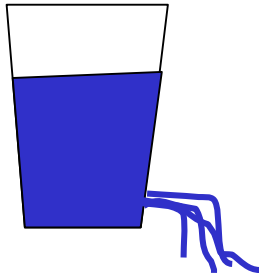


Electricity Merit Badge

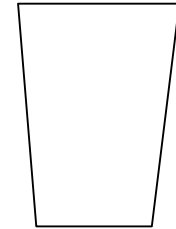
DC

Direct Current



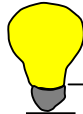
Glass of Water has Force called pressure

Direct Current

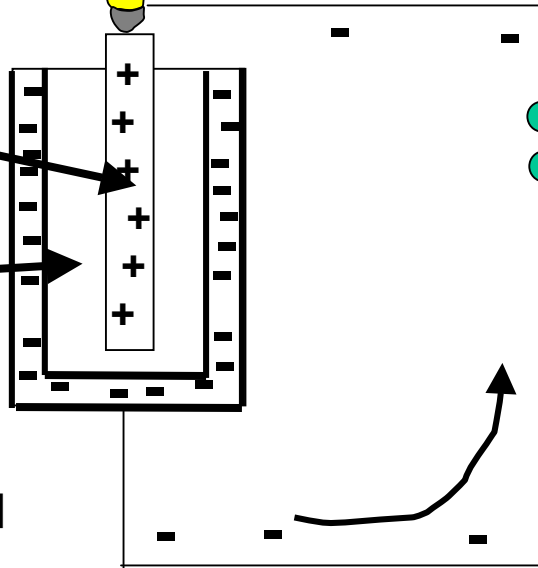


Empty Glass Has no Force

Flashlight



Carbon Rod
Gel Insulator
Zinc Casing

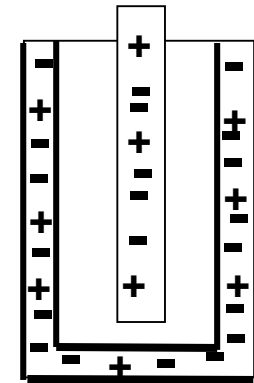


Switch

Battery works from a chemical reaction between the carbon rod and zinc case

Charged Battery
1.5 volts

Current Flow **Electrons**



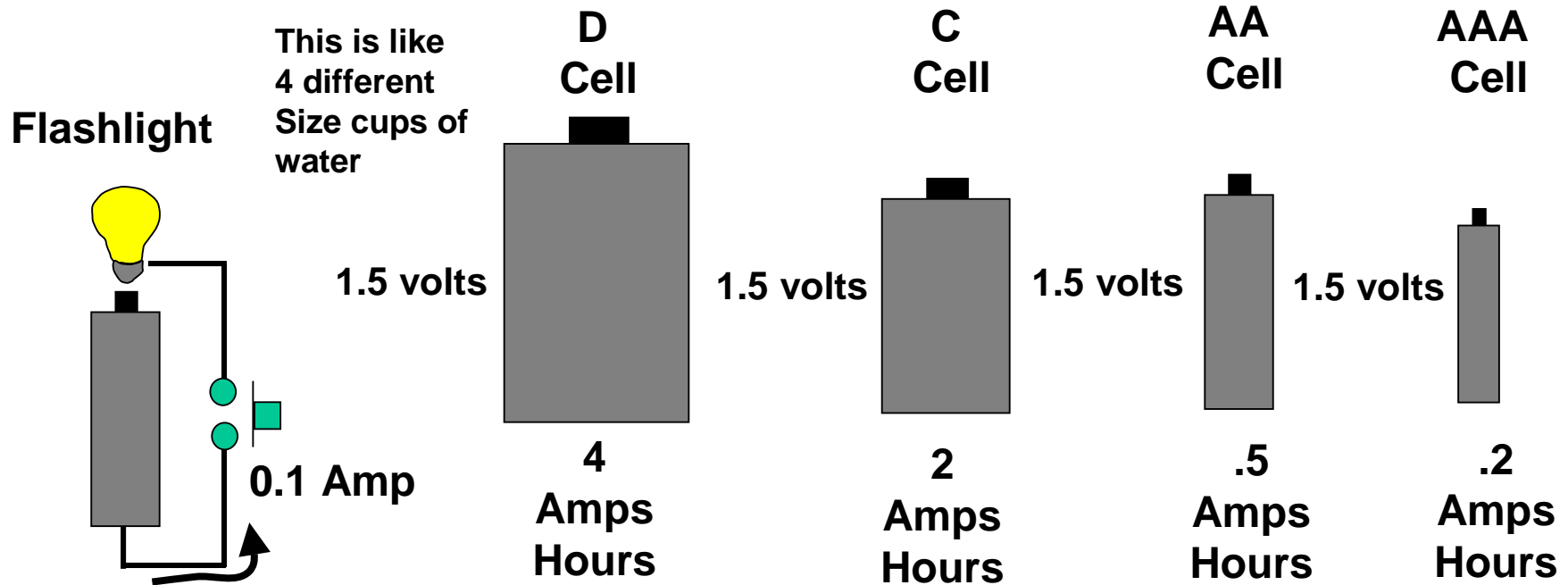
Dis-Charged Battery
No Voltage

Voltage is the quantity of electrical force Measured in Volts
 Current is the flow of electrons Measured in Amps
 DC Stand for Direct Current
 DC is current flowing in one direction

Direct Current

Pass out

Typical Battery Rating - How Long will they Last



If a flashlight pulls .1 Amp, how long will each battery last?

Time = Amp Hours / Load in Amps

D cell = $\frac{\text{Amp Hours}}{\text{Amps}}$ = _____ = _____ hours

C cell = $\frac{\text{Amp Hours}}{\text{Amps}}$ = _____ = _____ hours

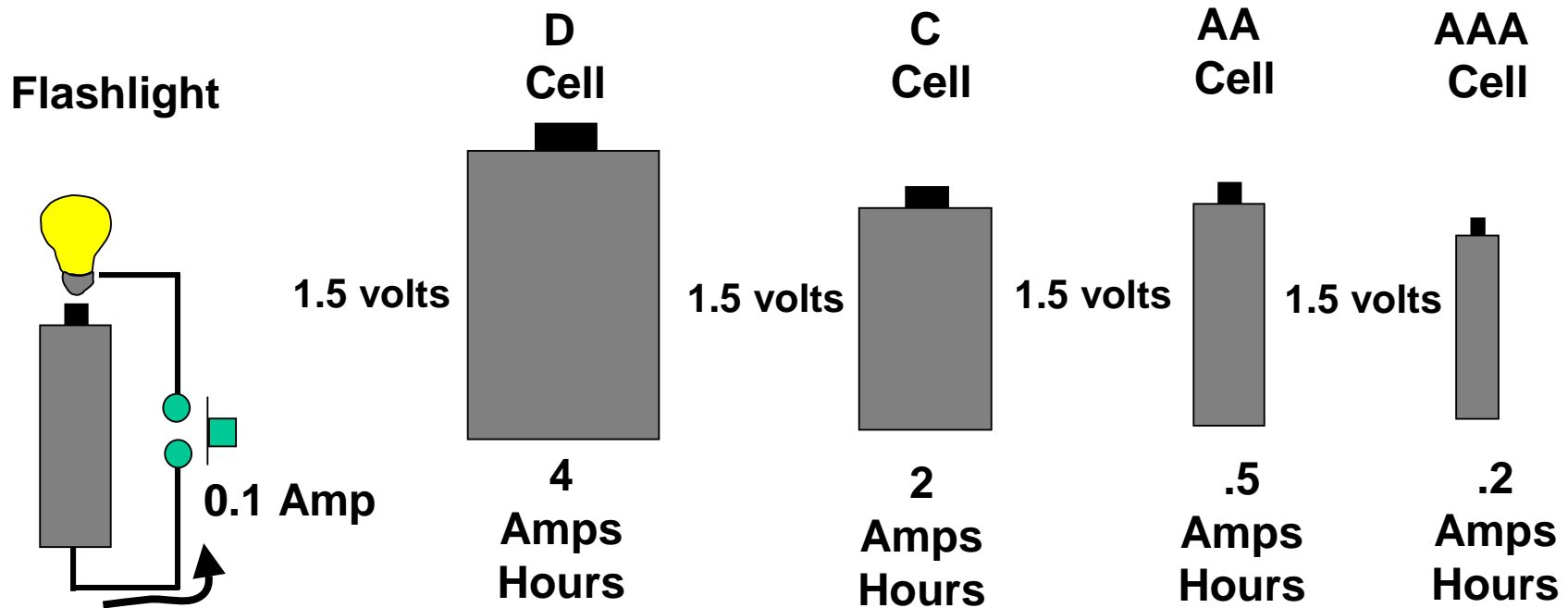
AA cell = $\frac{\text{Amp Hours}}{\text{Amps}}$ = _____ = _____ hours

AAA cell = $\frac{\text{Amp Hours}}{\text{Amps}}$ = _____ = _____ hours

2m
5m

Direct Current

Battery Types How Long will they Last



If a flashlight pulls .1 Amp, how long will each battery last?

Time = Amp Hours / Load in Amps

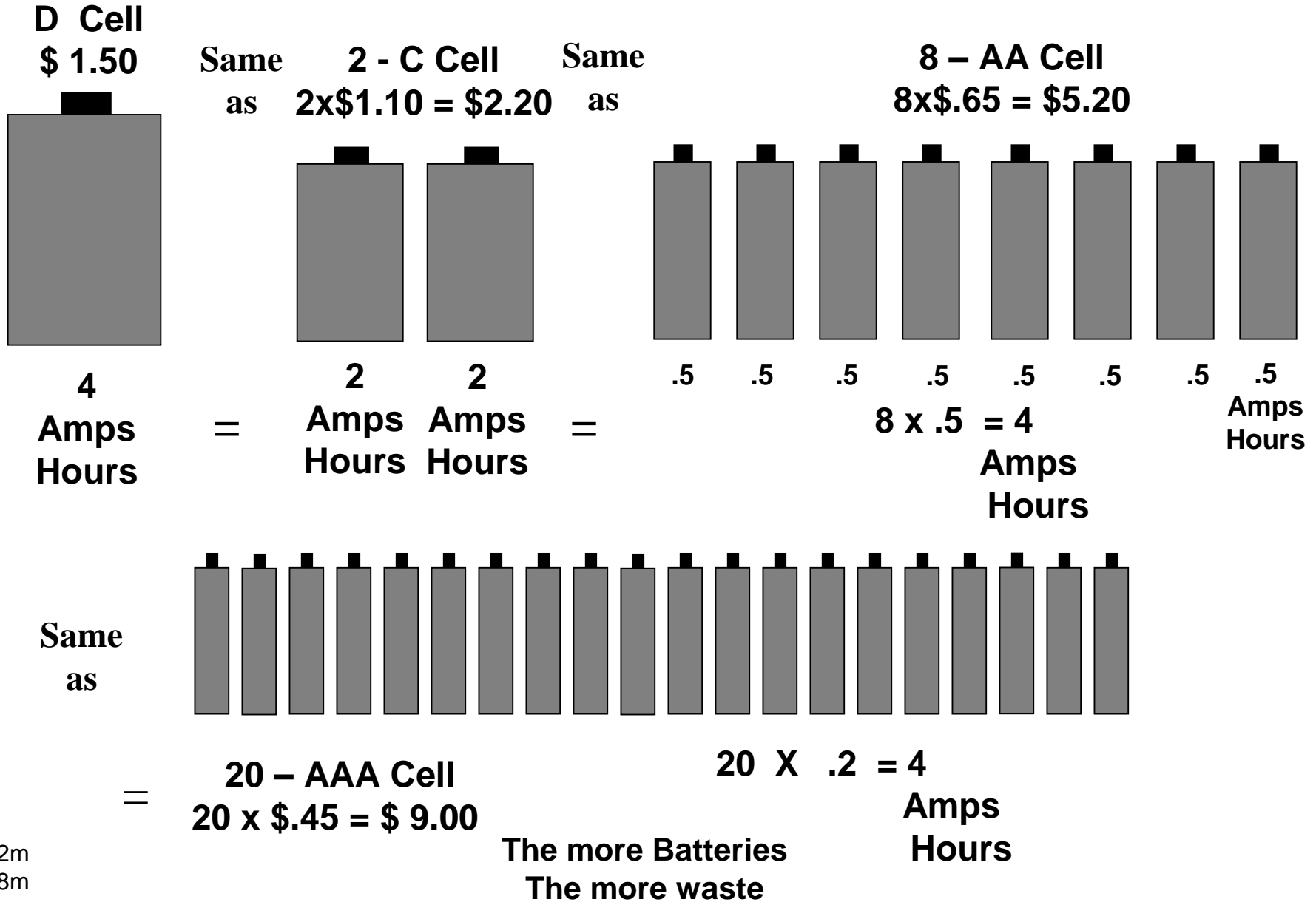
$$\text{D cell} = \frac{\text{Amp Hours}}{\text{Amps}} = \frac{4}{.1} = 40 \text{ hours}$$

$$\text{C cell} = \frac{\text{Amp Hours}}{\text{Amps}} = \frac{2}{.1} = 20 \text{ hours}$$

$$\text{AA cell} = \frac{\text{Amp Hours}}{\text{Amps}} = \frac{.5}{.1} = 5 \text{ hours}$$

$$\text{AAA cell} = \frac{\text{Amp Hours}}{\text{Amps}} = \frac{.2}{.1} = 2 \text{ hours}$$

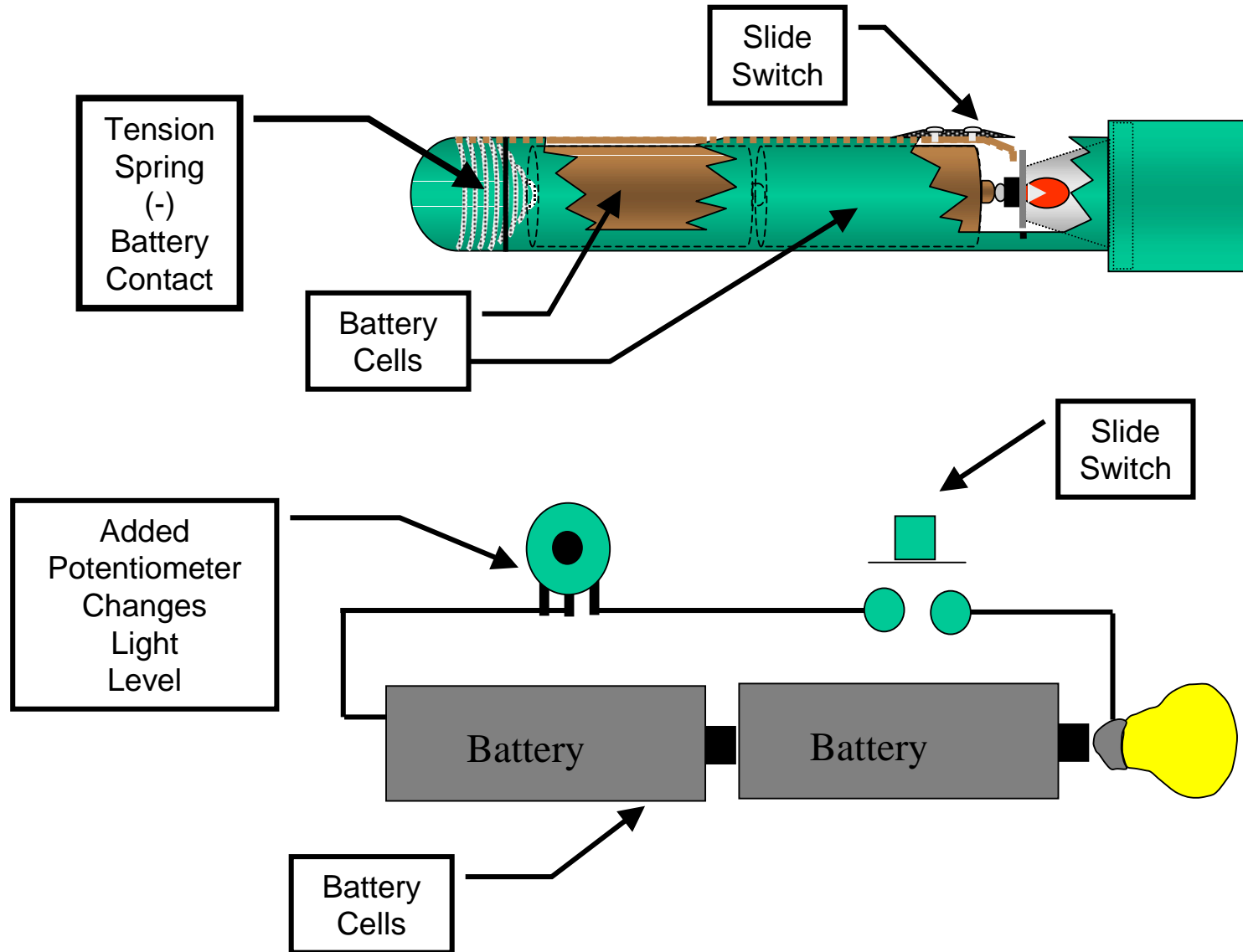
Direct Current Cost of Batteries for the Same Output



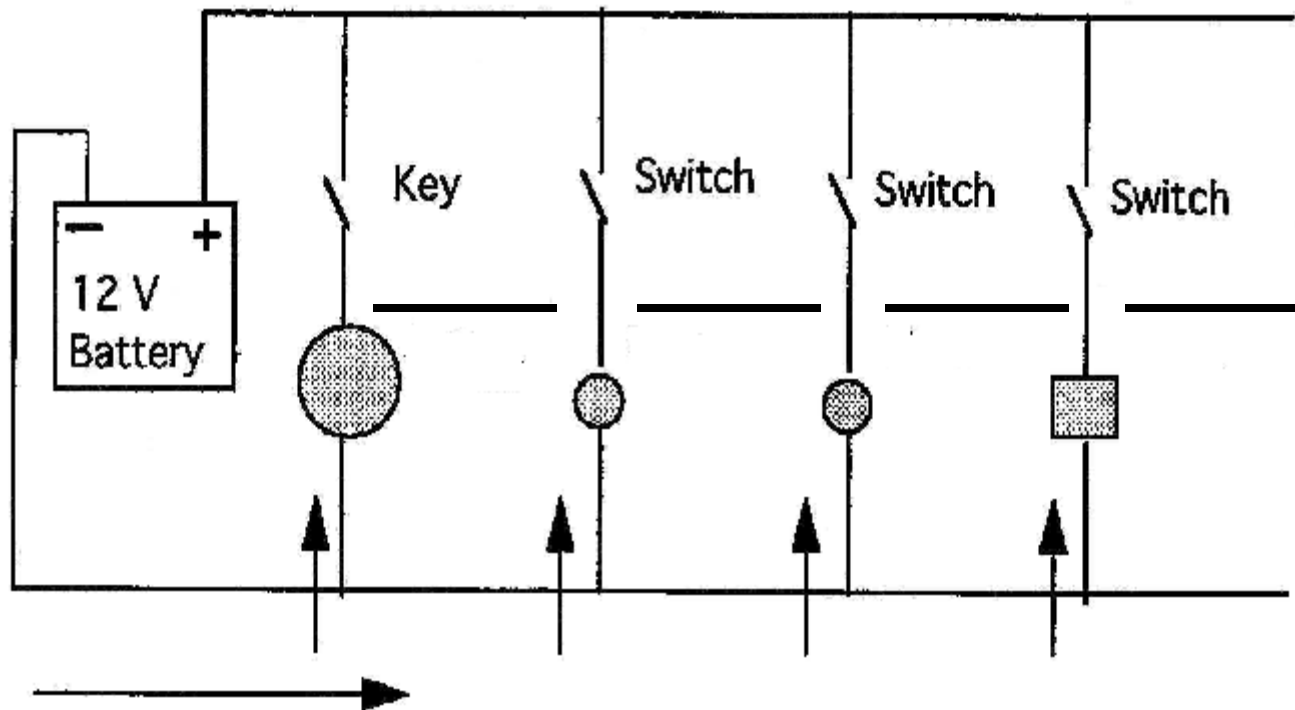
Many Battery Types

- **Zinc-carbon battery** - Also known as a **standard carbon** battery, zinc-carbon chemistry is used in all inexpensive AA, C and D dry-cell batteries. The electrodes are zinc and carbon, with an acidic paste between them that serves as the electrolyte.
- **Alkaline battery** - Used in common Duracell and Energizer batteries, the electrodes are zinc and manganese-oxide, with an alkaline electrolyte.
- **Lithium photo battery** - Lithium, lithium-iodide and lead-iodide are used in cameras because of their ability to supply power surges
- **Lead-acid battery** - Used in automobiles, the electrodes are made of lead and lead-oxide with a strong acidic electrolyte (rechargeable).
- **Nickel-cadmium battery** - The electrodes are nickel-hydroxide and cadmium, with potassium-hydroxide as the electrolyte (rechargeable).
- **Nickel-metal hydride battery** - This battery is rapidly replacing nickel-cadmium because it does not suffer from the memory effect that nickel-cadmiums do (rechargeable).
- **Lithium-ion battery** - With a very good power-to-weight ratio, this is often found in high-end laptop and cell phones (rechargeable).
- **Zinc-air battery** - This battery is lightweight and rechargeable.
- **Zinc-mercury oxide battery** - This is often used in hearing-aids.
- **Silver-zinc battery** - This is used in aeronautical applications because the power-to-weight ratio is good.
- **Metal-chloride battery** - This is used in electric vehicles

Flashlight Diagram



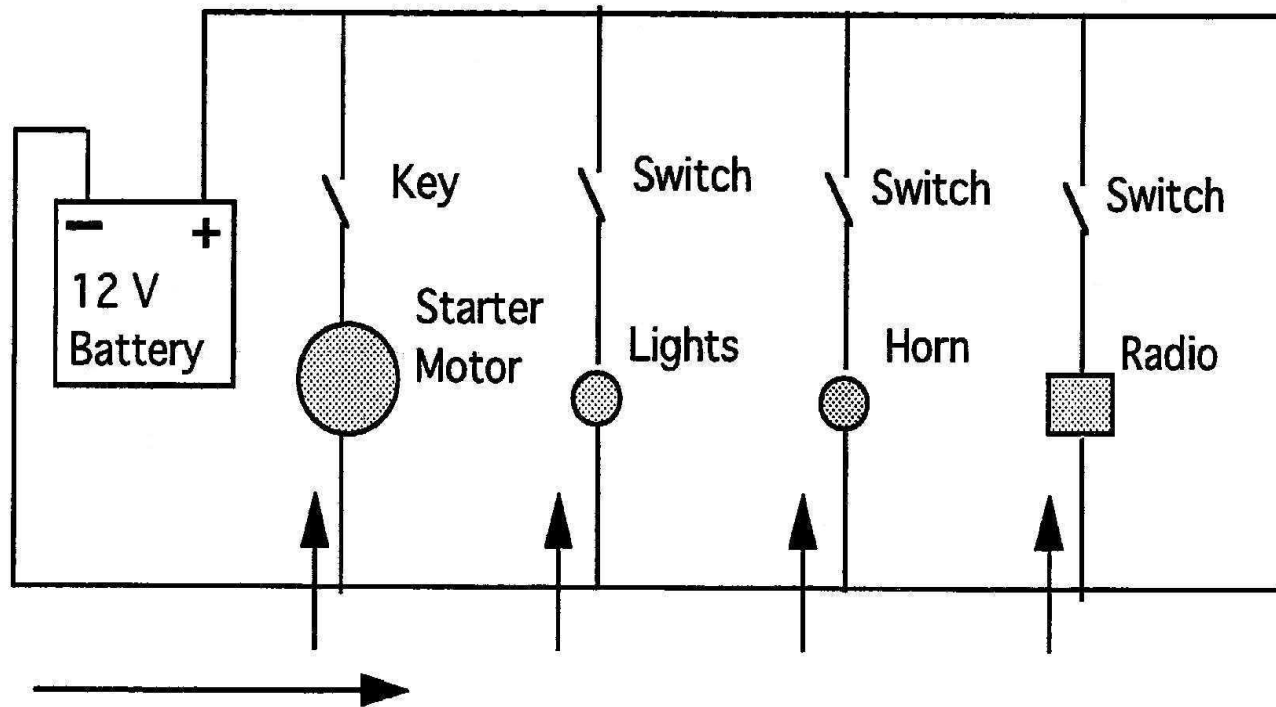
Car DC Electrical System



Name four electrical items in a car

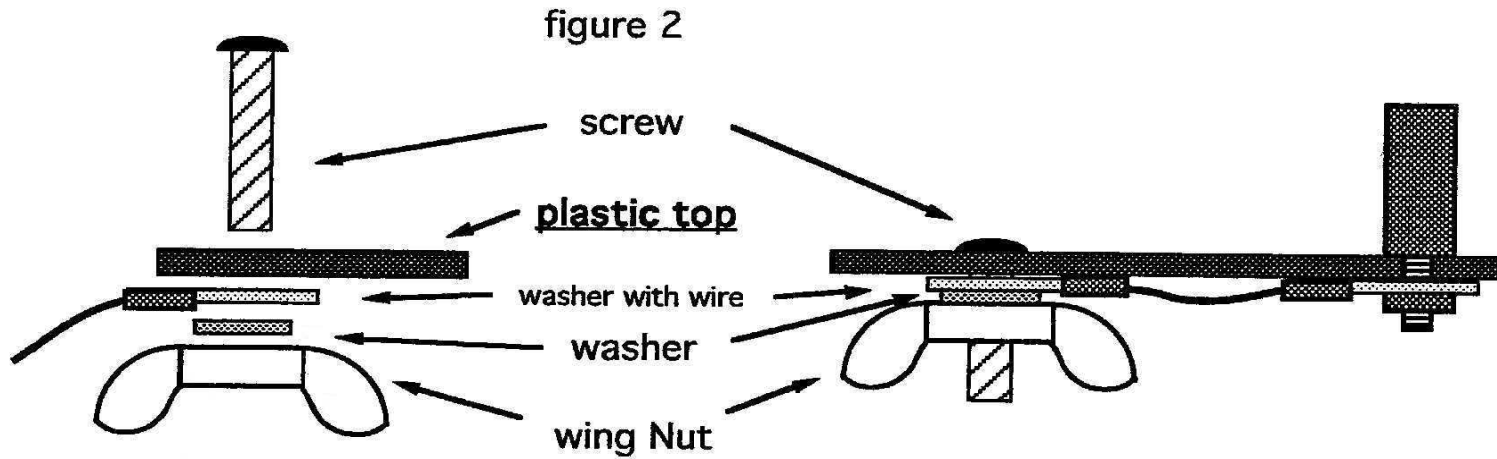
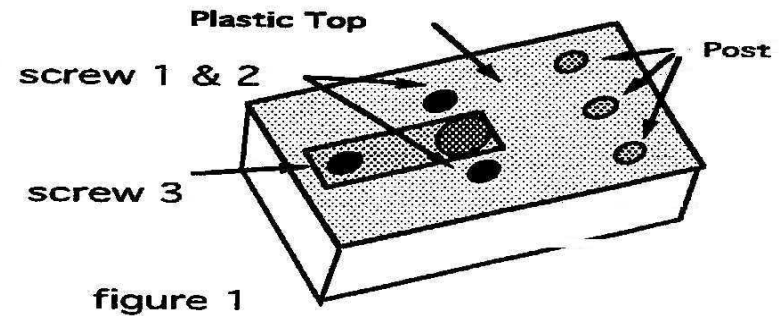
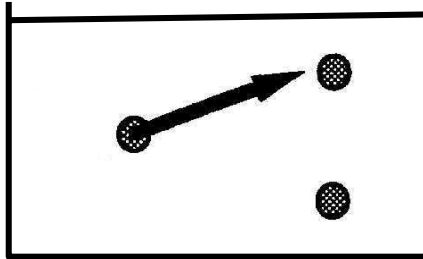
1 m
12 m

Car DC Electrical System

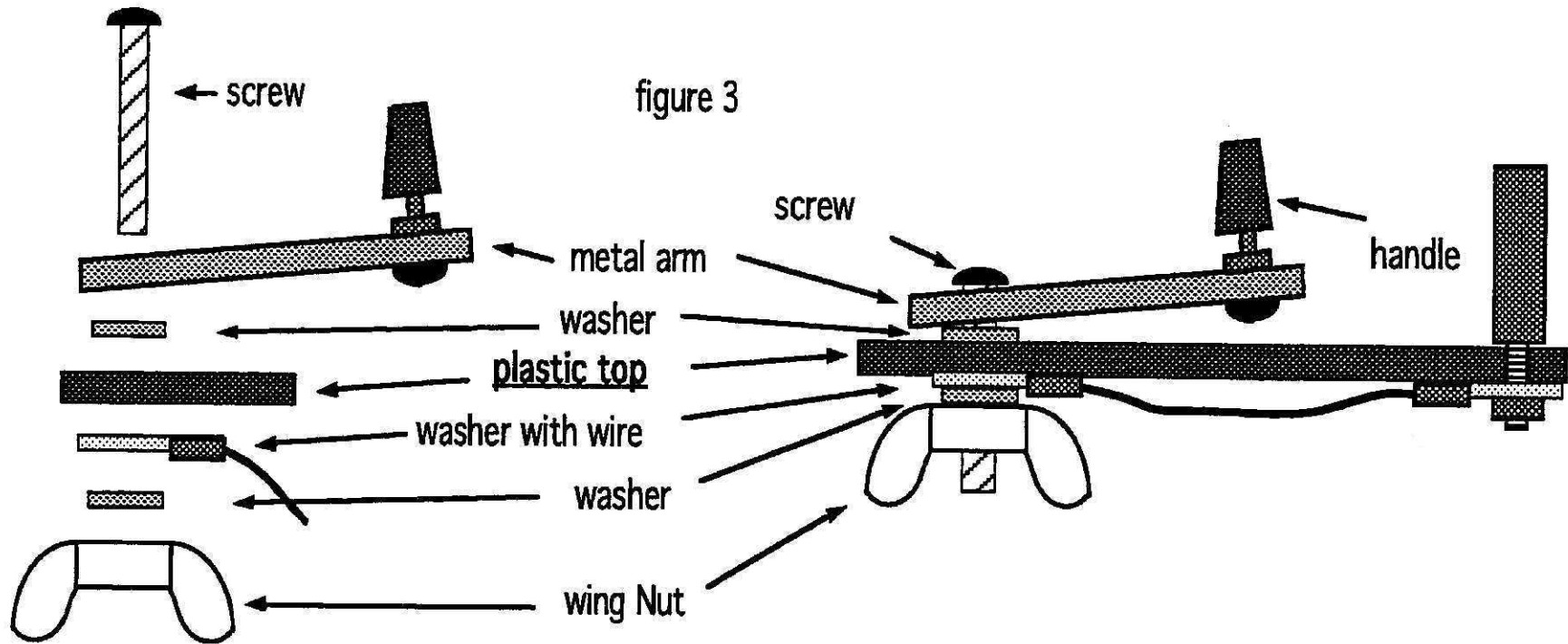


1 m
12 m

Build an Electrical Switch



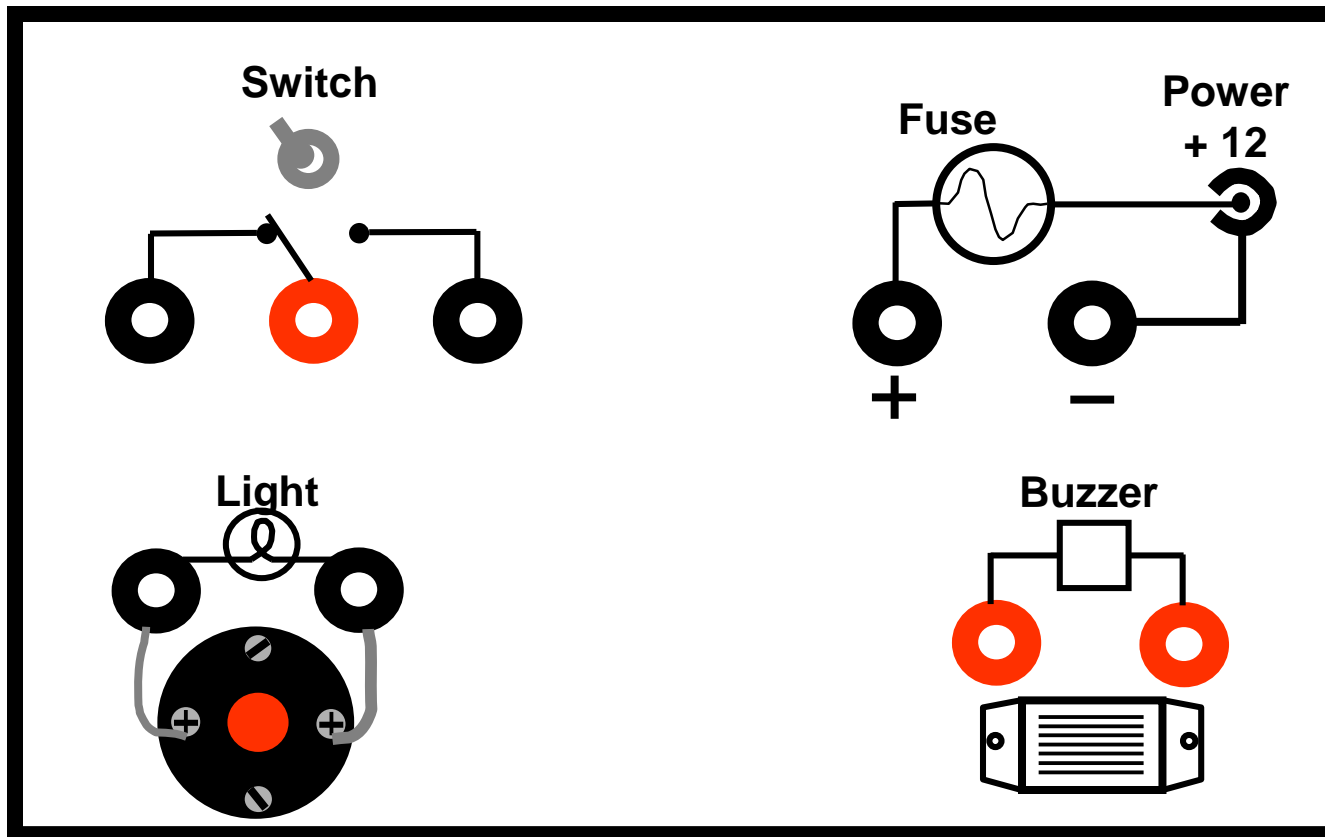
Build an Electrical Switch



5 m
18 m

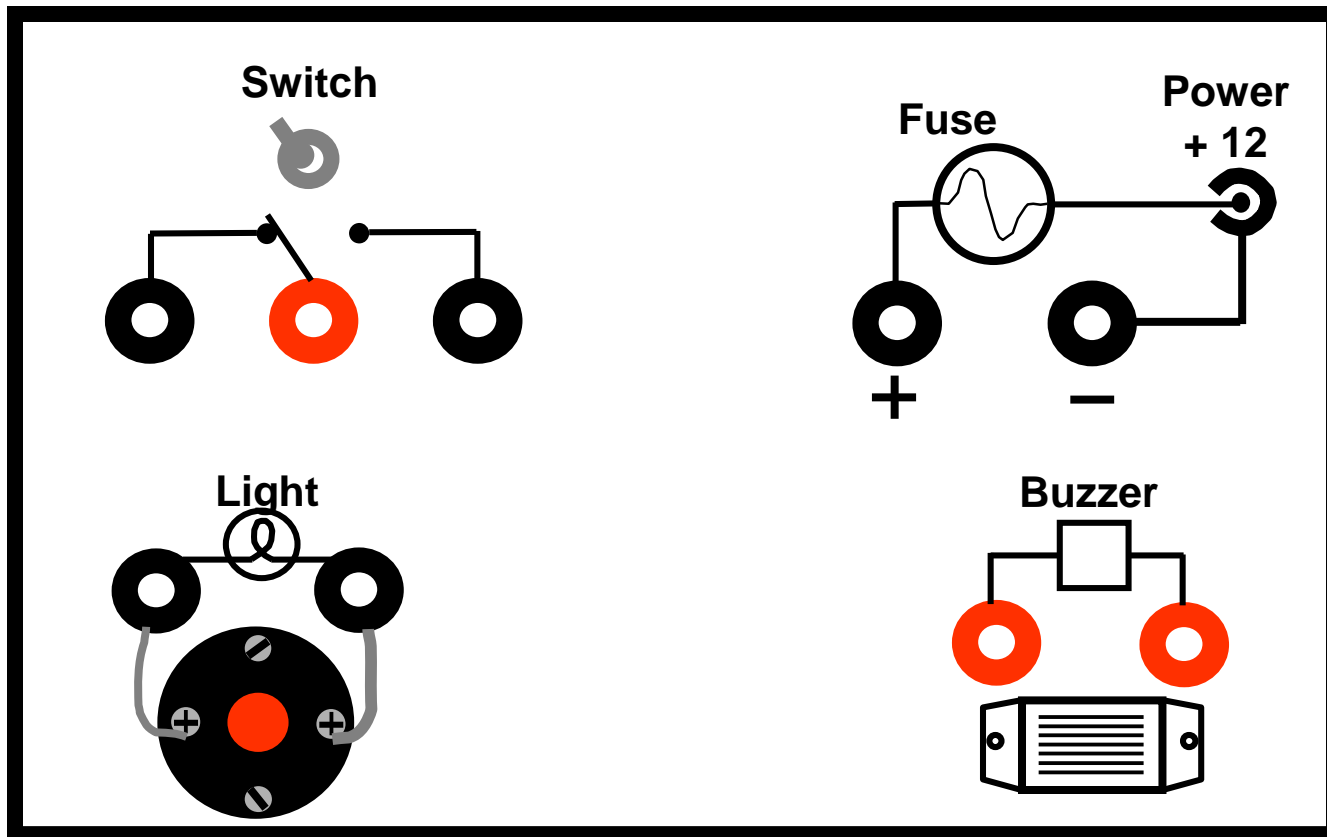
Direct Current Test Box

Draw 4 different wiring test circuits, then pass out boxes.



Direct Current Test Box

Draw Circuit to Switch Buzzer On / Off - Instructor draws this one first

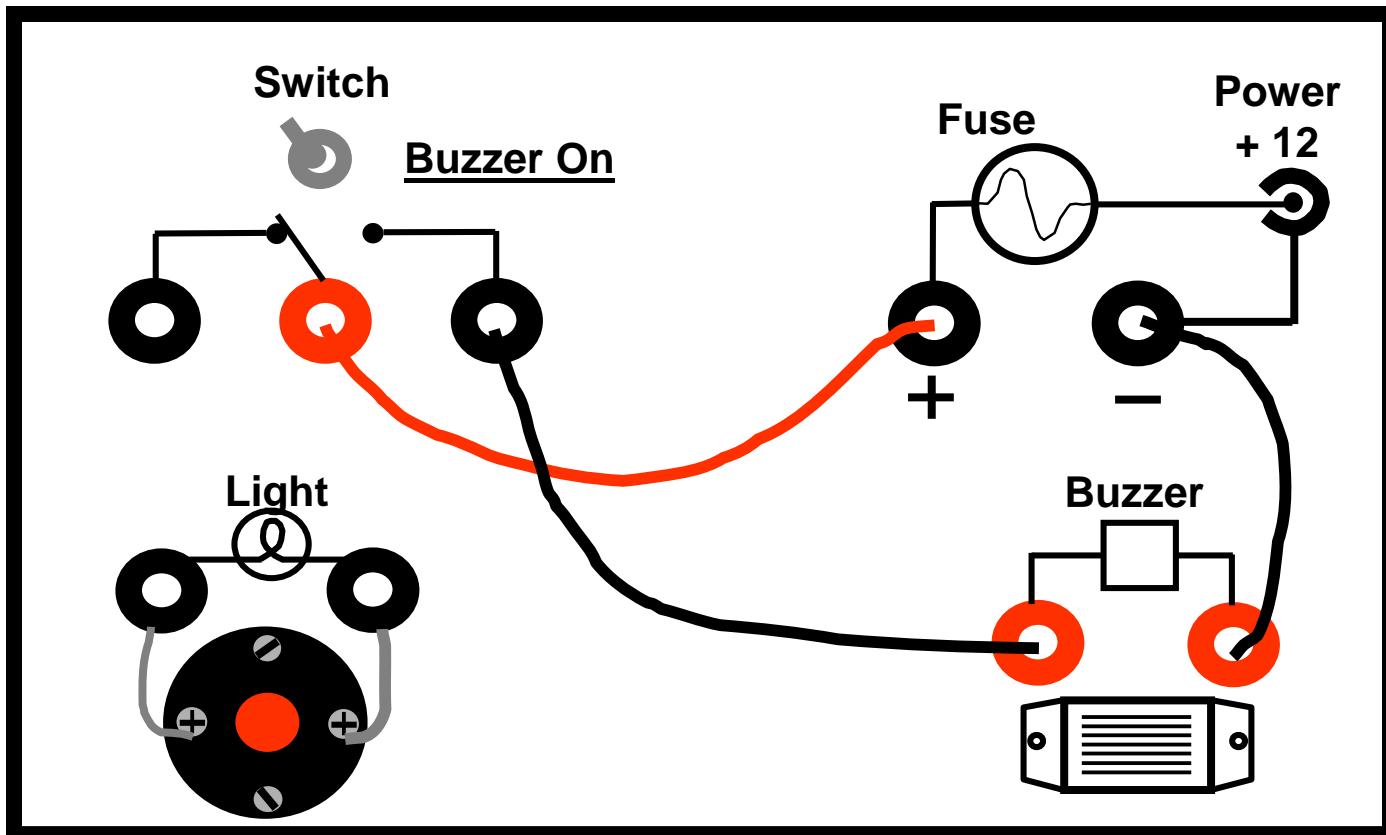


1 m
20 m

Instructor _____

Direct Current Test Box

Draw Circuit to Switch Buzzer On / Off - Instructor draws this one first

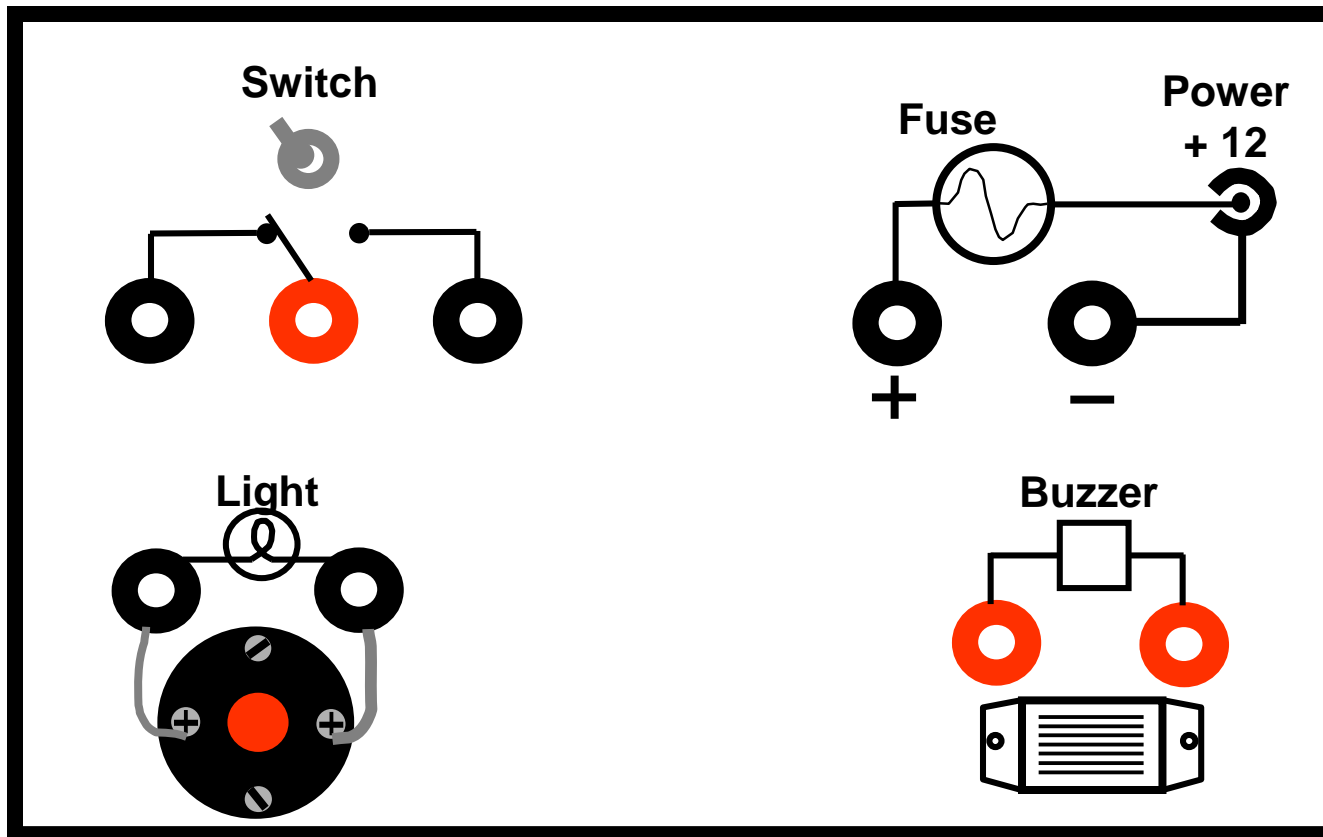


1 m
21 m

Instructor _____

Direct Current Test Box

Draw Circuit to Switch Light On / Off

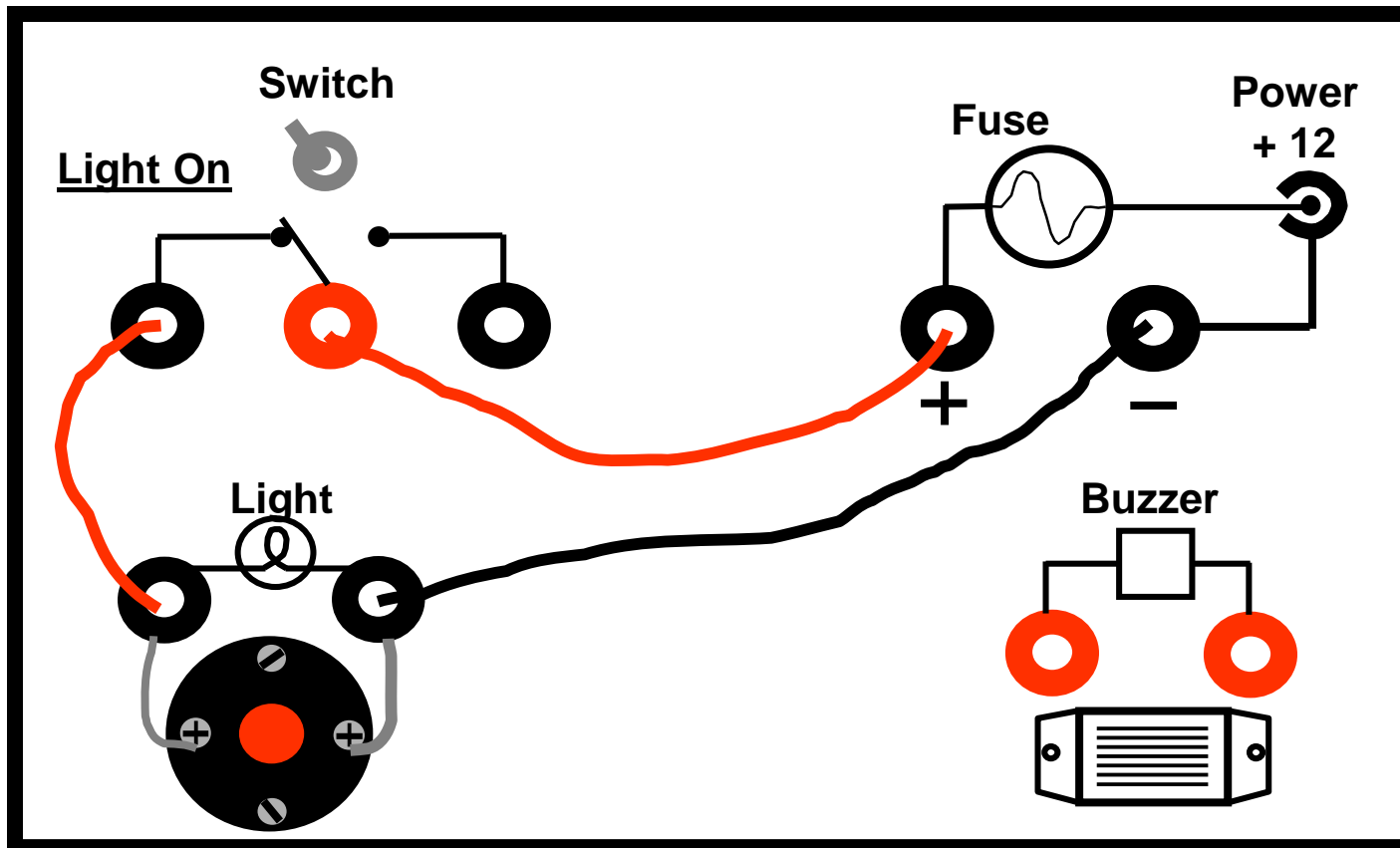


1 m
22 m

Instructor _____

Direct Current Test Box

Draw Circuit to Switch Light On / Off

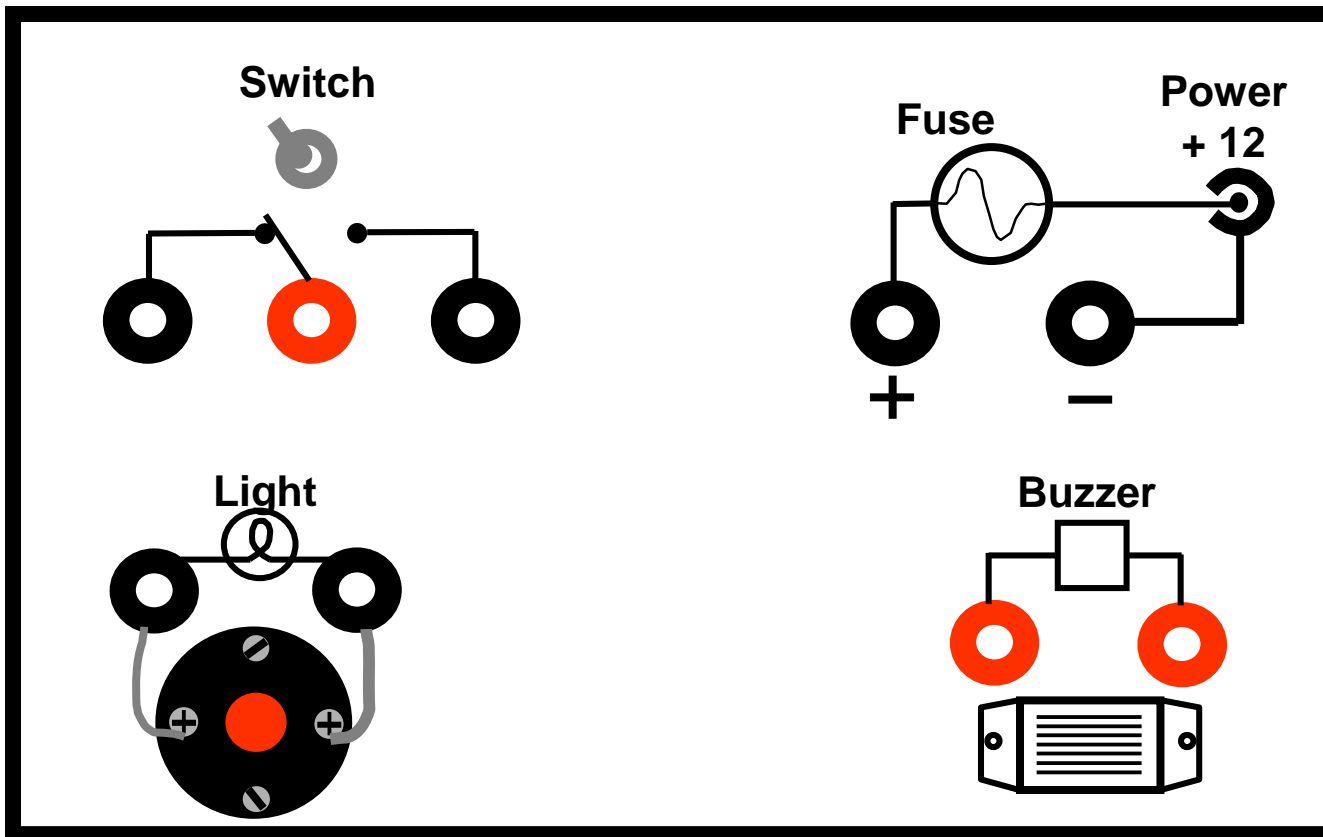


1 m
23 m

Instructor _____

Direct Current

Draw Circuit to Turn Buzzer on in one Direction and Light in other Direction

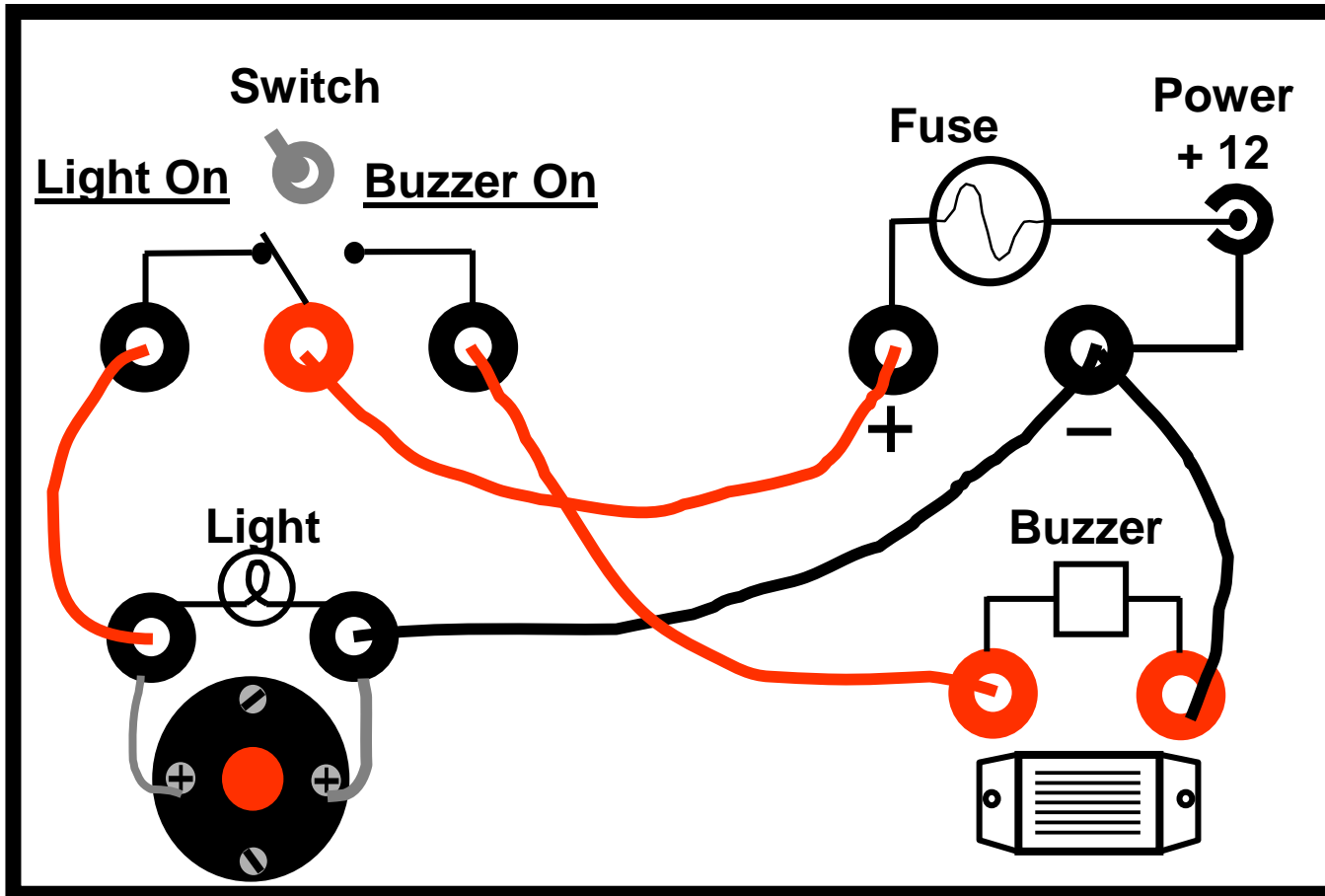


1 m
24 m

Instructor _____

Direct Current

Draw Circuit to Turn Buzzer on in one Direction and Light in other Direction

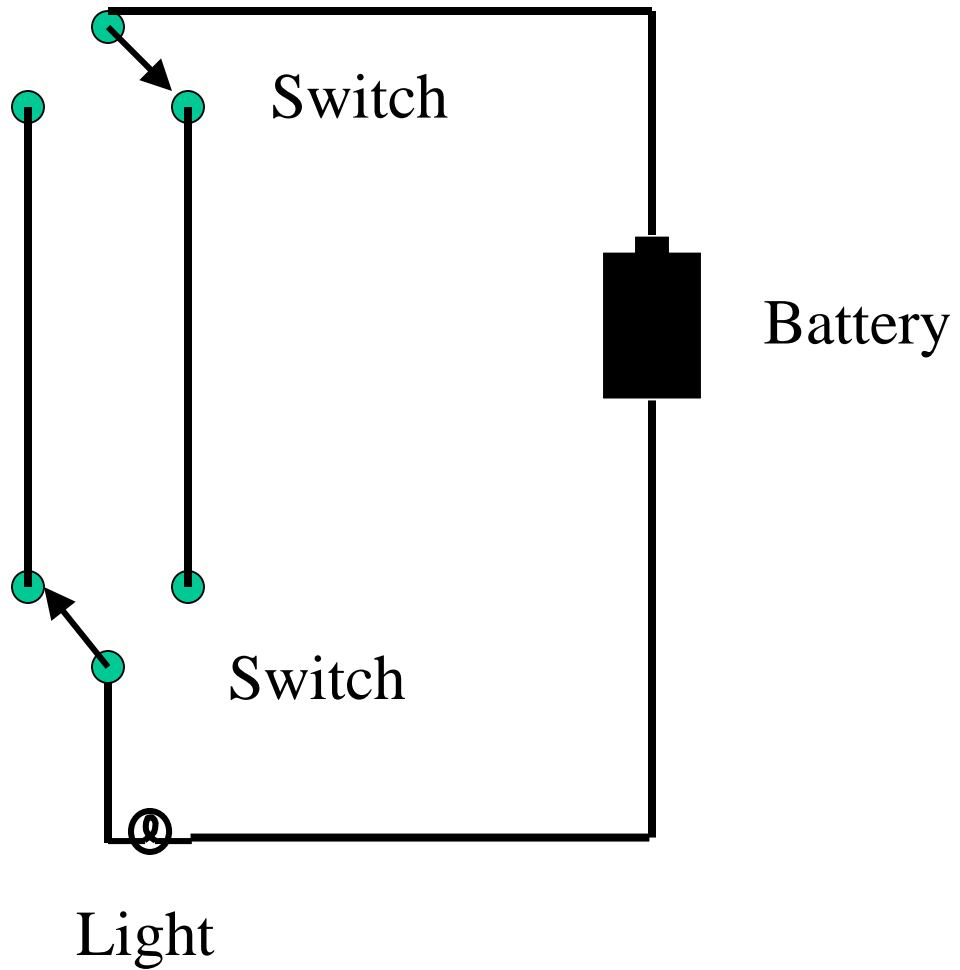


1 m
25 m

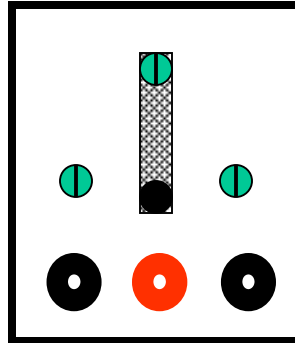
Instructor _____

Two Switches Control One Light

Two different
Light Switches
Control one Light

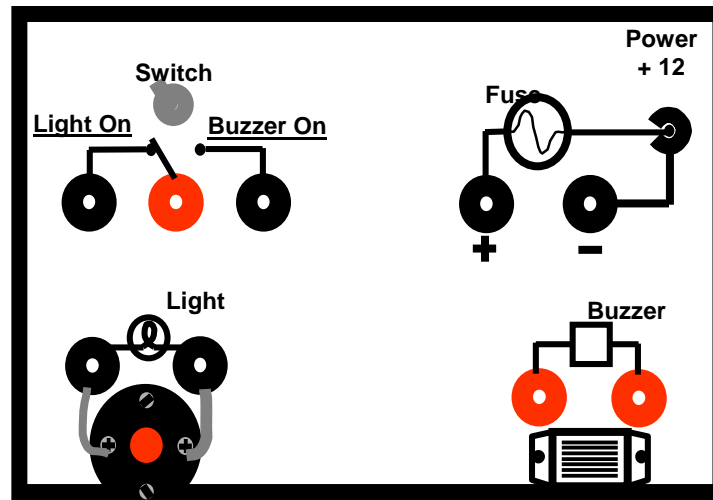


Draw a Circuit with Two Switch External Switch and On-board Switch



When complete dismantle switch box and put all components back into its box.

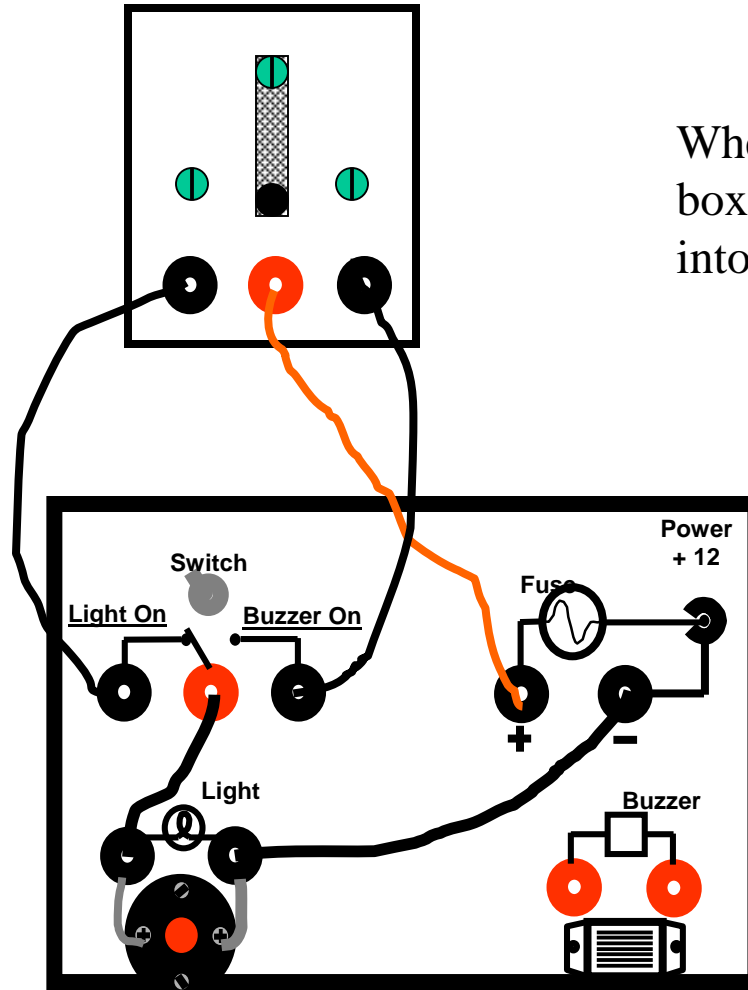
Turn Light on



1 m
27 m

Pass out boxes, connect 4 test circuits Instructor _____

Draw a Circuit with Two Switch External Switch and On-board Switch



When complete dismantle switch box and put all components back into its box.

Turn Light on

1 m
28 m

20m
48m

Pass out boxes, connect 4 test circuits
Student work at own pace

Instructor _____