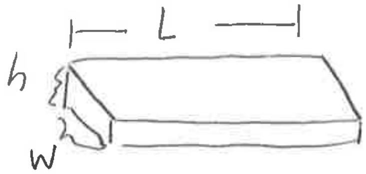
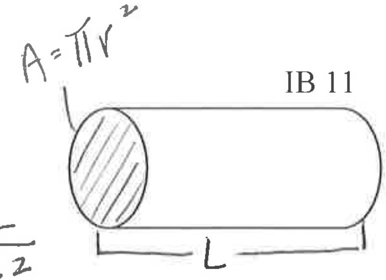




Formula for a conducting wire at a constant temperature . . . $R = \frac{\rho L}{A} = \frac{\rho L}{W \cdot h} = \frac{\rho L}{\pi r^2}$

2. What are the properties of wire that is the best conductor (has the least resistance)?

cold, short, wide

3. What are the properties of wire that is the worst conductor (has the most resistance)?

warm, long, thin

4. What material would you use to make a wire with the:

a) least resistance silver

b) most resistance metal alloy = nichrome

5. What is the resistance of a copper wire 2.0 meters long with a cross-sectional area of 6.4×10^{-8} m^2?

$R = \frac{\rho L}{A}$ $\frac{(1.7 \times 10^{-8}\ \Omega \cdot m)(2.0 m)}{6.4 \times 10^{-8}\ m^2} = \boxed{0.53\ \Omega}$

6. a) What is the resistance of a nichrome wire 12 meters long with a diameter of 2.7×10^{-4} meter?

$1.5 \times 10^{-6}\ \Omega \cdot m$

$R = \frac{(1.5 \times 10^{-6}\ \Omega \cdot m)(12 m)}{\pi(\frac{1}{2} \cdot 2.7 \times 10^{-4} m)^2} = 314\ \Omega$

b) If the diameter of the wire above is doubled, what is its resistance?

$R = \frac{\rho L}{\pi (2r)^2}$ resistance would be $\frac{1}{4}$ as much $310\ \Omega$

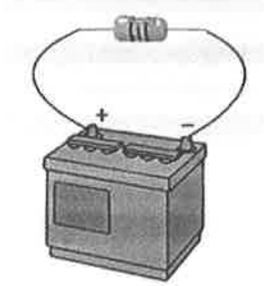
Simple Circuits

Schematic: diagram using symbols to represent circuit elements

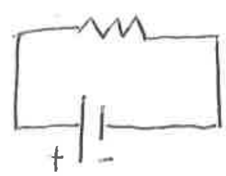
pg 631 in textbook

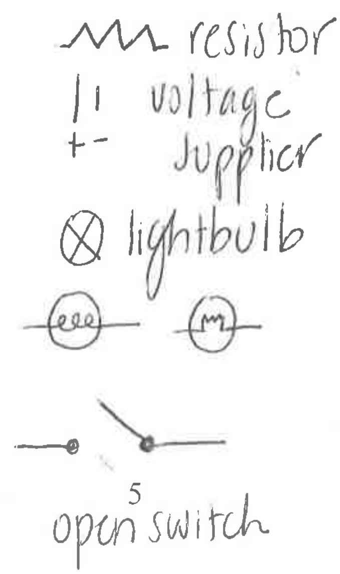
Draw a corresponding schematic diagram using appropriate *Circuit Symbols*.

Actual Circuit

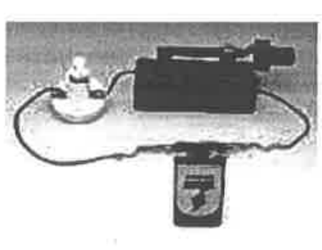


Schematic Diagram of Circuit

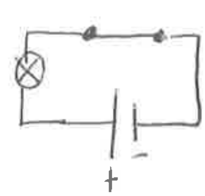




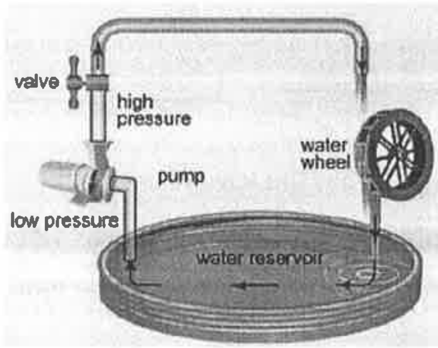
Actual Circuit

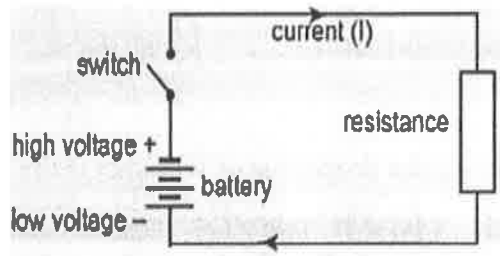


Schematic Diagram of Circuit

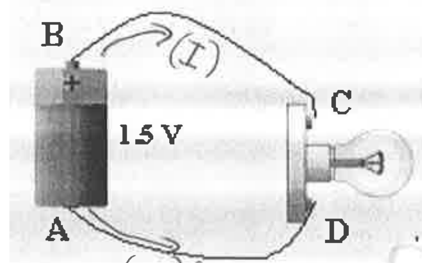


Water Analogy for a simple circuit





1. For the electric circuit shown at right, what is the potential (voltage) at:



Point A	Point B	Point C	Point D
ØV	1.5V	1.5V	ØV

2. For the electric circuit shown, what is the potential difference from:

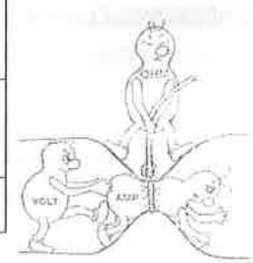
A→B	B→C	C→D	D→A
rise or gain of ⊕ 1.5V	no ΔV or change in potential difference	drop of 1.5V or ⊖ 1.5V lost	no change in potential difference ΔV=Ø

Electromotive force (emf): conversion from some other form of energy into electrical energy
voltage rise

Potential difference (pd): conversion from electrical energy into some other form of energy
voltage drop

Device					pd or emf?
Cell	converts energy from	chemical	into	electrical	emf
Resistor		electrical		internal	pd
Microphone		sound		electrical	emf
Loudspeaker		electrical		sound	pd
Lamp		electrical		light (and internal)	pd
Photovoltaic cell		light		electrical	er
Dynamo		kinetic		electrical	emf
Electric motor		electrical		kinetic	pd

Variable	V	I	R
Quantity	potential difference	current	resistance
Units	[V] = [J/C]	[A] = [C/s]	[Ω] = [V/A]
Type	scalar	scalar	



Electrical resistance:
ratio of applied potential difference to current

Formula:

$R = \frac{V}{I}$ $V = IR$

3. What is the resistance of a small appliance that draws 3.00 A at 120 Volts?

$R = \frac{V}{I} = \frac{120V}{3.00A} = 40\Omega$

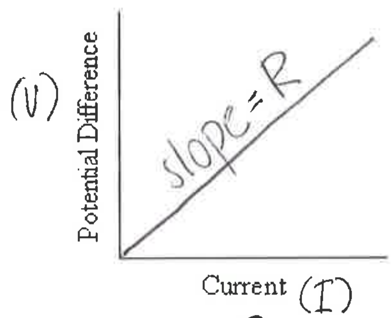
Ohm's Law:

$R = \frac{V}{I}$

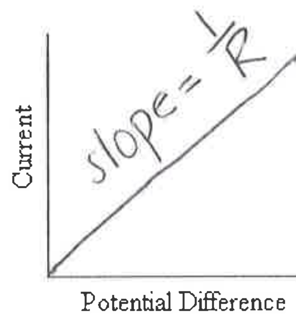

Georg Simon Ohm
(1787 – 1854)

This means that for a conductor at a constant temperature potential difference is proportional to current over a wide range of potential differences

I. Ohmic device:



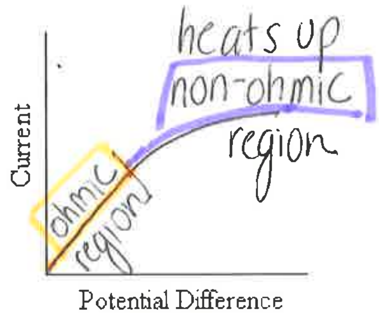
Example:



Slope: R or resistance

Slope: R^{-1}

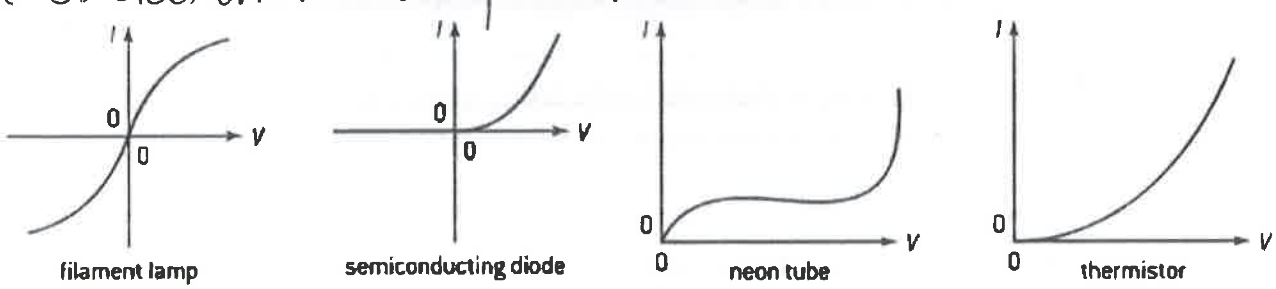
II. Non-ohmic device:



Relationship: current increases but not as fast as voltage as resistance increases

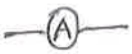
Example: filament bulb

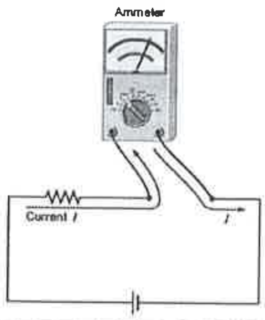
4. Why is a filament lamp non-ohmic? As temperature increases, resistance increases because electrons collide more with lattice ions (i.e. electron flow is impeded)



I-V characteristics for various non-ohmic conductors

Types of Meters





Ammeter: device to measure current

Placement: Must be placed in series to allow current to flow through it

Circuit must be broken to insert ammeter.

Ideal ammeter: has zero internal resistance so it will not affect current flowing through it

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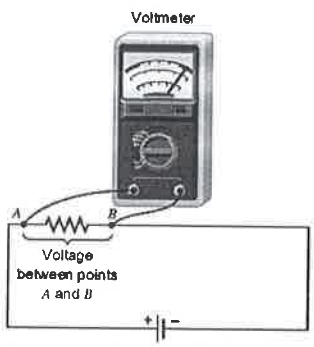


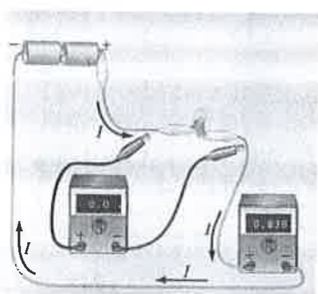
Voltmeter: device to measure voltage or potential difference

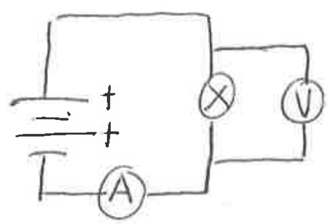
Placement: Must be placed in parallel to measure potential difference between two points

Placed outside circuit – no need to break circuit

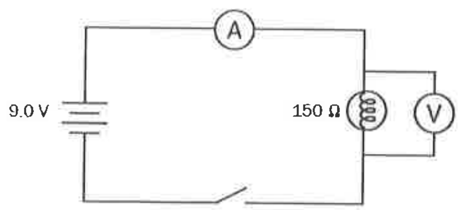
Ideal voltmeter: has infinite resistance internal resistance so it will not allow any current to flow through it rather than the circuit

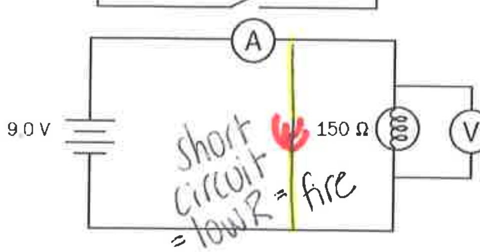
5. Draw a circuit diagram to include a 6.0 V battery hooked to a 12.5 Ω resistor. Include an ammeter reading the current in the circuit and a voltmeter to measure the potential difference across the resistor. Determine the reading on each meter.





6. Determine the readings on the meters when the switch is open and when it is closed.





Meter	Reading when Open	Reading when Closed
V	Ø	9.0V
A	Ø	0.060A

$$I = \frac{V}{R} = \frac{9V}{150\Omega} = 0.060A$$

Open circuit: incomplete path

Closed circuit: complete path

Short circuit: circuit with very little resistance; danger of overheating or fire!