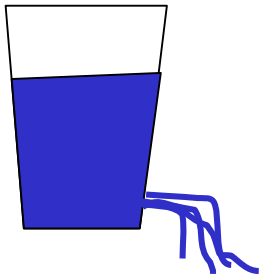
Electricity Merit Badge

DC

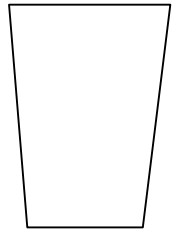
Direct Current

Student Copy

Direct Current

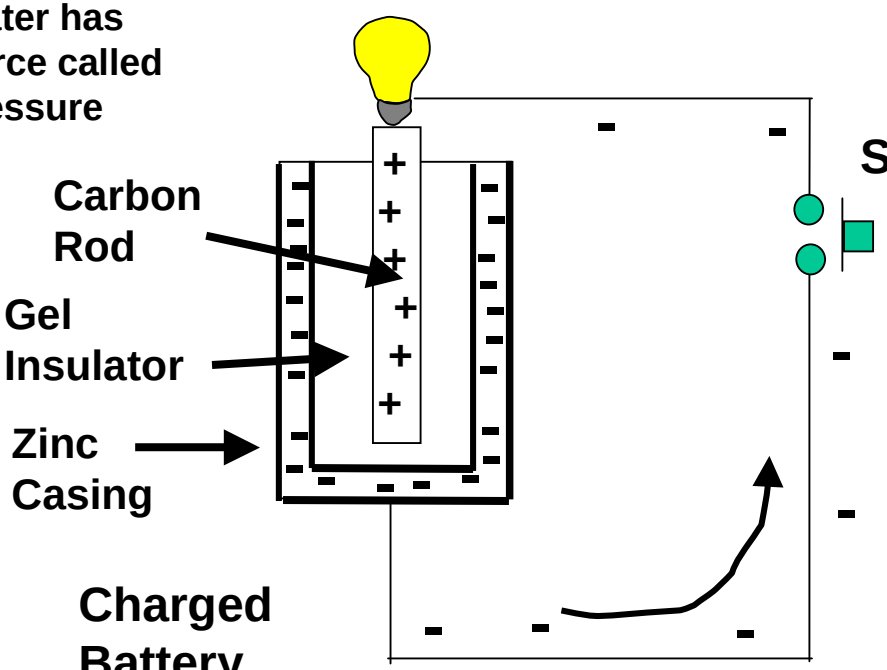


Glass of Water has Force called pressure

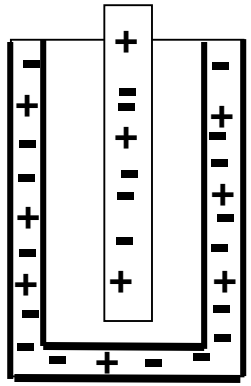


Empty Glass Has no Force

Flashlight



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



Dis-Charged Battery
No Voltage

Charged Battery
1.5 volts

Current Flow Electrons

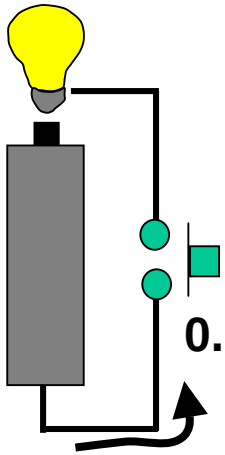
Voltage is the quantity of electrical force Measured in Volts
Current is the flow of ___electrons___ Measured in Amps
DC Stand for Direct Current
DC is current flowing in one direction

Direct Current

Pass out

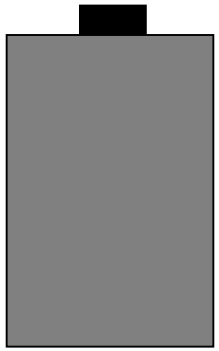
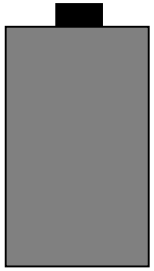
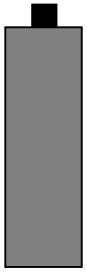
Typical Battery Rating - How Long will they Last

Flashlight



0.1 Amp

This is like 4 different Size cups of water

	D Cell	C Cell	AA Cell	AAA Cell
				
1.5 volts	1.5 volts	1.5 volts	1.5 volts	
	4 Amps Hours	2 Amps Hours	.5 Amps Hours	.2 Amps Hours

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

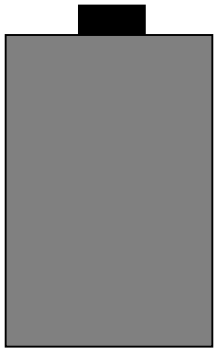
C cell = $\frac{\text{Amp Hours}}{\text{Amps}}$ = _____ = _____ hours

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

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

Direct Current
Cost of Batteries for the Same Output

D Cell
$ 1.50

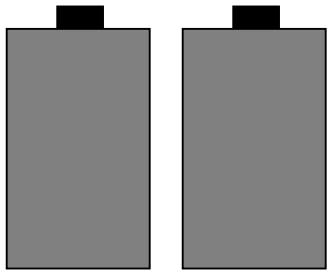


4 Amps Hours

=

Same as

2 - C Cell
2x$1.10 = $2.20

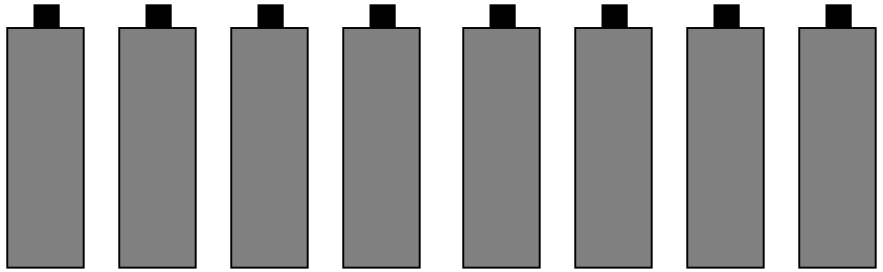


2 Amps Hours **2 Amps Hours**

=

Same as

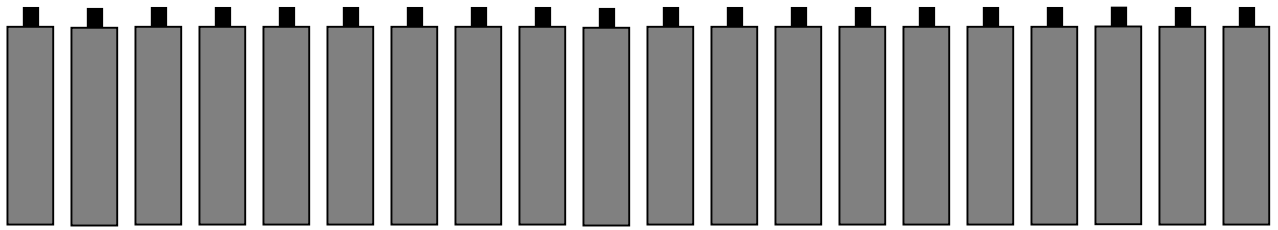
8 – AA Cell
8x$.65 = $5.20



.5 **.5** **.5** **.5** **.5** **.5** **.5** **.5 Amps Hours**

8 x .5 = 4 Amps Hours

Same as



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20 – AAA Cell
20 x $.45 = $ 9.00

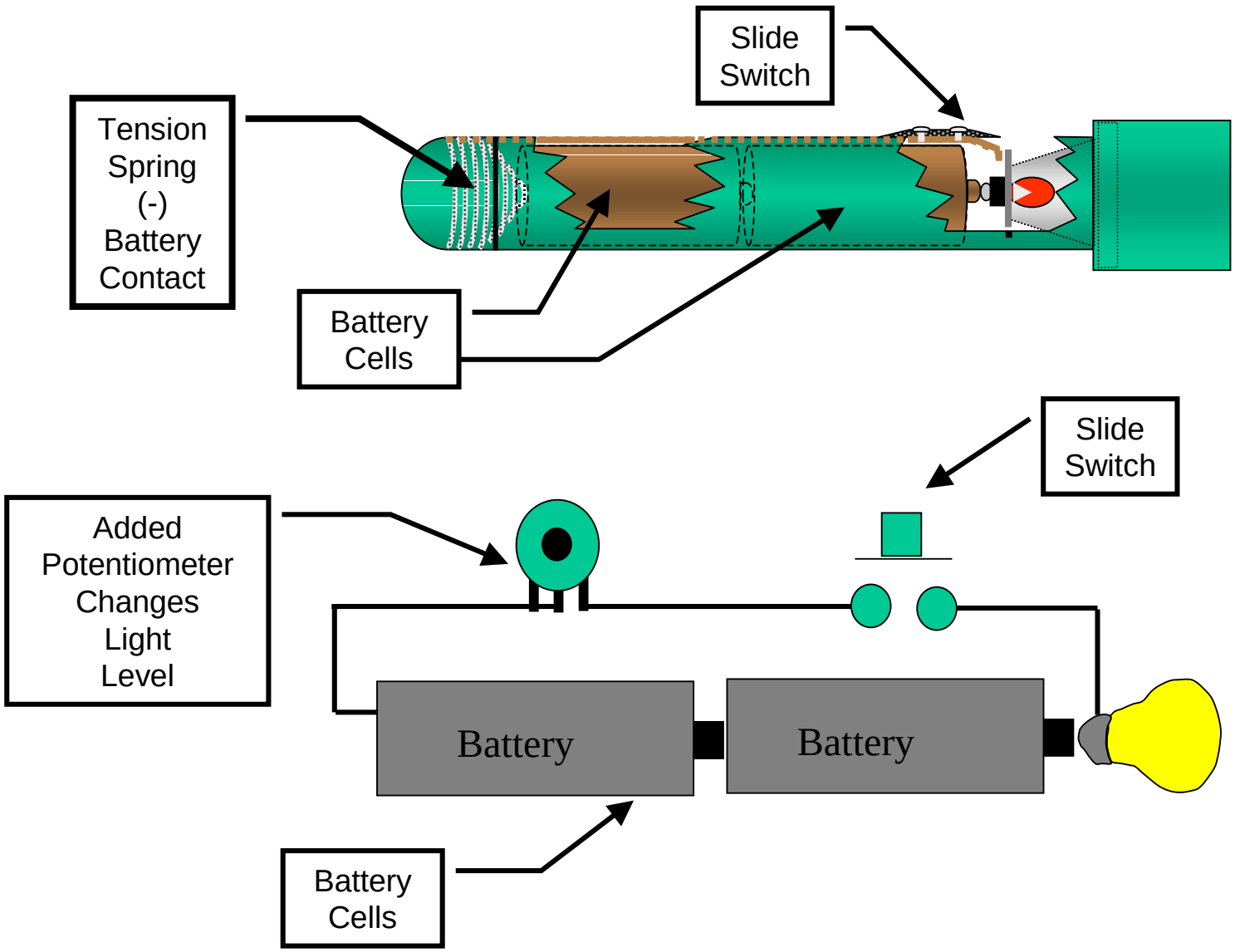
20 X .2 = 4 Amps Hours

The more Batteries
The more waste

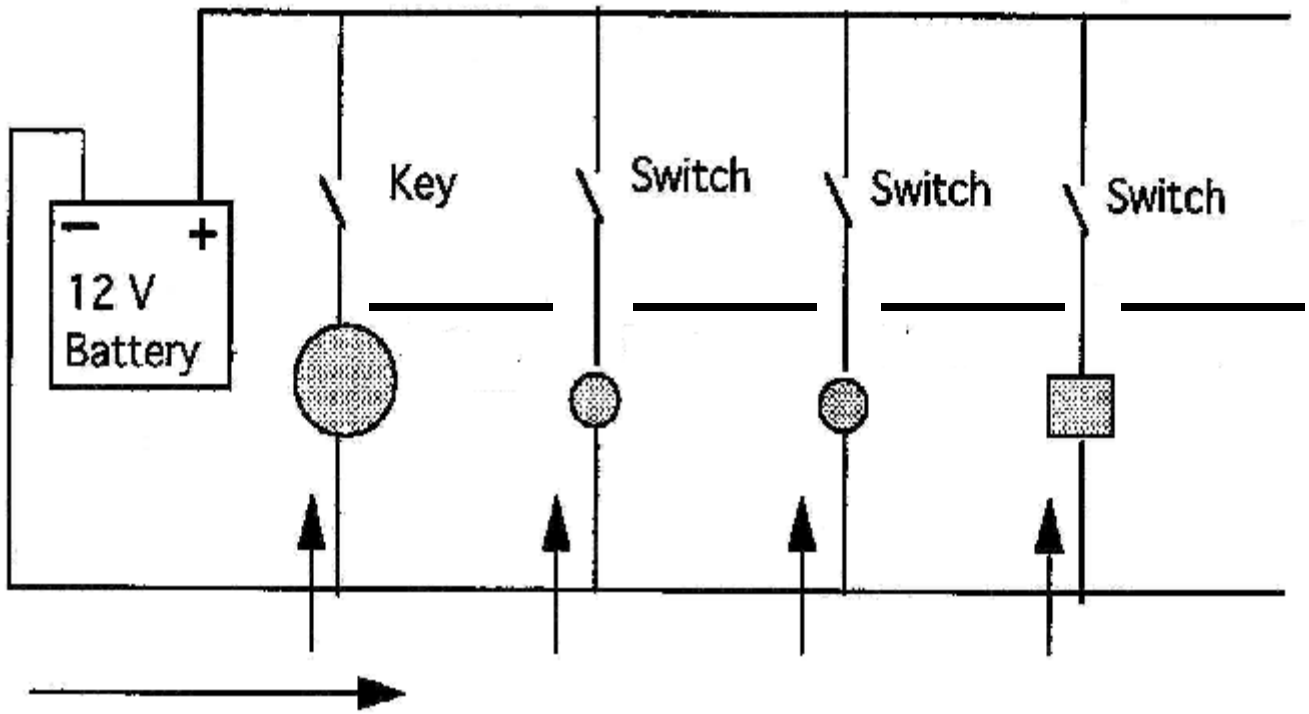
Many Battery Types

•**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

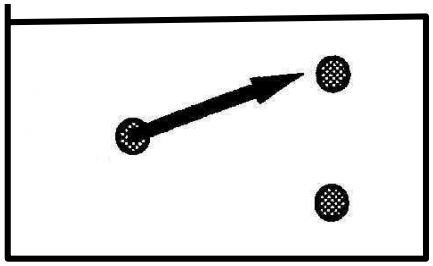


Car DC Electrical System



Name four electrical items in a car

Build an Electrical Switch



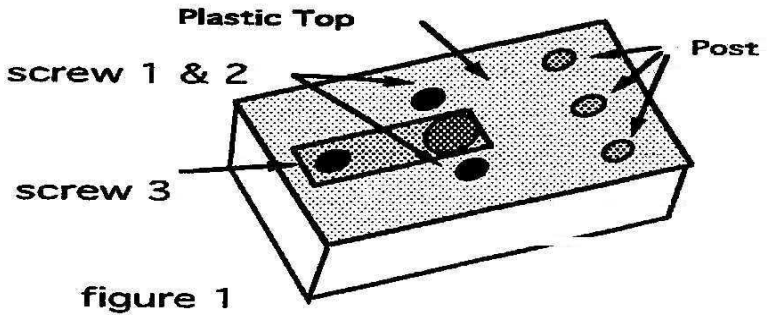
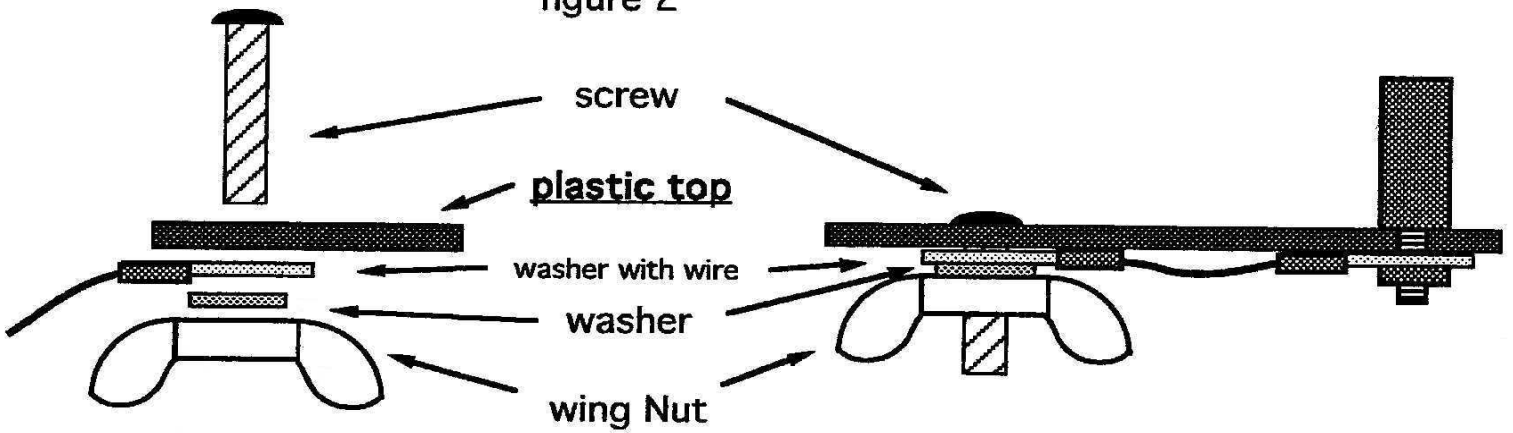
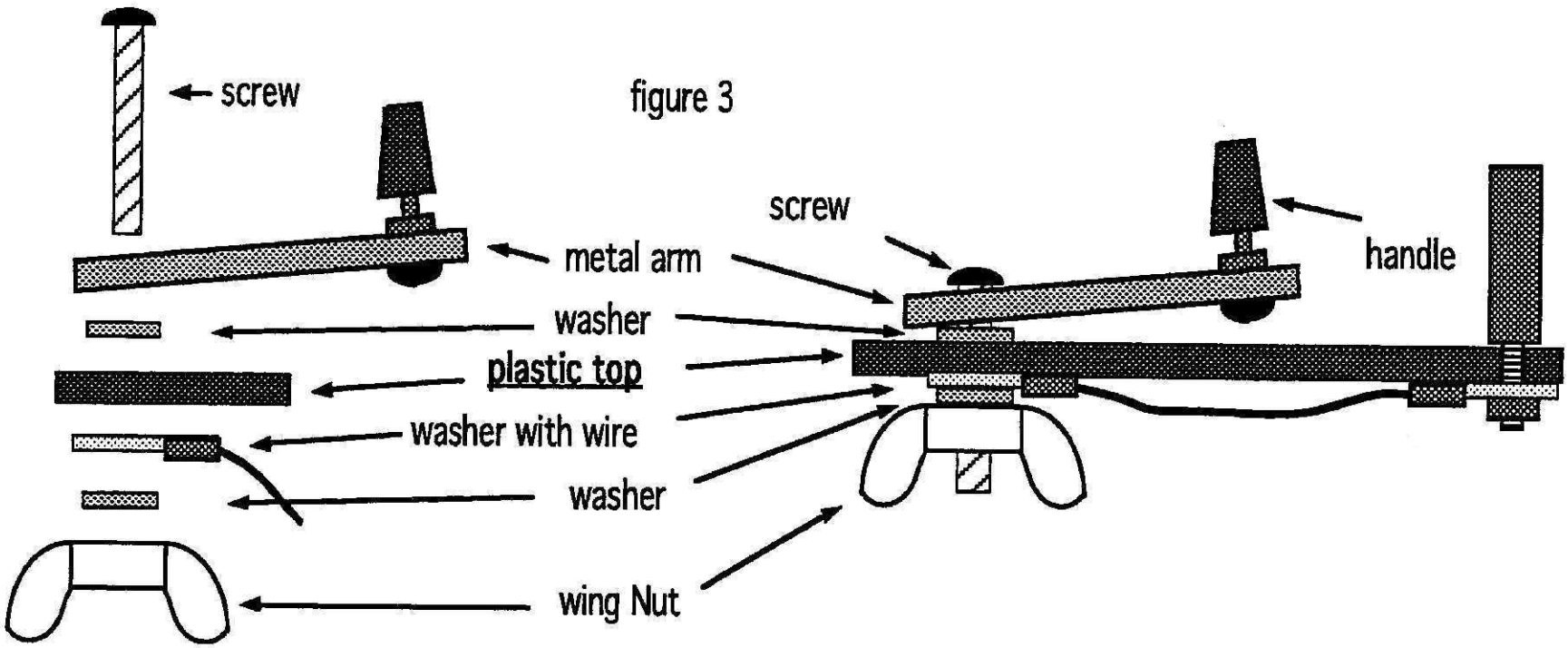


figure 1

figure 2

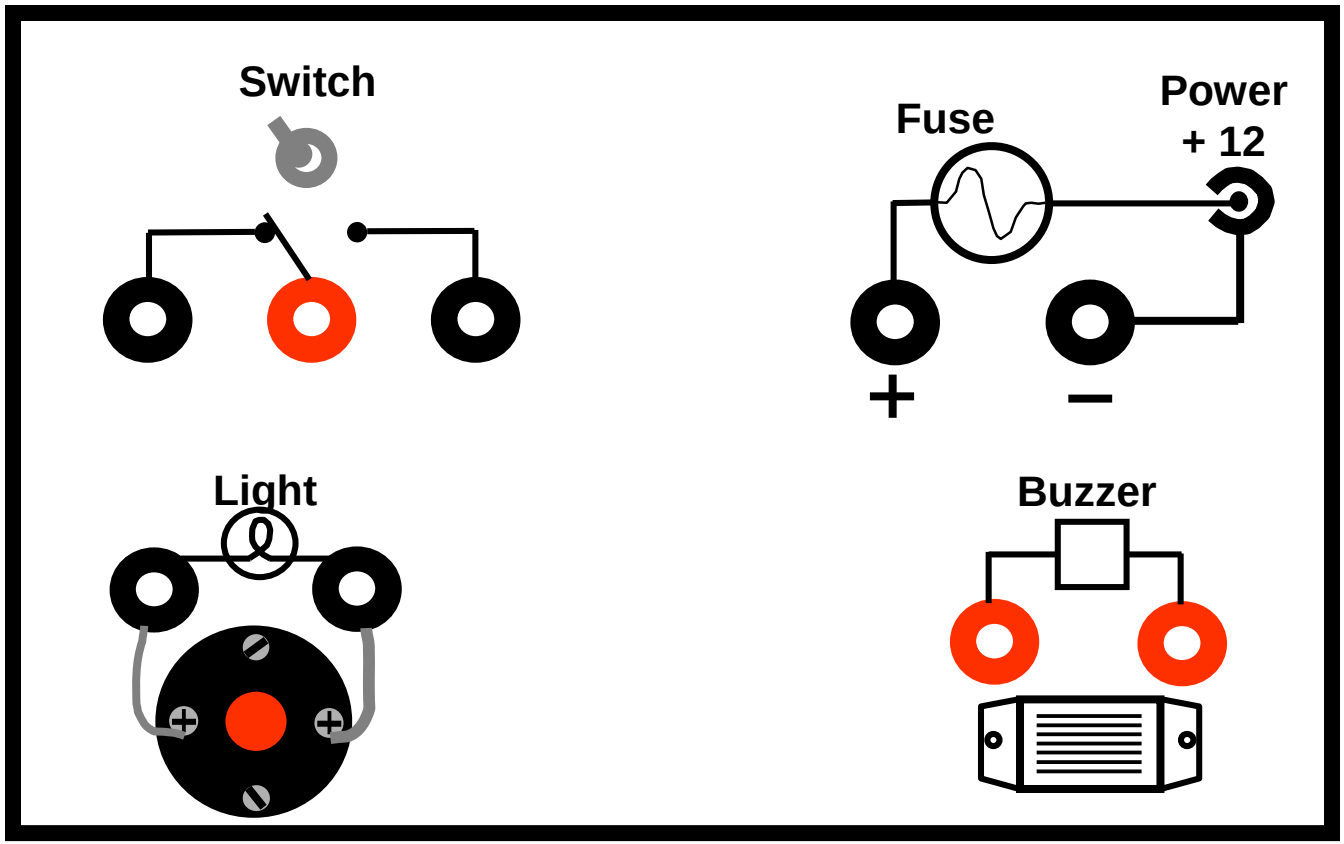


Build an Electrical Switch



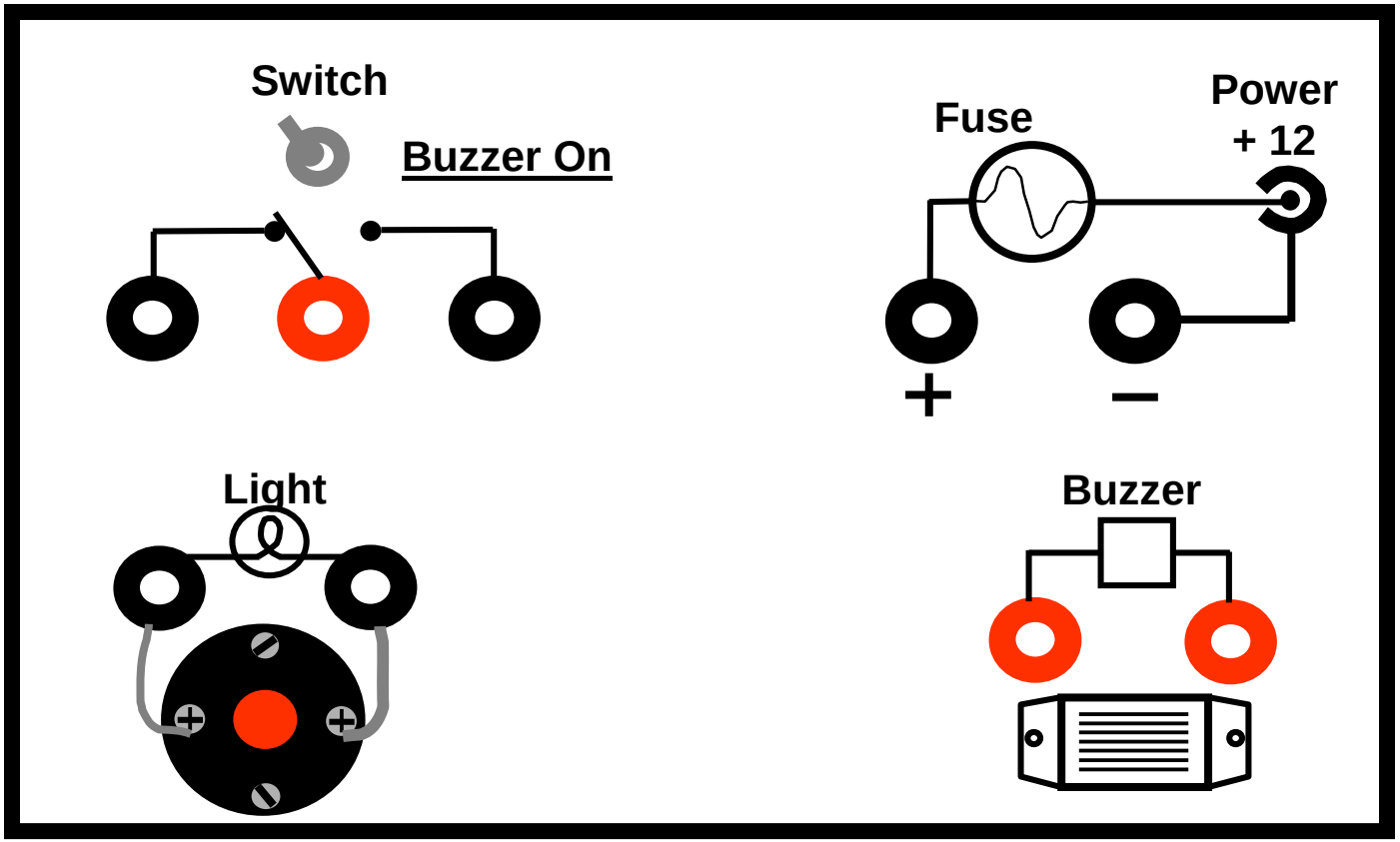
Direct Current Test Box

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



Direct Current Test Box

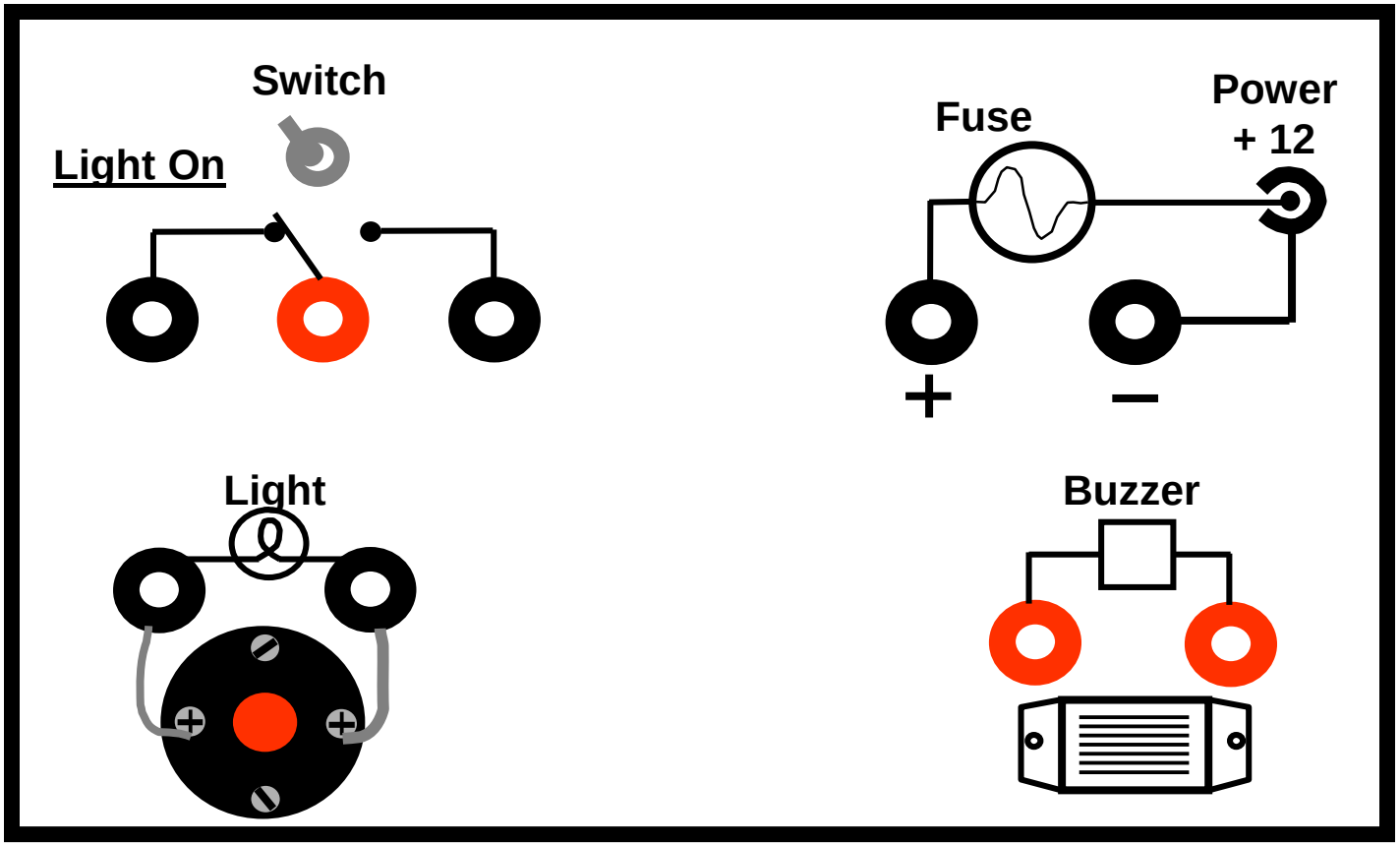
Draw Circuit to Switch Buzzer On / Off - Instructor draws this one first



Instructor _____

Direct Current Test Box

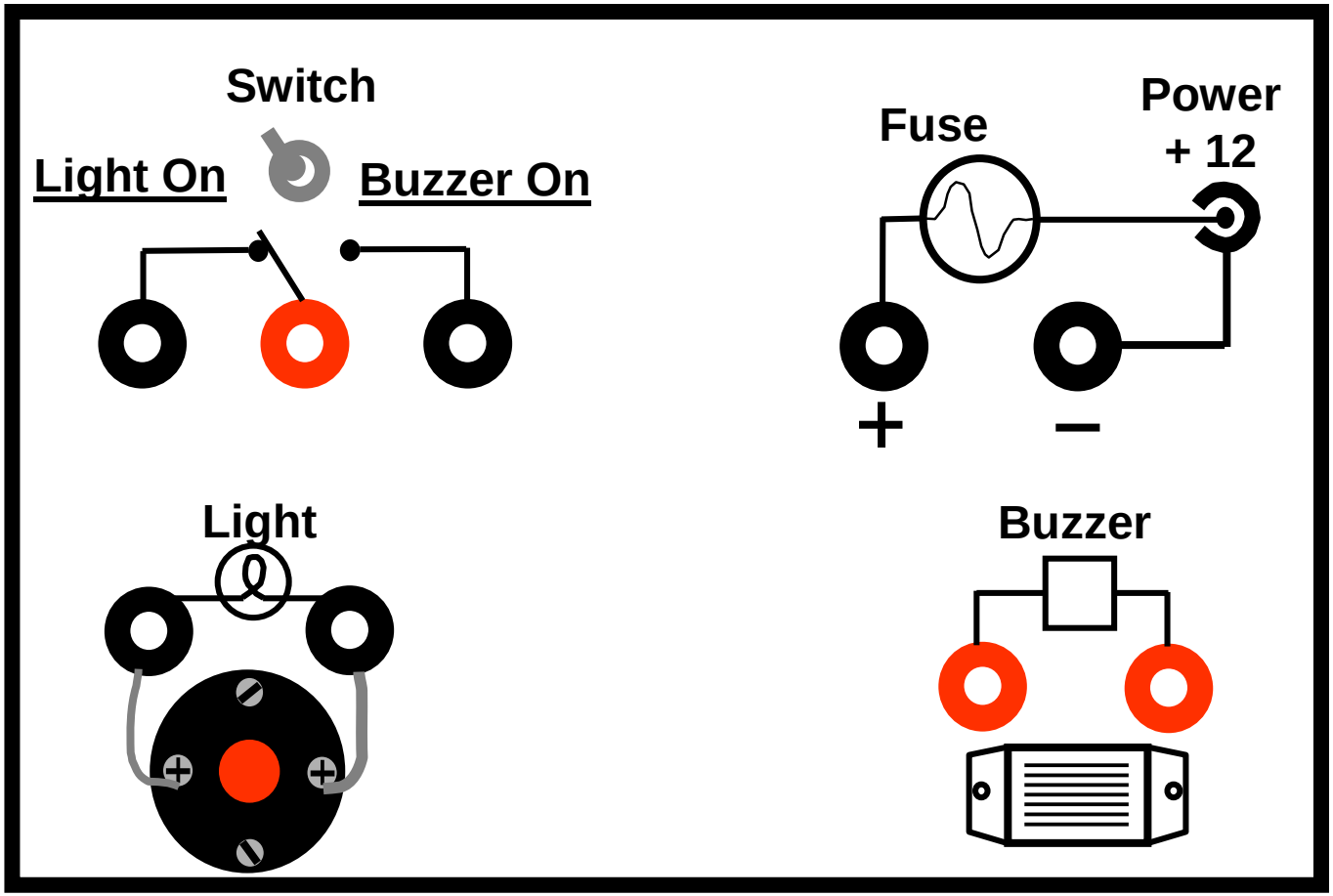
Draw Circuit to Switch Light On / Off



Instructor _____

Direct Current

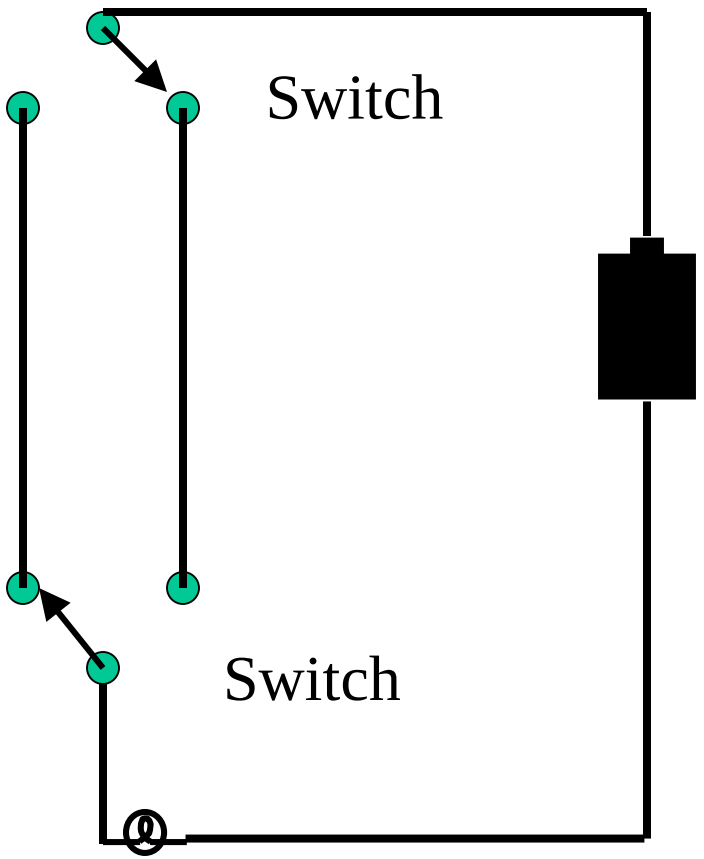
Draw Circuit to Turn Buzzer on in one Direction and Light in other Direction



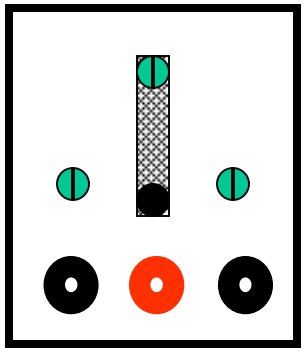
Instructor _____

Two Switches Control One Light

Two different
Light Switches
Control one Light

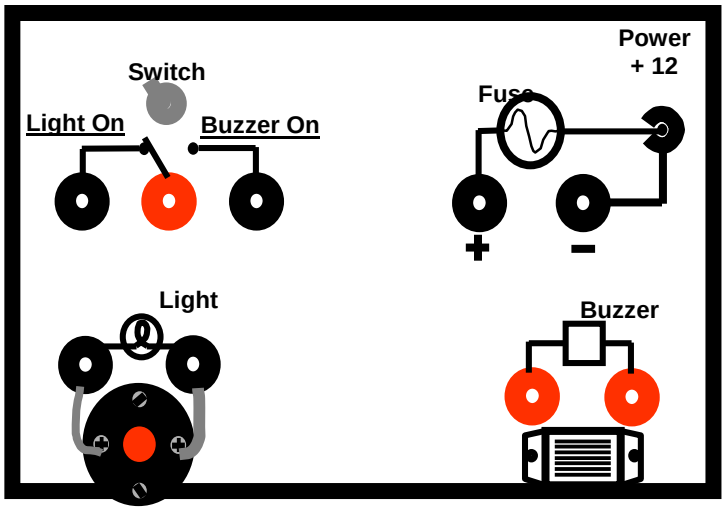


Draw a Circuit with Two Switch
External Switch and On-board Switch



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

Turn Light on



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

Instructor _____