Automotive Basic Electricity – Introduction

- Electricity works a lot like water does.
- Water pressure is potential to do work.
- Voltage (pressure) is electrical potential to do work.
- Water flow is work being done.
- Current (flow) is electricity doing work.
- A water or electric motor does work by resisting.
  - August 27, 2008

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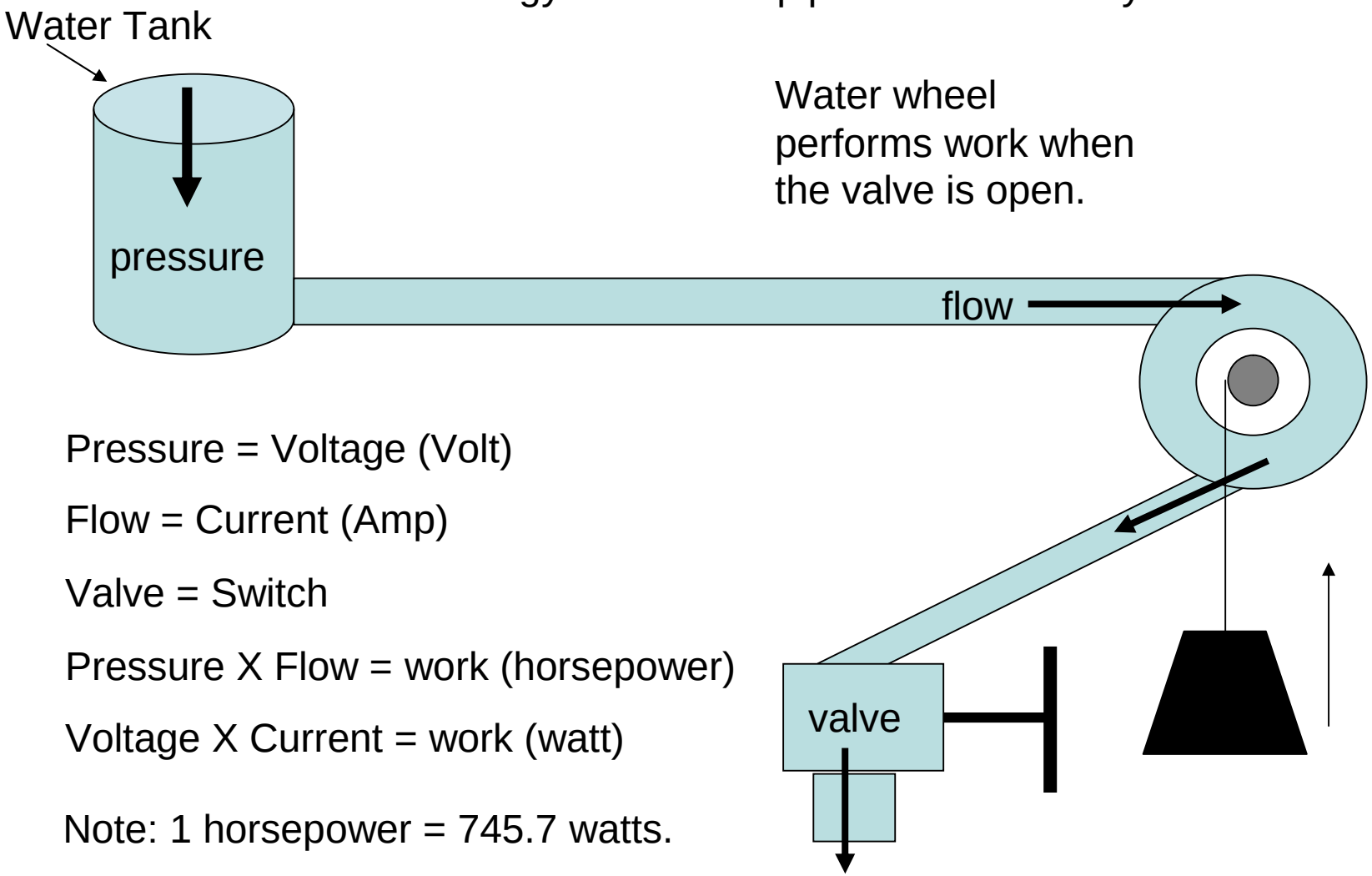
Analogy: Water in a pipe is like electricity in a wire.



Pressure = Voltage (Volt)

Flow = Current (Amp)

Valve = Switch

Pressure X Flow = work (horsepower)

Voltage X Current = work (watt)

Note: 1 horsepower = 745.7 watts.

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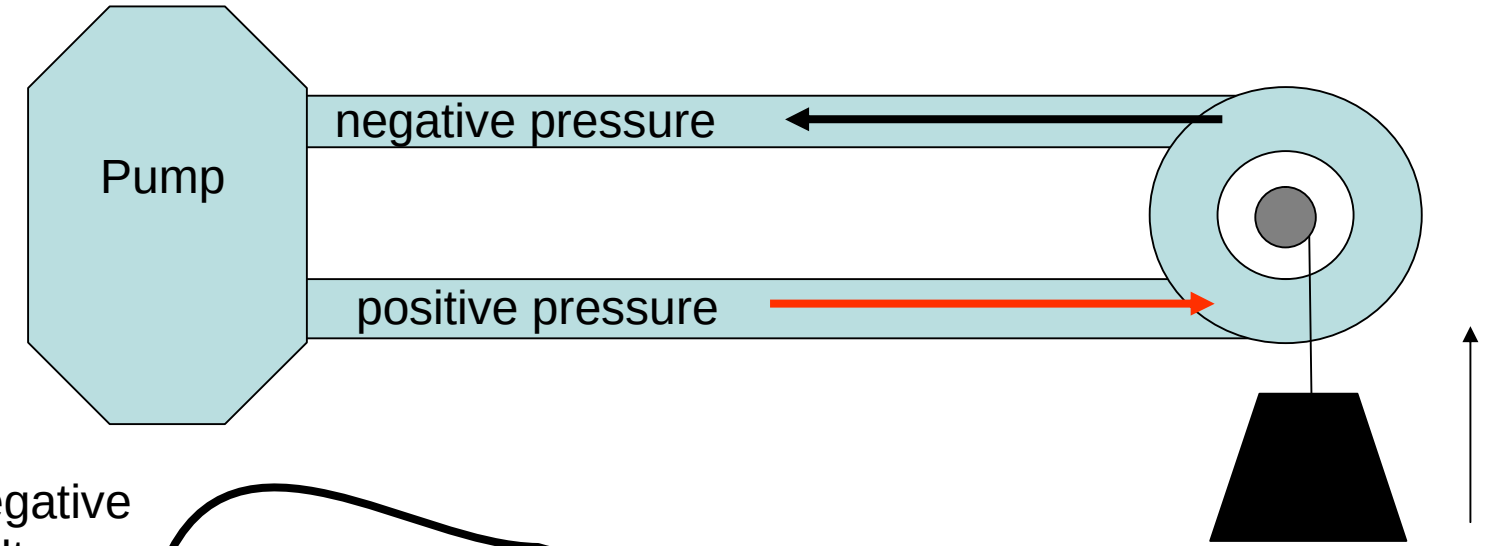

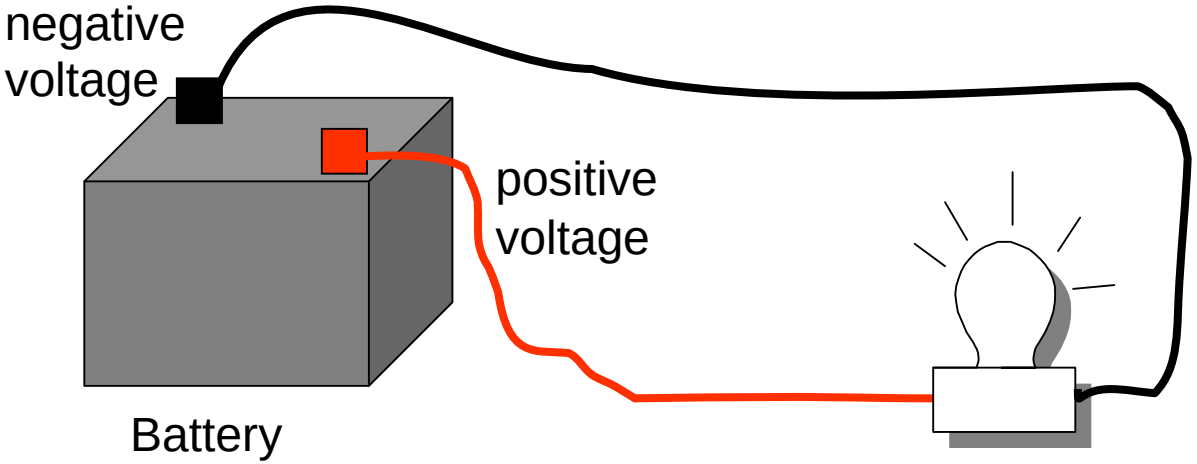

Resistance to flow AND pressure = work.

Or

Resistance to current AND voltage = work.

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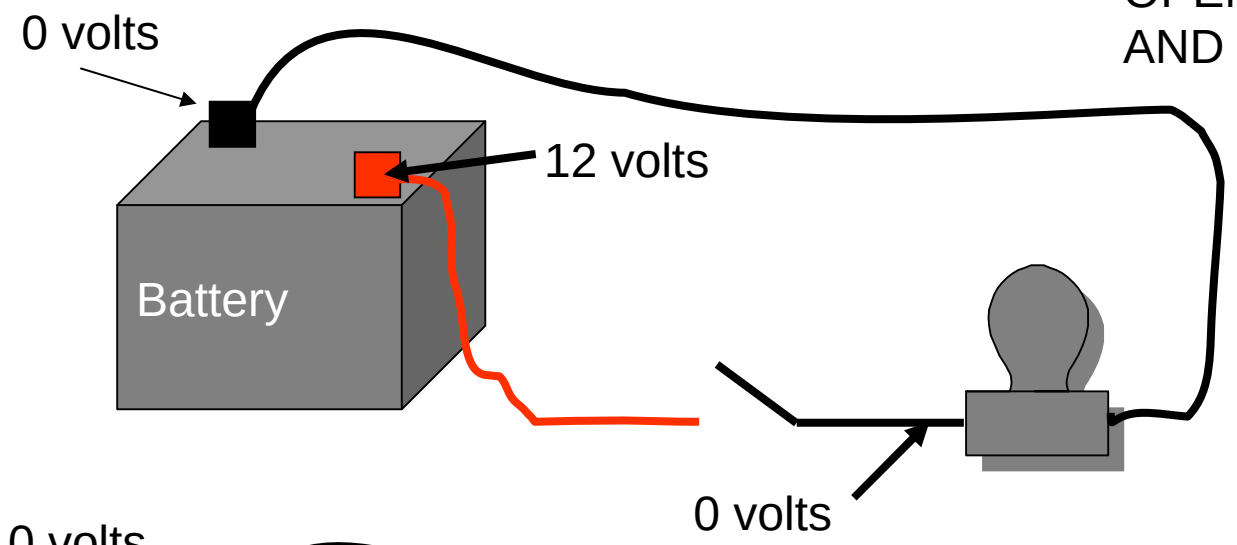
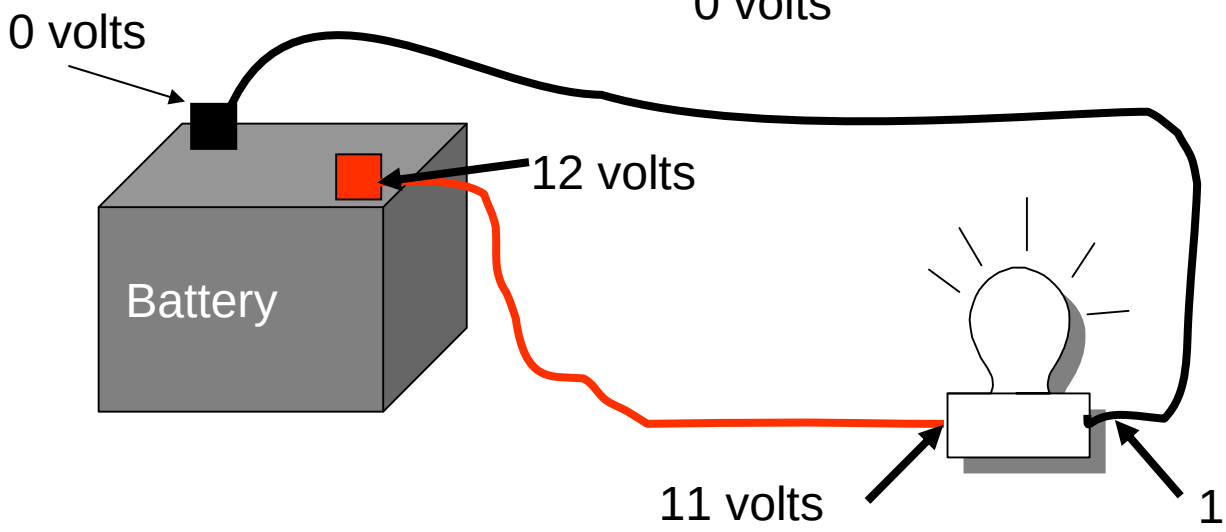
OPEN (circuit) = NO FLOW
AND MAXIMUM VOLTAGE





The greater the current (flow) the bigger the wire (pipe) should be to minimize resistance to current in the wire (pipe).

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The Golden rules of electricity – **Ohm's and Watt'sLaw**

1. Voltage = Current (amps) X Resistance (ohms)
   (V=I x R)
2. Current (amps) = Voltage / Resistance (ohms)
   (I=V / R)
3. Resistance (ohms) = Voltage/Current (amps)
   (R=V / I)
4. Watts (power) = Voltage x Current (amps)
   (W=V x I)
5. Current (amps) = Watts / Voltage
   (I=W / V)
6. Voltage = Watts / Current(amps)
   (V=W / I)

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- Examples:

Example 1 : My headlight bulb is rated at 56 Watts at 14 Volts. So how much current is that? I need to know how big a wire or fuse is needed.

Answer: Current (amps) = Watts/Voltage or 56/14 = 4 amps. Two headlights would be 2 x 4 = 8 amps if they use the same wire.

Example 2 : Why do my headlights dim when the engine is off?

Answer: When the engine runs the generator or alternator make about 14volts. When only the battery supplies power the voltage drops to about 12 volts. So if the voltage is lower the current will be lower for the unchanging resistance of the headlamp. A 56 watt headlamp at 14 volts uses 4 amps.

It has a resistance of (R=V / I) 14V / 4A = 3.5 ohms. So at 12 volts the current and wattage drops. (I=V / R) or 12V / 3.5ohms = 3.43Amps and (W= V x I) or 12Volts x 3.43Amps = 41Watts.

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- Why do automobiles have DC and houses have AC power.
- DC or Direct Current is supplied by a battery. Positive to negative. Cars use batteries to start (and in the old days to supplement the generator).
- AC or Alternating Current is supplied by long distance transmission lines and transformers must change voltages for use in houses. Transformers ONLY work with AC
- Hey! Wait a minute a car ignition coil is a type of transformer – how does it work on DC.
  - Answer – The coil doesn't work on DC. The points open and close so the voltage and current at the coil rise and fall (alternate).

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- Conventional Current –
  - 99% of electrical design is dealt with using conventional current theory – BUT in reality direct current can flow simultaneously in both directions in a wire. Unless you're a physicist it doesn't matter.

- Work (Starter, lights, horn: action!) –
  - When current flows it creates work by heat (light is visible heat) and magnetism and this work results in a voltage drop across the device doing the work (higher pressure on one side than the other).