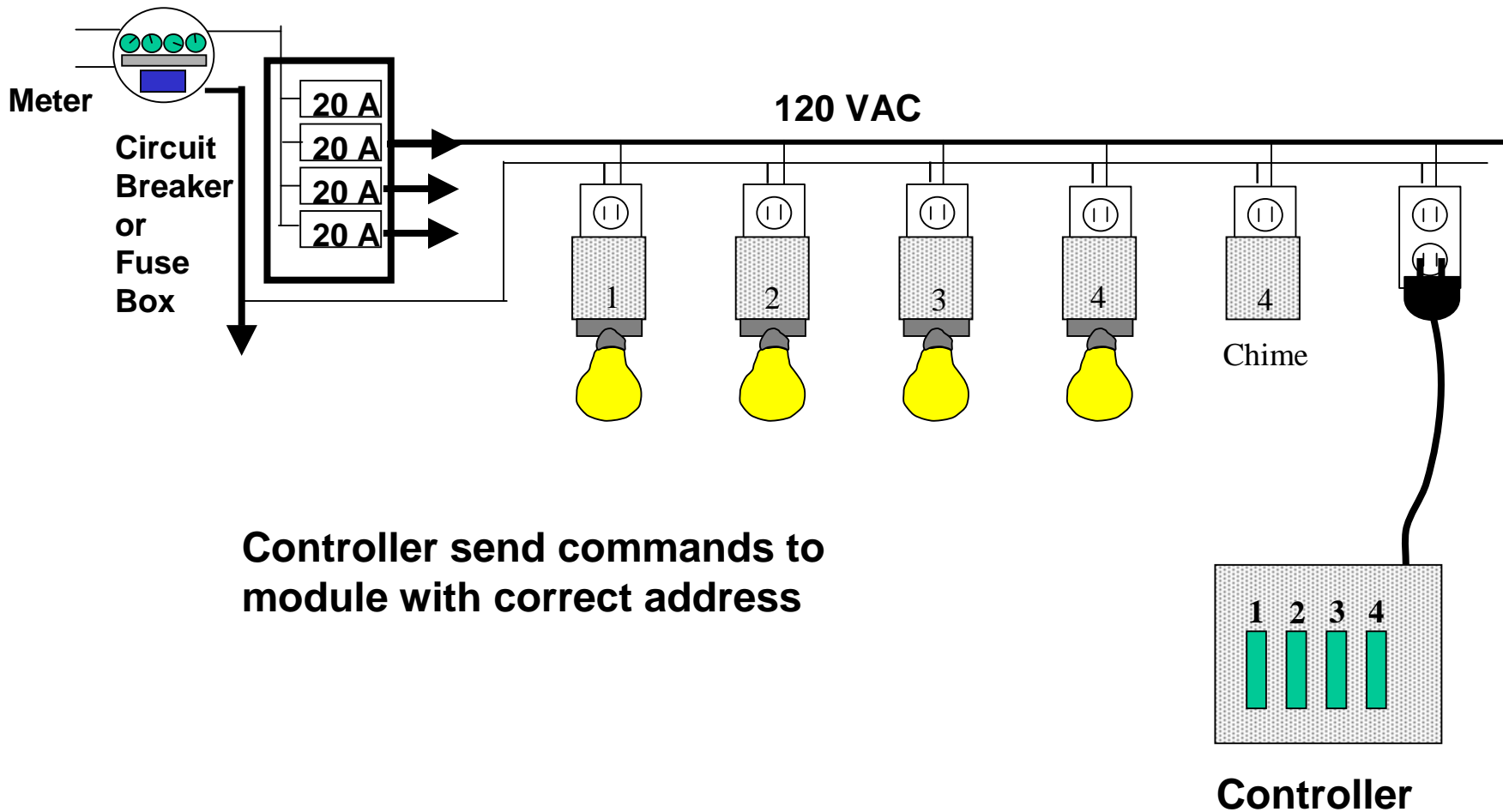


3 m
50 m

In room, draw electrical outlets, switches, and lights. Draw only one side of electricity called the Hot side. Also show doors and windows.

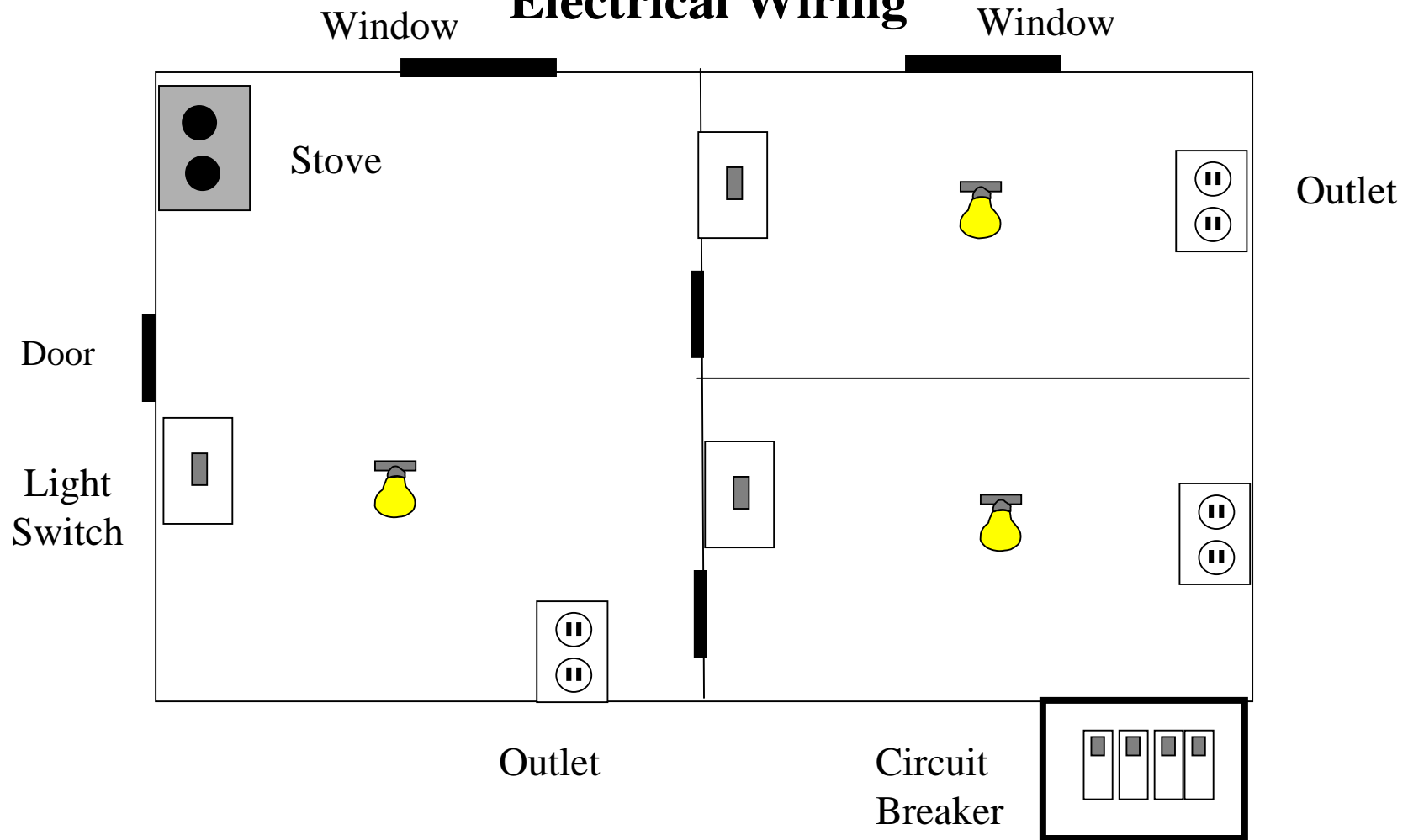
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X10 Home Control



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Electrical Wiring

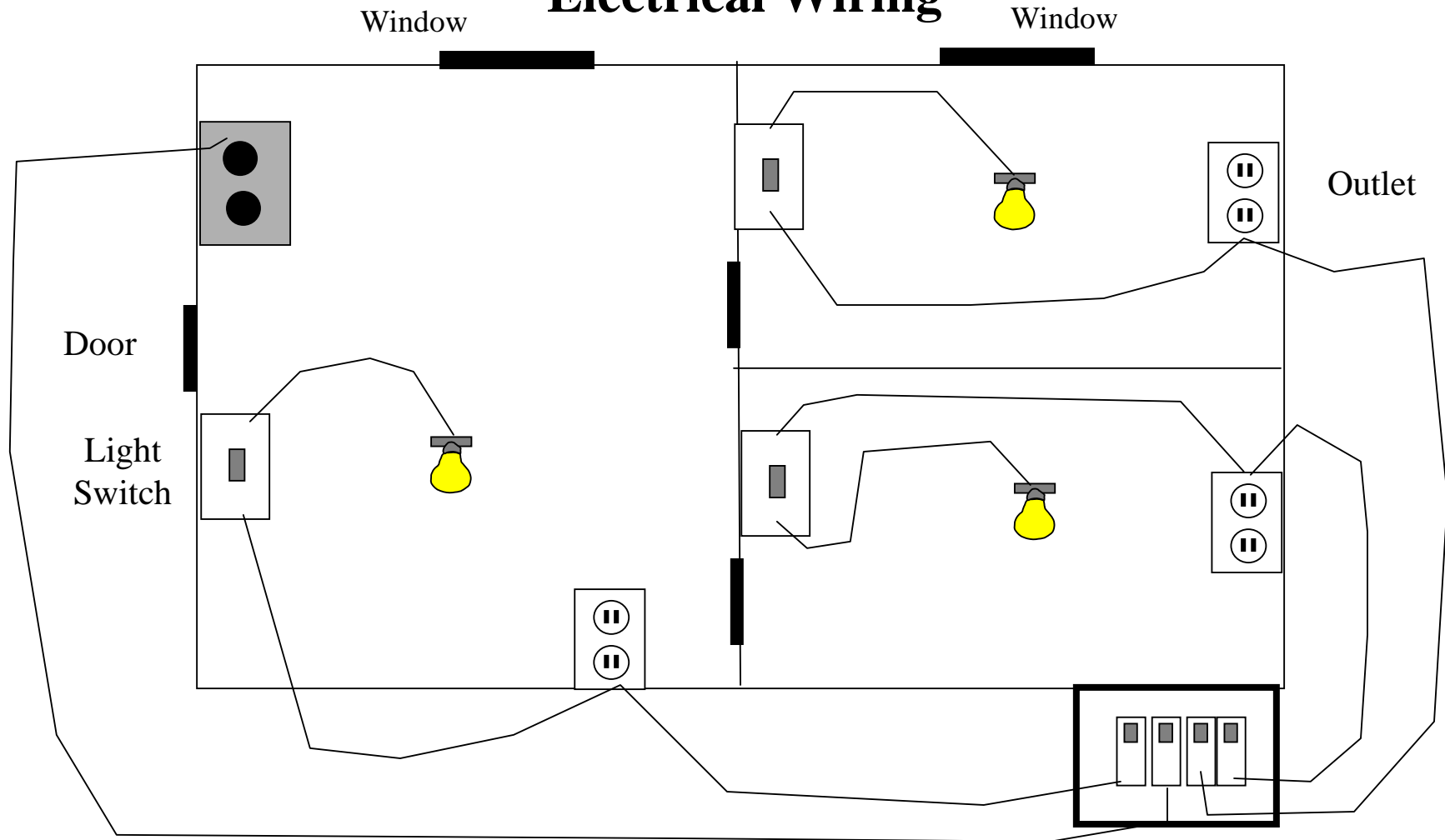


In room, draw electrical outlets, switches, and lights. Also show doors and windows.

3 m
50 m

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Electrical Wiring



In room, draw electrical outlets, switches, and lights. Also show doors and windows.

3 m
50 m