Unit 11 – Reading 4 - Resistance and flow rate

We have previously classified objects and types of materials as either conductors or insulators. Most of the objects we tested were

either very good at allowing charge flow -- the conductors

or very good at blocking charge flow -- the insulators

But many materials behave in a manner somewhere between these two extremes. These materials allow some flow to take place -- but at a rate that's much lower than conductors. Circuit components made of these intermediate materials are called RESISTORS.

The property of resistors that specifies the degree of ability to "hold back charge flow" is called RESISTANCE. A resistor that allows charge to go through easily has low resistance, while one that is "a harder place to get through" has high resistance.

Electrical resistance is measured in terms of a unit called the OHM — named after the German physicist and teacher Georg Ohm. The symbol for Ohm is the Greek letter *omega*, Ω. The physical design (size and shape) of these objects can have as much effect on resistance as the type of material itself. Copper is considered a good conductor; it has less resistance, for example, than glass or graphite. Besides type of material, a resistor's size and shape affects the magnitude of its resistance. Light bulb filaments are good examples, which we will investigate later in this Section.

Most textbooks use the term CURRENT to represent flow rate of charge in a circuit.

Flow rate is measured in terms of a unit called the AMPERE — named after the French physicist André Ampere.

Flow rate is not the same idea as speed. Flow rate refers to net amount of charge per second passing through part of a circuit. Speed refers to distance traveled per second by a small bit of charge.

Consider the analogy of water flow in a river. The water normally moves with the same flow rate everywhere along a stretch of river with no tributaries to add water or drains to remove water. But at places where the river channel is narrower or shallower, individual drops of water must move faster to provide the same flow rate everywhere along the river.

A compass detects the overall flow rate of charge moving in a wire placed over the compass, not the speed of any bit of moving charge. The evidence is:

- Compass deflection goes up and down together with bulb brightness.
- Bulb lighting is caused by all the charge passing through the filament.