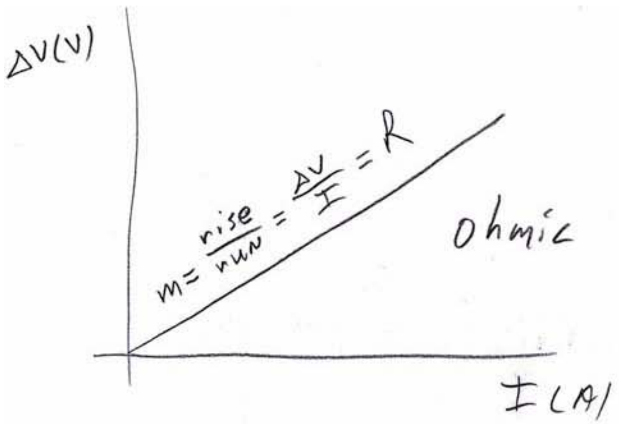
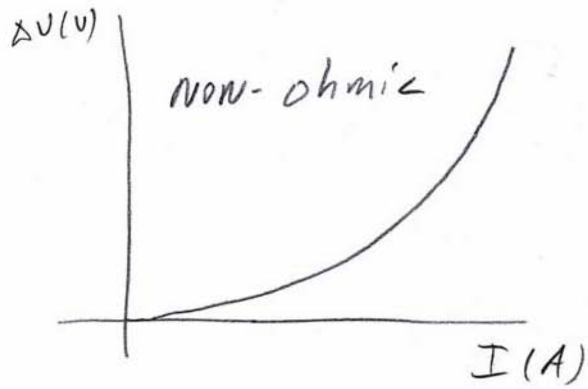
College Prep Physics II – Video Lecture Notes – Chapter 19
Video Lecture #2
Defining Resistance, Ohmic vs. Non-Ohmic, Electrical Power

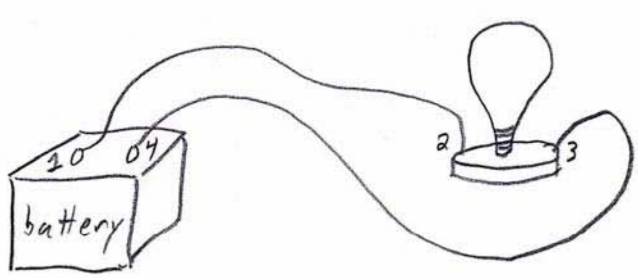
Resistance, R, is the resistance to current flow. $R = \frac{\Delta V}{I} \Rightarrow \boxed{\Delta V = IR}$ (Ohm's Law)

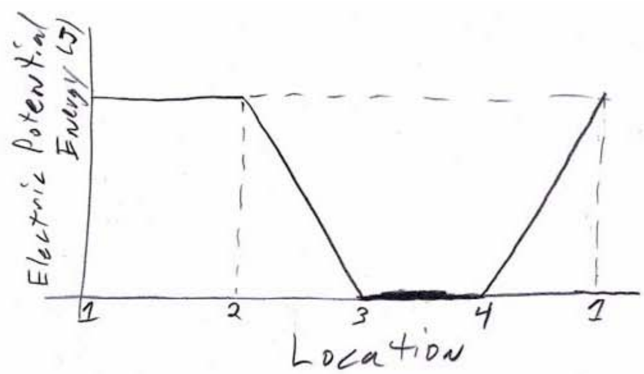
$R = \frac{\Delta V}{I} \Rightarrow \frac{Volts}{Amps} = \Omega$ or Ohms (Capital Omega, an upside down horse shoe, it's unlucky.)





Materials that follow Ohm's Law are called Ohmic. If they don't they are Non-Ohmic.
We will consider all resistors to be Ohmic, unless otherwise stated.





Electric Power: The rate at which electrical potential energy is being converted to heat, light and sound.

From 1-2 and 3-4 the charges are moving along the wire and we consider wires to have zero resistance unless otherwise stated.
From 2-3 the electric potential energy of the electrons is converted to heat, light and sound.
From 4-1 the electrons are being given electric potential energy by the battery.

Derivation of Electric Power Equation:

$$P = \frac{W}{t} = \frac{\Delta PE_{electric}}{t} \Rightarrow \frac{J}{s} = Watts \ \& \ \Delta V = \frac{\Delta PE_{ele}}{q} \Rightarrow \Delta PE_{ele} = q\Delta V$$

Therefore: $P = \frac{\Delta PE_{electric}}{t} = \frac{q\Delta V}{t} = \left(\frac{q}{t}\right)\Delta V = I\Delta V \ \& \ \Delta V = IR$

Gives: $P = I\Delta V = I(IR) = I^2 R \ \& \ \Delta V = IR \Rightarrow I = \frac{\Delta V}{R}$

Gives: $P = I^2 R = \left(\frac{\Delta V}{R}\right)^2 R = \frac{\Delta V^2 R}{R^2} = \frac{\Delta V^2}{R}$ Therefore: $\boxed{P = I\Delta V = I^2 R = \frac{\Delta V^2}{R}}$