Electrical Current – Current Model

Model for Electrical Current

1. There is a flow of something around an electrical circuit.
2. What goes around comes around. (Electrical current is not used up as it travels the circuit.)

Kirchoff's Junction Law

3. When **RESISTANCE** of the circuit goes **UP**, then the **CURRENT** across the battery goes **DOWN**. Inverse rule.
    a. **Adding** any **obstacle** in series will **increase Resistance** in circuit, which **decreases Current** across battery. (DO YOU NEED SCISSORS WHEN YOU ADDED IT TO THE CIRCUIT?)
    b. **Adding** anything in parallel will **decrease Resistance** in circuit and **increase current** across the battery. (DO YOU USE ALLIGATOR CLIPS TO ADD IT TO CIRCUIT?)

Use a different colored pen – Circle the new stuff, Ask Did I have to break an existing line to do it?

4. Current favors the path of least resistance.
5. Two flavors of Parallel
    a. Parallel ACROSS THE BATTERY (Independent branches)
    b. Parallel (VANILLA) No direct line to both sides of the battery.
6. When comparing different circuits or components in a circuit ask, "What do I have to do to make this circuit look like that circuit?"
7. For equivalent resistance in a circuit ask two questions:
    a. Are any resistors in series? If so replace then with the sum of the resistors.
    b. Are any resistors in parallel? (The resistance will be less than the lowest resistor.) If so then make paths identical by replacing resistors with the lowest common denominator. Take size of resistor divided by the number of paths. (SHHH, don't tell but $1/R_{total} = 1/R_1 + 1/R_2 + \ldots$)
    c. Repeat a & b till you arrive at a equivalent resistance.
8. It is ok to say that our model fails.
    a. But you must be able to describe X was getting more than ½ of the current but now is getting less than ½ of the new current even though the current thru the battery increased. 1/2 a large PIZZA or all of small pizza??? (Or **kumquat**)

9. Use the term **INDICATOR BULB** – this tells use that it is getting all of the current thru the battery goes thru it.
    a. Or you can say the indicator bulb is for a particular path and it is getting all of the current thru that path.

Electrical Current – Voltage Model

1. "Push", change in "pressure" – Voltage is the **CAUSE**, the current is the **EFFECT**.
2. **ANY** path from one side of the battery to the other side must have the sum of the voltage drop equal to the voltage rise of the battery. **Kirchoff's Loop Law**
3. Parallel branches have the same voltage across them.
4. Voltage across a dark bulb is ZERO.
5. Voltage across a gap is the total for that loop.
6. MORE VOLTS, MORE JOLT (GLOW)
7. For elements in series: Bigger share of the total Resistance gets the bigger share of the battery Voltage.
8. In series share voltage across elements.
9. In parallel share current
10. When trying to figure out a voltage it is often helpful to LOOK AWAY, LOOK AWAY!
11. $i_1 + i_2 = i_3 + i_4 + i_5$ The algebraic sum of the currents at a node is zero. Kir 1
12. An **ammeter** has extremely **low resistance** so it will not change the current when it is added to the circuit in **series**. A **voltmeter** has extremely **high resistance** so that is why it does not increase current when added in **parallel**.

IF MODEL FAILS SWITCH MODELS!!!!

SLOW DOWN

TAKE YOUR TIME ANSWER THE QUESTION ASKED!!

INDICATOR BULB!!!!!

Section 7 – Multiple batteries

When batteries are placed in series (normal way) their voltages add together if positive end is hooked to the negative end of the next battery. If it goes positive to positive then one battery will be added to the voltage one will be subtracted from the voltage. If the batteries are different strengths then there will be a current.

MORE VOLTS BRIGHTER BULB.

An **ammeter** has extremely **low resistance** so it will not change the current when it is added to the circuit in **series**. A **voltmeter** has extremely **high resistance** so that is why it does not increase current when added in **parallel**.

Voltage in series is equally divided if the elements have equal resistance. If unequal the larger resistance gets the larger portion of the voltage.

Voltage across the battery equals the voltage across all of the elements in a loop.

Batteries in parallel do not increase the voltage of the circuit but do share the amount of current that is provided.

For **SERIES** $V_1 + V_2 = V_o$ $i_1 = i_2 = i_o$
For **PARALLEL** $V_1 = V_2 = V_o$ $i_1 + i_2 = i_o$

Section 8 – Kirchhoff's Second Rule

The voltage across the battery in a current loop is equal to the sum of the voltages across all the other elements.

Voltage increases in an element when it's share of the resistance increases in a loop.

An open circuit has zero voltage across the good elements and **all** of the voltage across the breaks in the circuit.

A shorted out element will have zero voltage across it while the other elements will have a non-zero voltage.