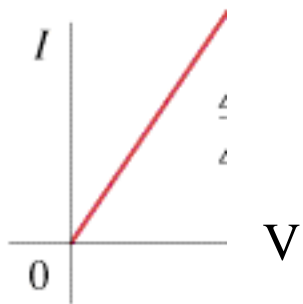


## II. Ohm's Law

For a metal conductor



$$I=V/R; V=IR$$

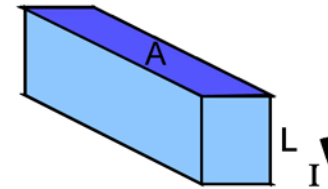
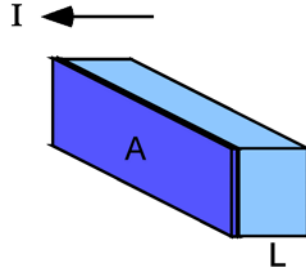
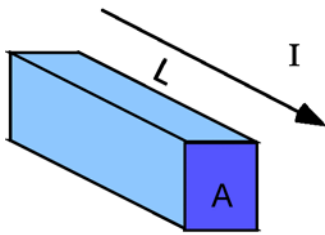
$$R=V/I \text{ - resistance}$$

$$\text{Unit: Ohm (1}\Omega=1\text{V/A)}$$

Substances not obeying Ohm's law: **non-ohmic**  
**diode, transistor, semiconductor, insulator,...**

# Resistivity

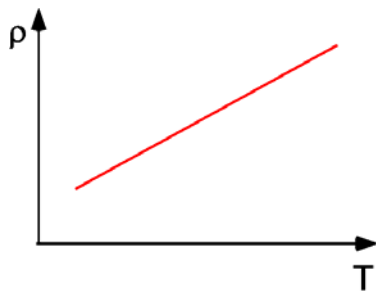
$$R = \rho L / A$$



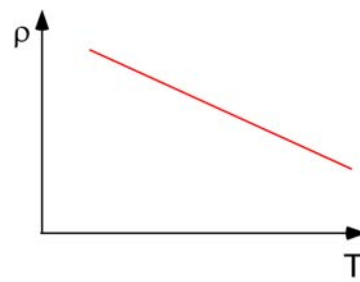
$\rho$ : resistivity,  $\Omega\text{-m}$

intrinsic to material ( $\rho$  -R analogous to density-mass)

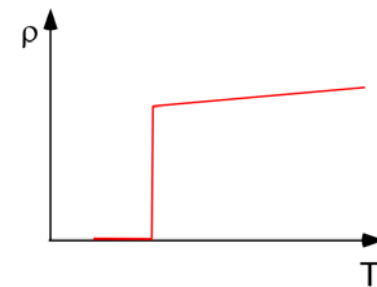
depends on temperature and other parameters



Metal



Semiconductor/insulator



Superconductor

# Puzzle

Three identical normal light bulbs inside a closed room  
Three corresponding switches outside the room

Goal: determine which switch controls which bulb

Rule: flip the switches outside the room,  
determine the correspondence inside the room

Reward: No such problems in the final

# III. Electric Power

Power=power transferred/time  
=QV/t

$$P=IV$$

Unit: watt (1W=1J/s)

Other expressions:

$$P=I(IR)=I^2R$$
$$=(V/R)V=V^2/R$$

# Household Circuit

