## CURRENTS, OHM'S LAW

An electric current *I* flows along a copper wire (low resistivity) into a resistor made of carbon (high resistivity) then back into another copper wire. *In which material is the electric field largest?* 



- A. In the copper wire
- B. In the carbon resistor
- C. It's the same in both copper and carbon
- D. It depends on the sizes of the copper and carbon

Which of the following is a statement of charge conservation?

A) 
$$\frac{\partial \rho}{\partial t} = -\int \mathbf{J} \cdot d\mathbf{I}$$
  
B)  $\frac{\partial \rho}{\partial t} = -\int \mathbf{J} \cdot d\mathbf{I}$   
C)  $\frac{\partial \rho}{\partial t} = -\int \int \int (\nabla \cdot \mathbf{J}) d\tau$   
D)  $\frac{\partial \rho}{\partial t} = -\nabla \cdot \mathbf{J}$ 

E) Not sure/can't remember

## **Georg Simon Ohm**

1789 – 1854. German physics and math teacher.

V = IR

## Empirical relation (not a law).





In 1781 Cavendish experimented with Leyden jars and glass tubes of varying diameter and length filled with salt solution. He measured the current by noting how strong a shock he felt as he completed the circuit with his body! He found the "velocity" (current) varied directly as the "degree of electrification" (voltage).

## MOTIONAL EMF

One end of rectangular metal loop enters a region of constant uniform magnetic field **B** with speed v, as shown. In which direction does the current flow?



- B. CCW
- C. Depends on the length of the sides
- D. Depends on the resistivity of the metal

One end of rectangular metal loop enters a region of constant uniform magnetic field **B**, with constant speed *v*, as shown. What direction is the net force on the loop?



E. The net force is zero

One end of rectangular metal loop enters a region of constant uniform magnetic field **B**, with constant speed *v*, as shown. What is the flux through the loop at the instant shown?



Consider two situations:

loop moves right at velocity V(loop), and
 magnet moves left, V(mag).
 Assuming |V(loop)| = |V(mag)|, what will
 the ammeter read in each case?
 (Call CW current positive)

