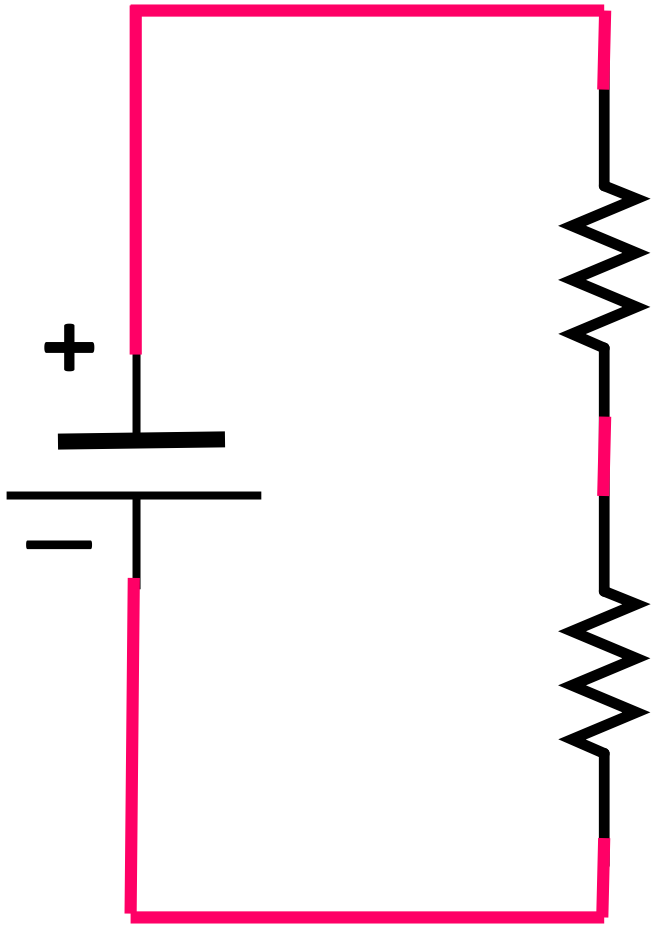
What to add next time you update?

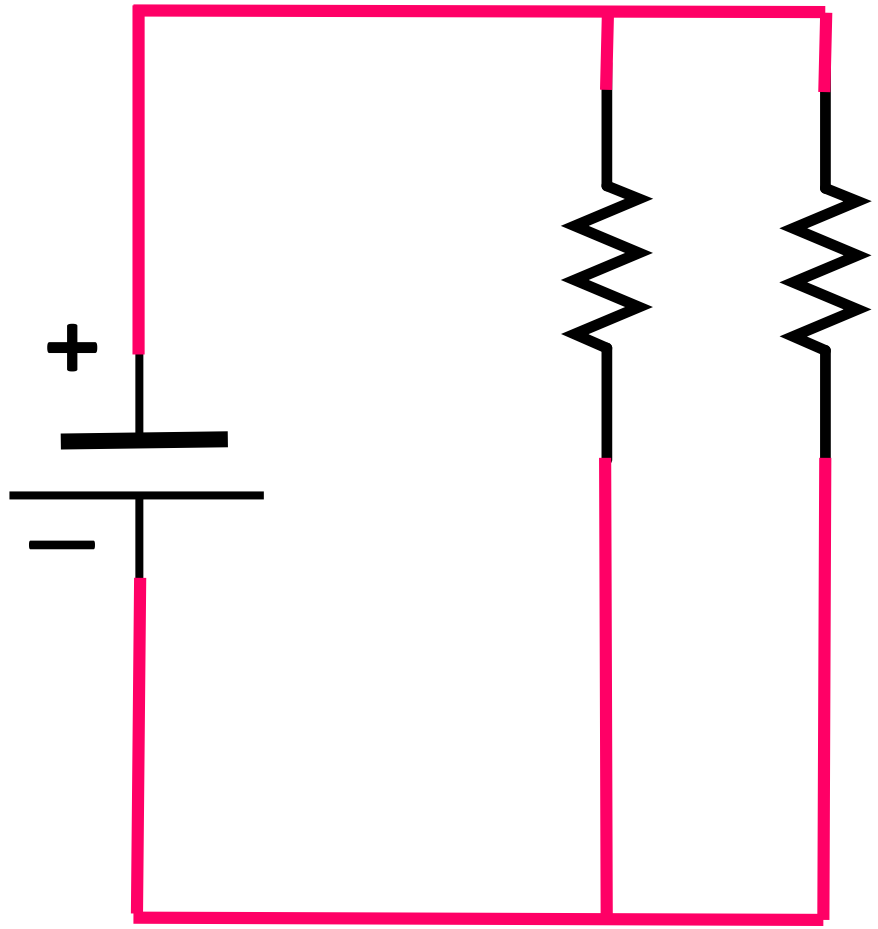
- Work sheet with 3 and 4 resistors
- Create worksheet of tables
- Add Hypothesis and Questions
- Add Lab and Lecture Objectives
- Add equipment needed
- Add science standards
- Review links for additional content

PARALLEL CIRCUITS

SERIES & PARALLEL CIRCUITS

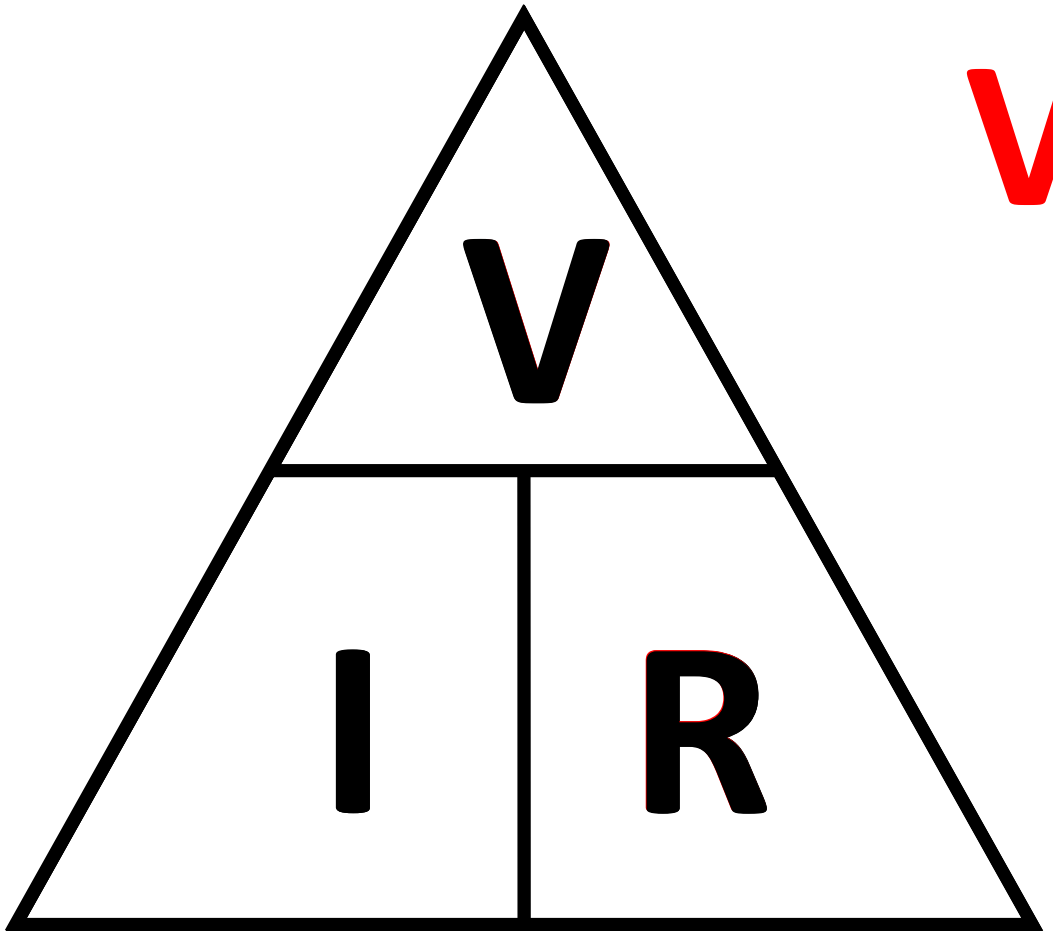


SERIES CIRCUIT



PARALLEL CIRCUIT

TRICK TO REMEMBER OHM'S LAW



$$V = I * R$$

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

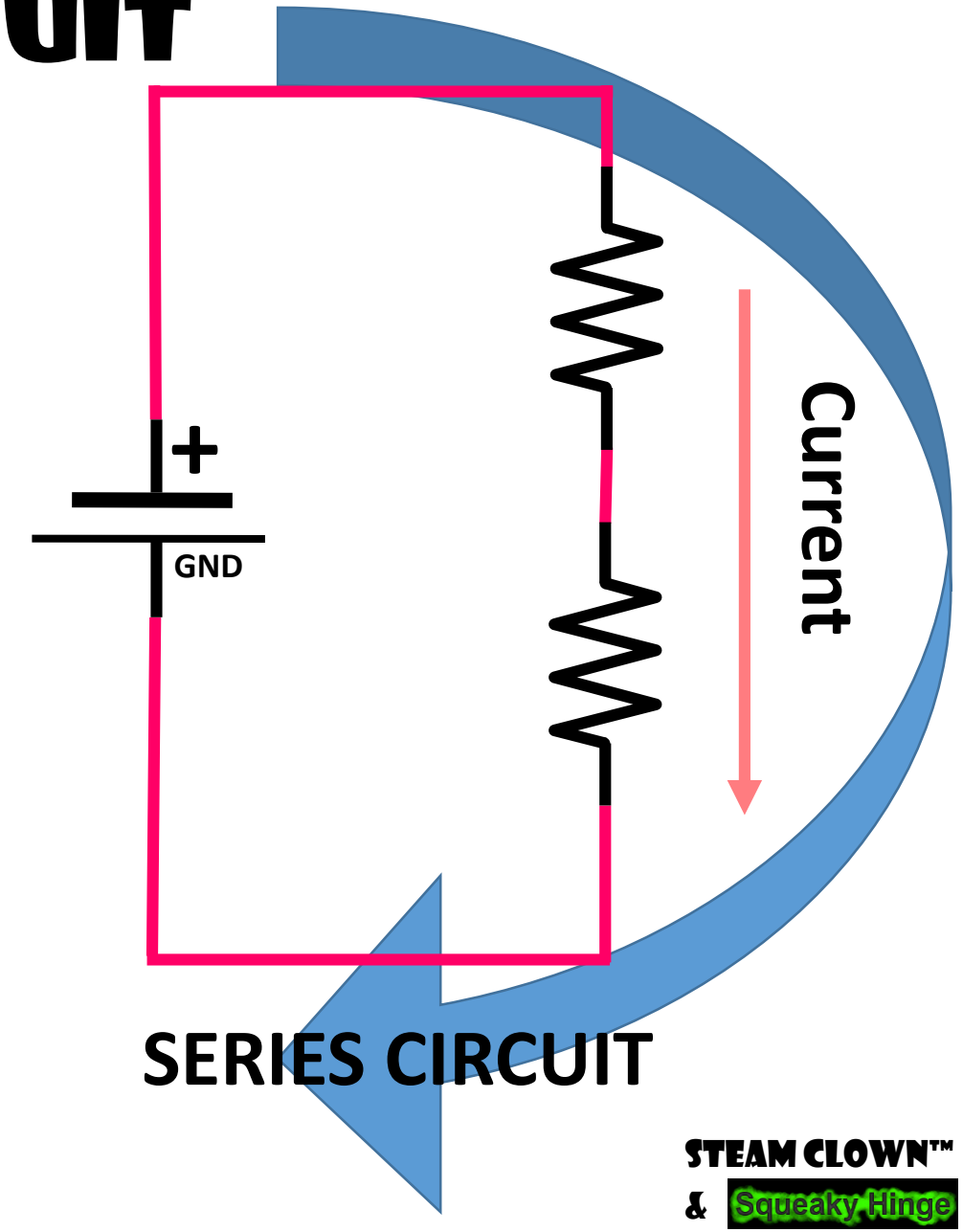
$$I = \frac{V}{R}$$

STEAM CLOWN™ & Squeaky Hinge PRODUCTIONS

REMEMBER, A SERIES CIRCUIT

- Complete, Closed Circuit
- Single Path from
  +V to GND
- The same current is flowing in both resistors

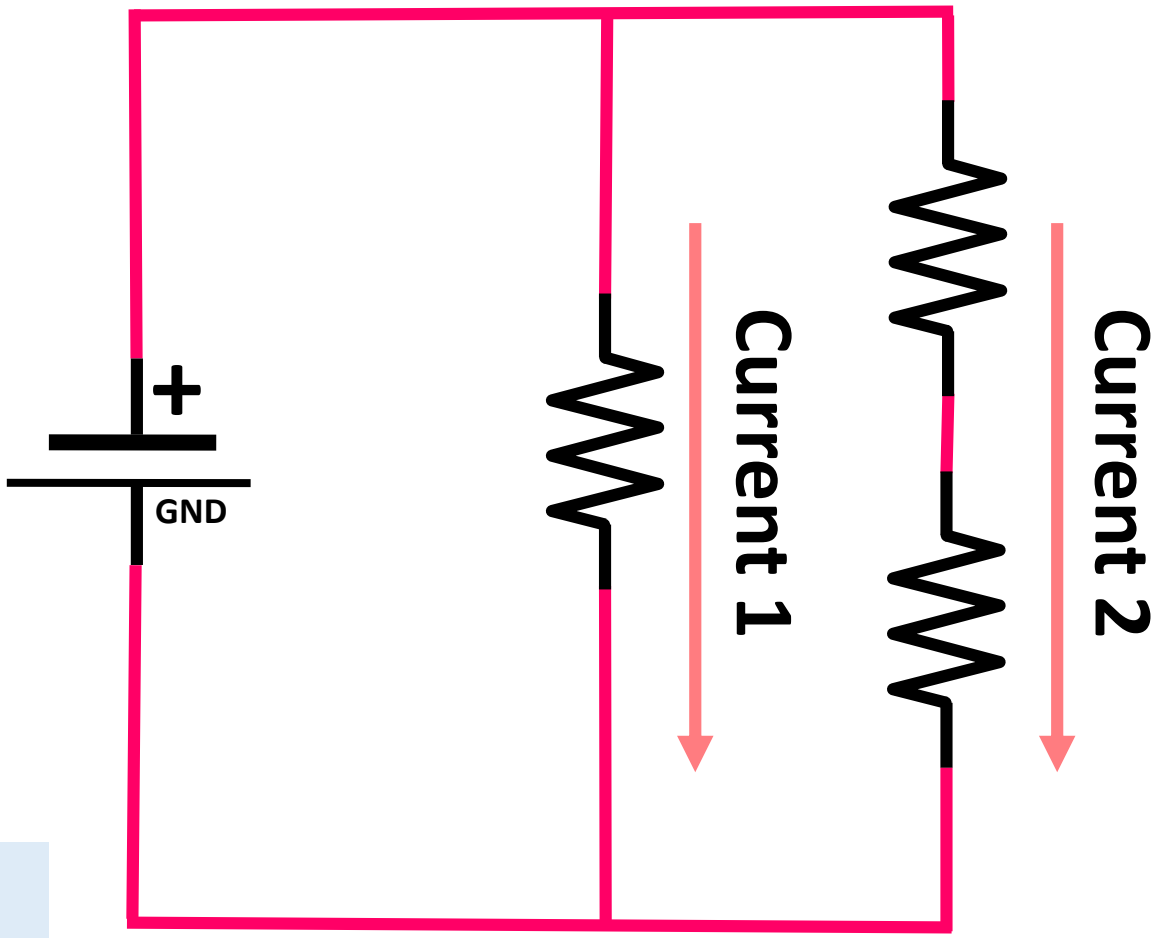
Yes, there is only one path for the current and it is the same at all points ion the circuit



PARALLEL CIRCUITS

- Complete, Closed Circuit
- Multiple Paths from +V to GND
- Is the same current flowing in all paths?

No, there are multiple paths, so there is multiple currents. Each path can have different Current.

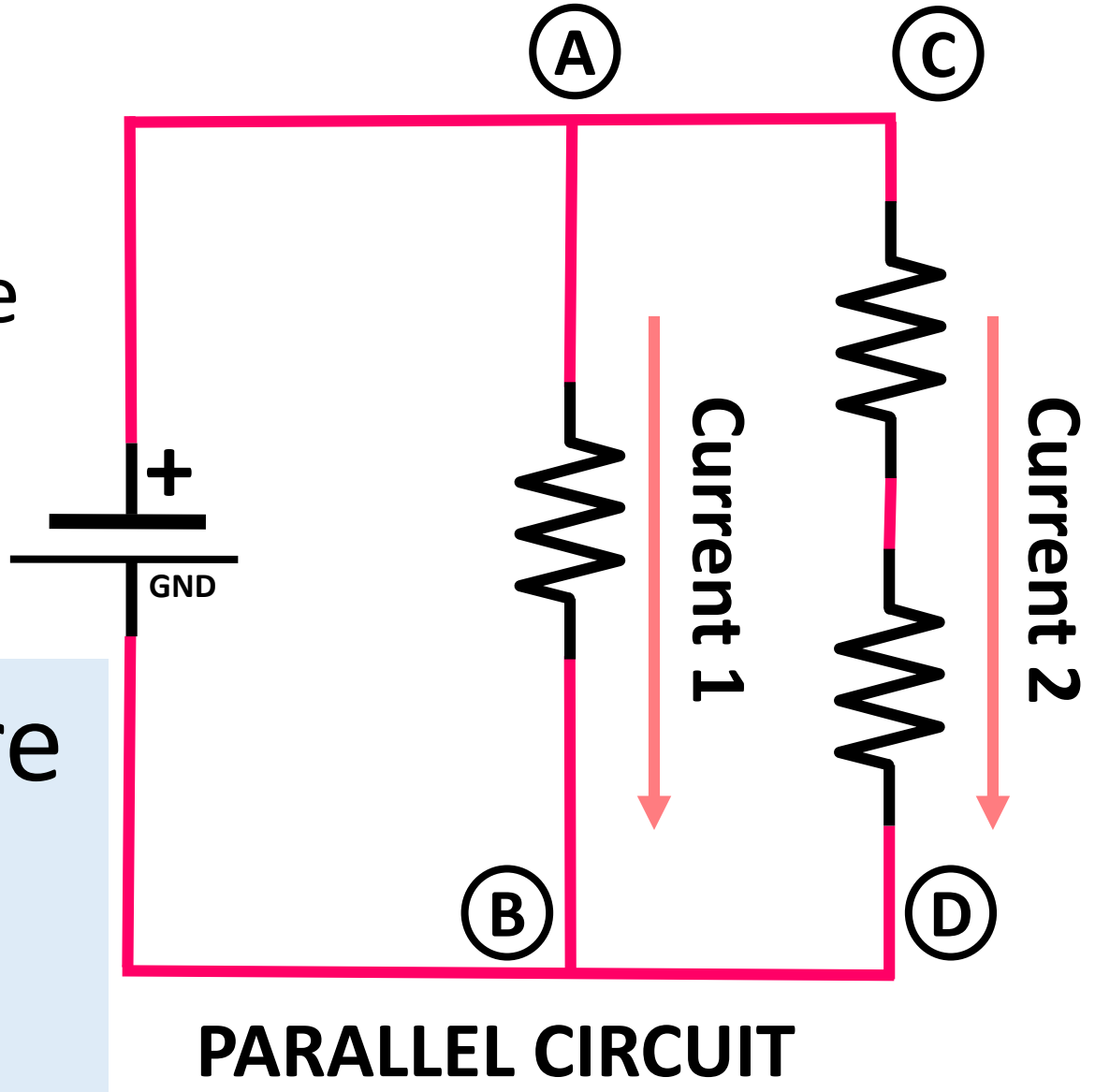


PARALLEL CIRCUIT

PARALLEL CIRCUITS

- Is the Voltage across A & B the same as across C & D?
  in all paths?

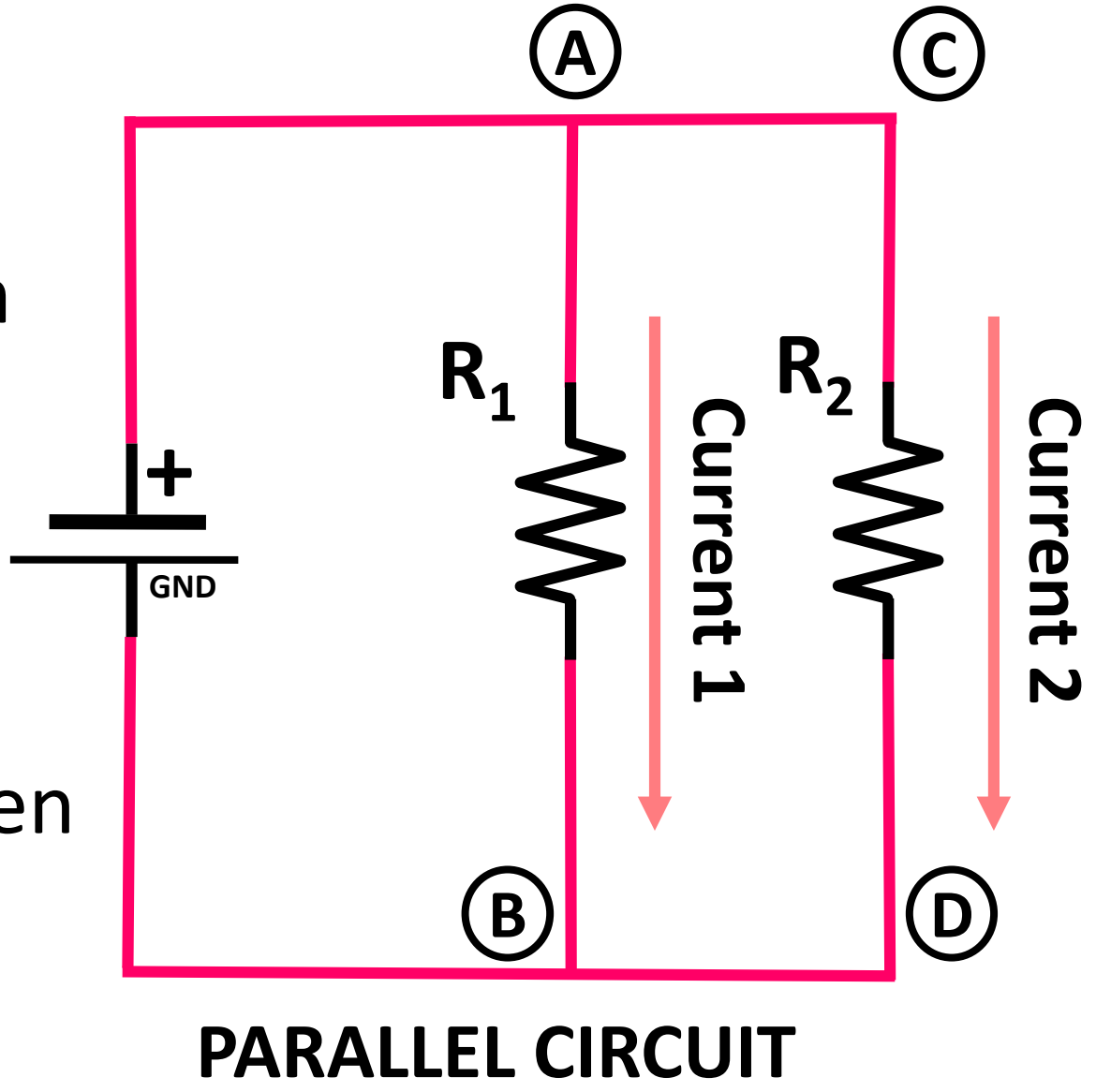
Yes, electrically, A & C are the same point. B & D are too… Right?



PARALLEL CIRCUIT

PARALLEL CIRCUITS

- If R1 & R2 were both 1KΩ then you really have two 1KΩ resistors as “loads” drawing current from the same power supply
- If 2x the current is flowing, then what does that mean for the equivalent resistance?



GO GET THE FOLLOWING

- Power Supply ← the smaller ones are better
- Power to Breadboard Adaptor
- Breadboard
- About 6 wire
- 1 plastic cup

- Resistors:
  - One **100Ω** resistor
  - Two **330Ω** resistors
  - One **680Ω** resistor
  - Two **1KΩ** resistors
  - One **2KΩ** resistor

LAB TIME...

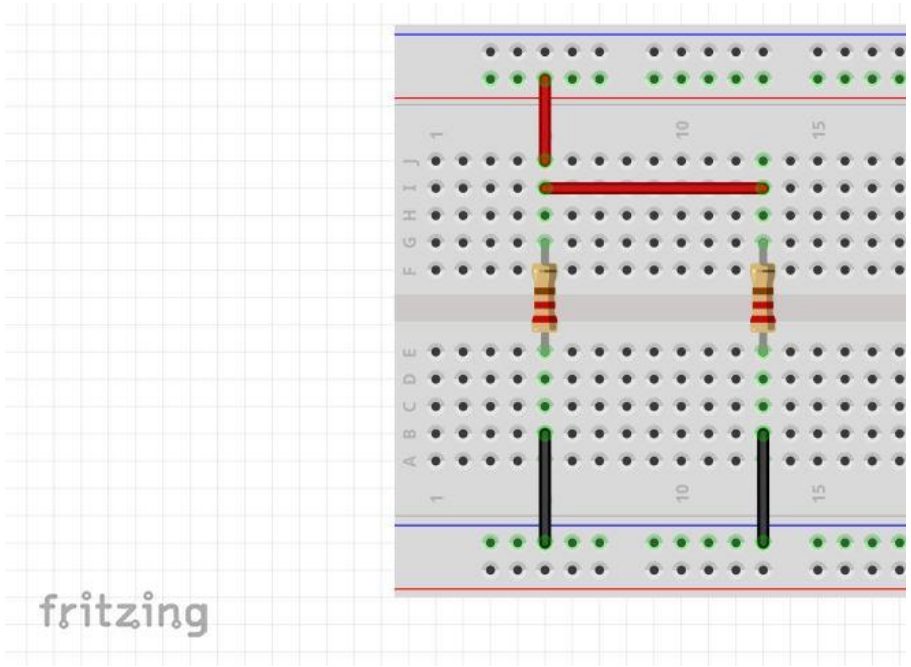
LOG SOME DATA

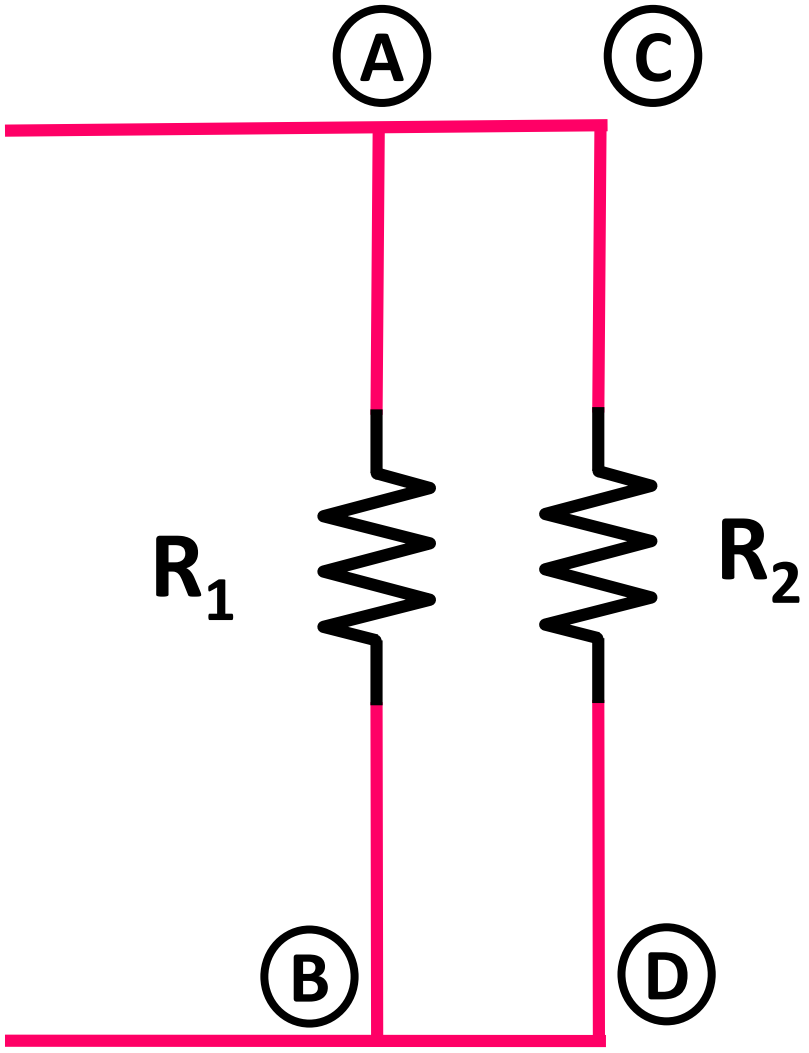
- Open your log books
- On the next available Page
  - Note the Date
  - Draw a table (“for a fixed 5 volt power supply”)

Parallel Circuit Measurements	Measured Resistance	Measured Voltage	Measured Current
R1 + R2 (measure in parallel)			
R1 = 1KΩ			
R2 = 1KΩ			

BUILD THIS PARALLELS CIRCUIT

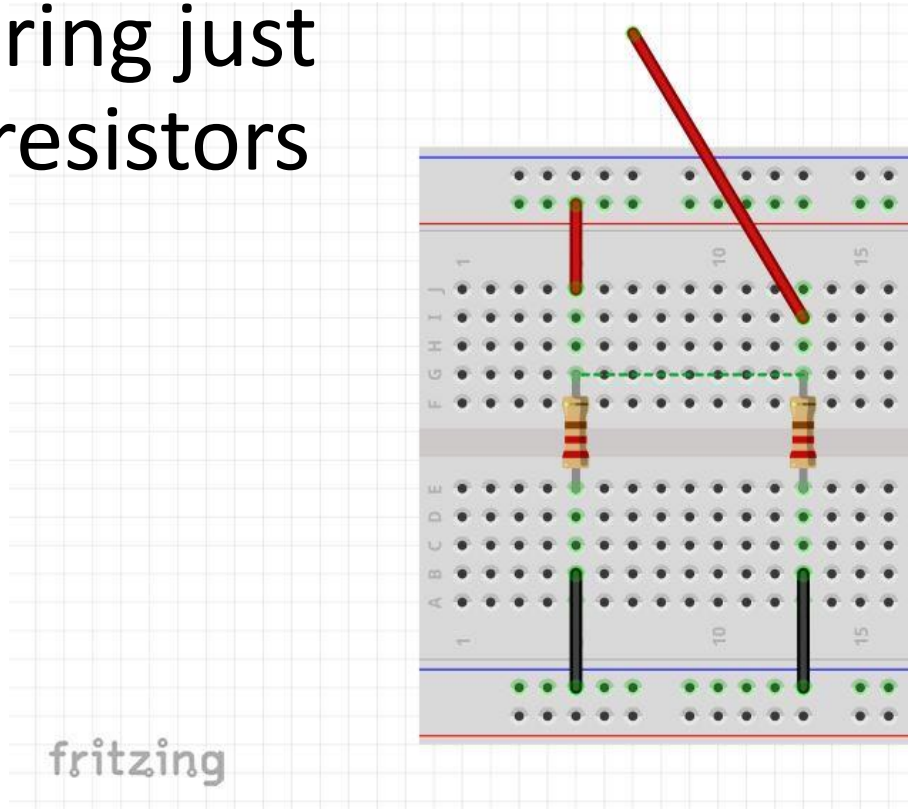
- How do you measure each resistor in a Parallel circuit?
- How do you measure the total resistance, as seen by the power supply?
- R_1 = 1KΩ
- R_2 = 1KΩ

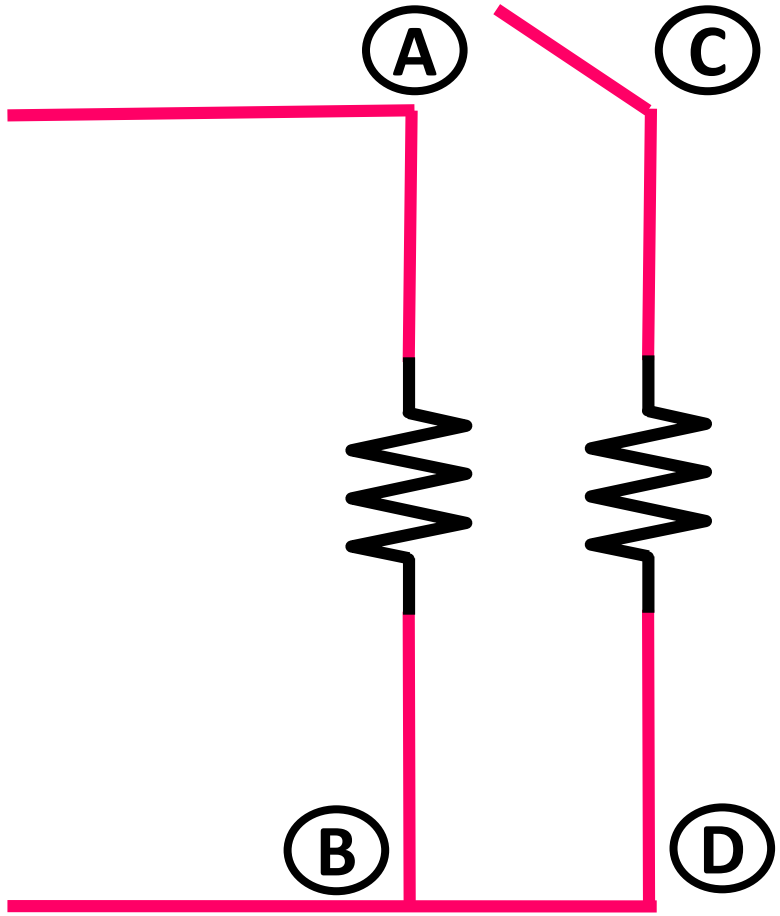




Measuring Individual Resistors in a Parallel Circuit

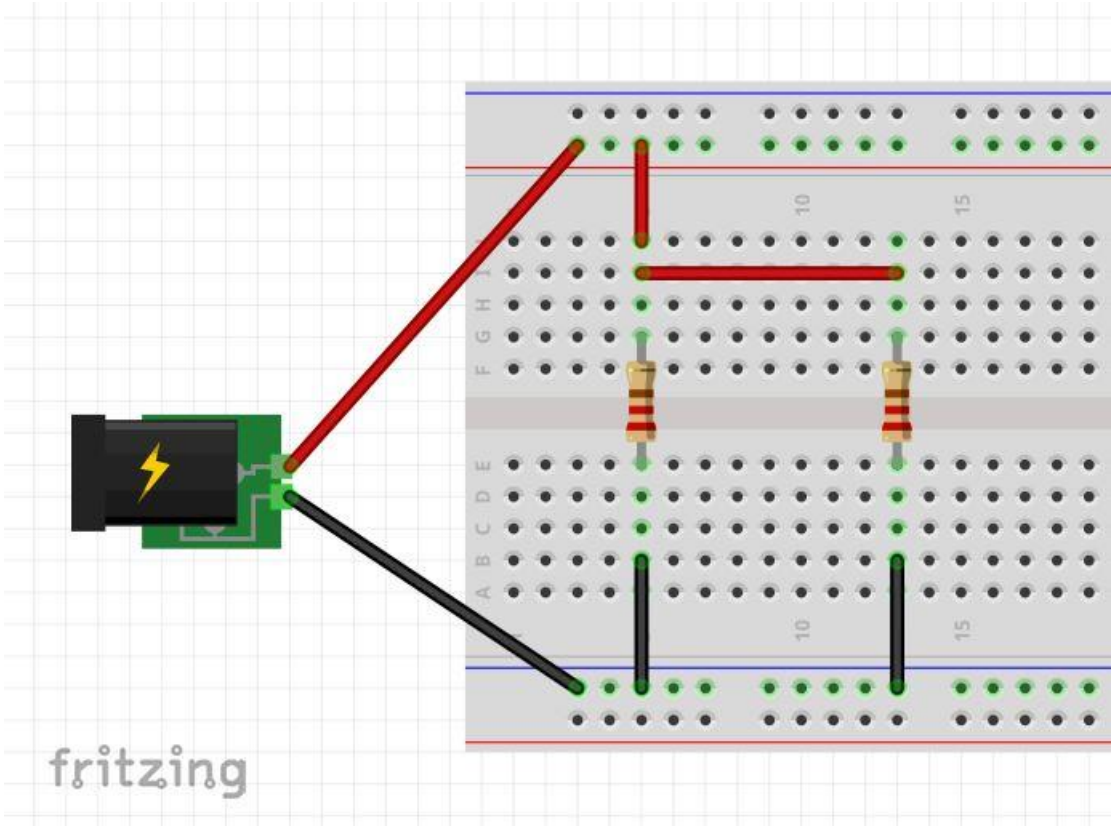
- To measure each resistor, you need to make sure you are measuring just the individual resistors

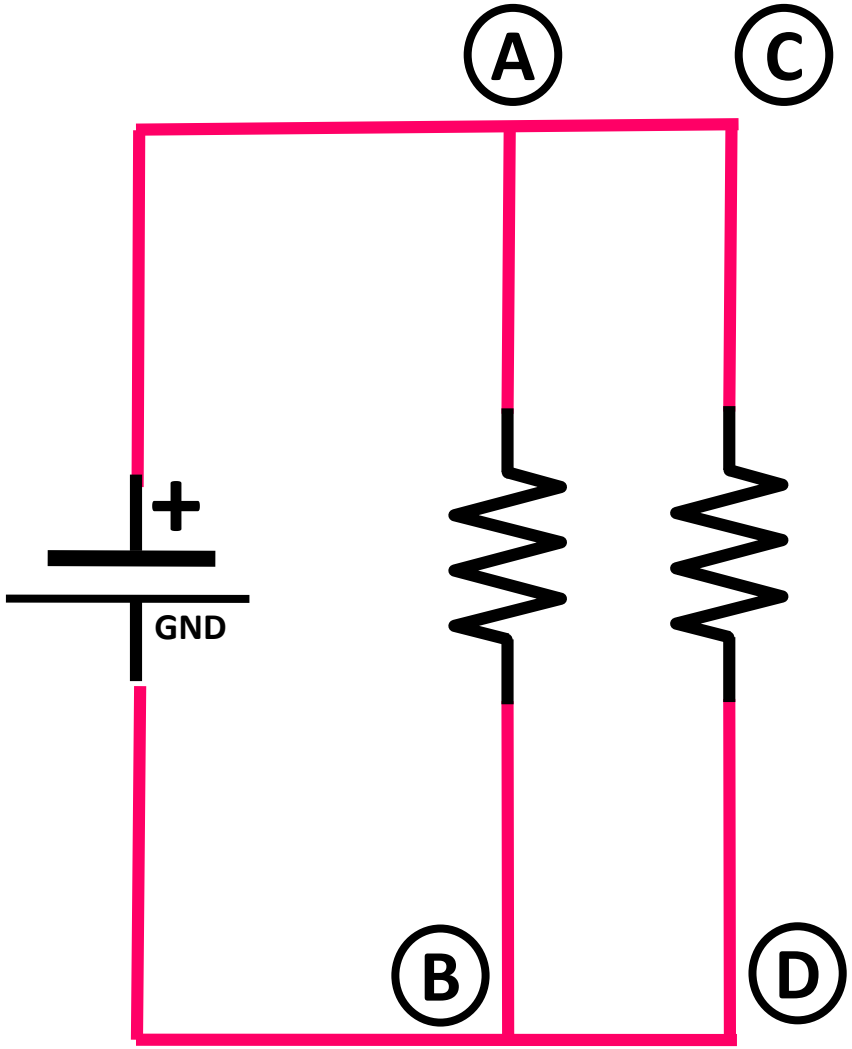




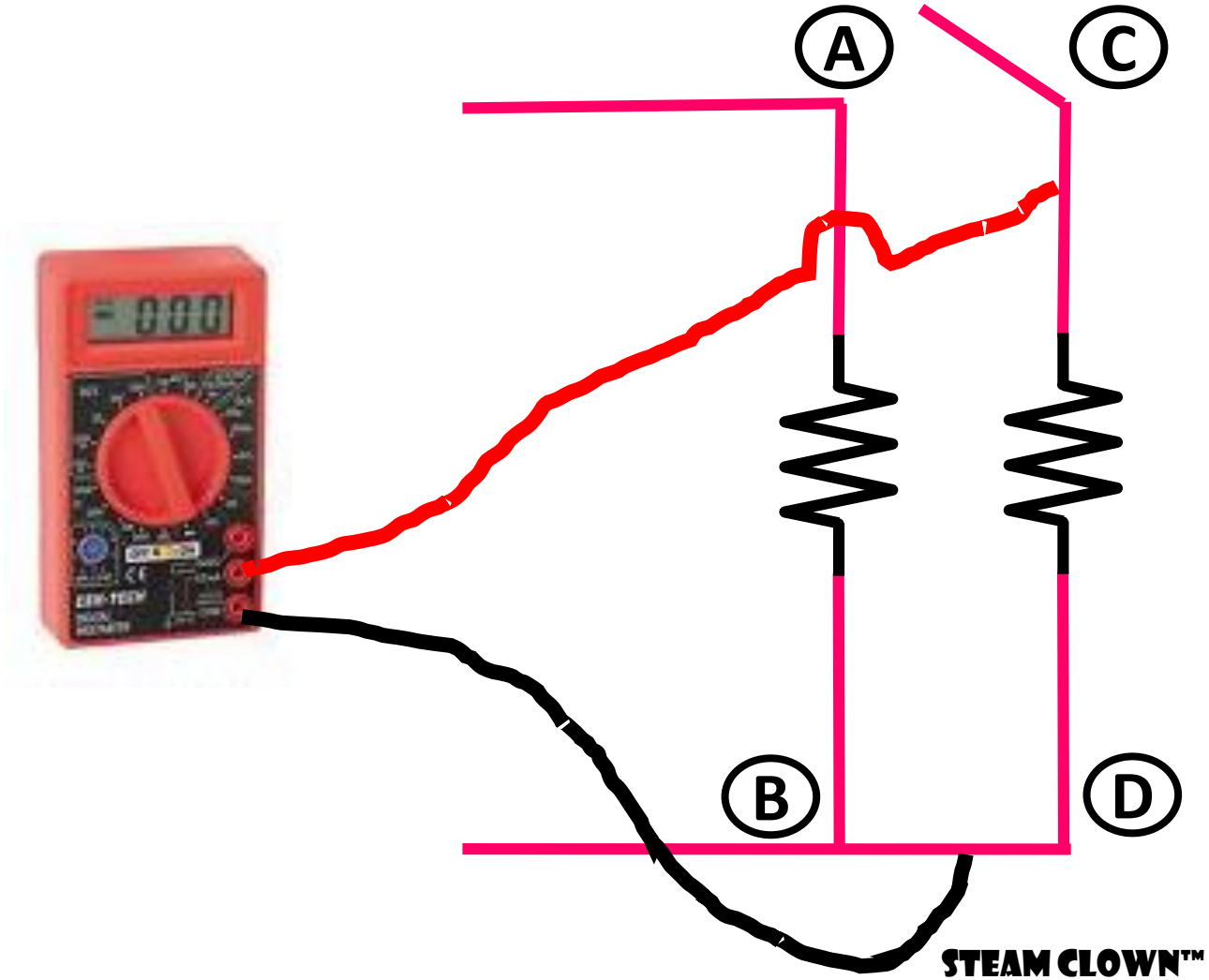
STEAM Clown™ & Squeaky Hinge Productions

BUILD THIS PARALLELS CIRCUIT



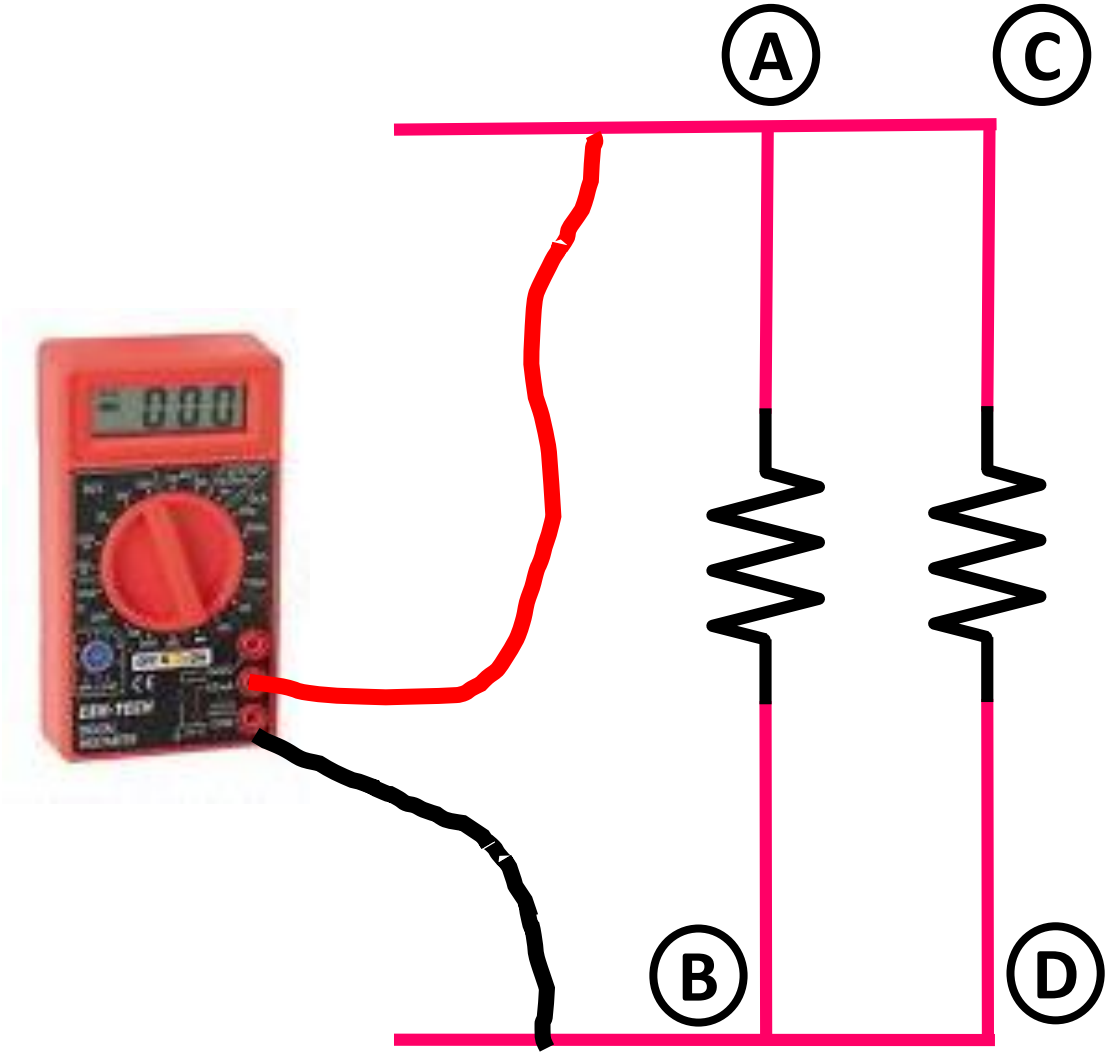


MEASURING INDIVIDUAL RESISTANCE

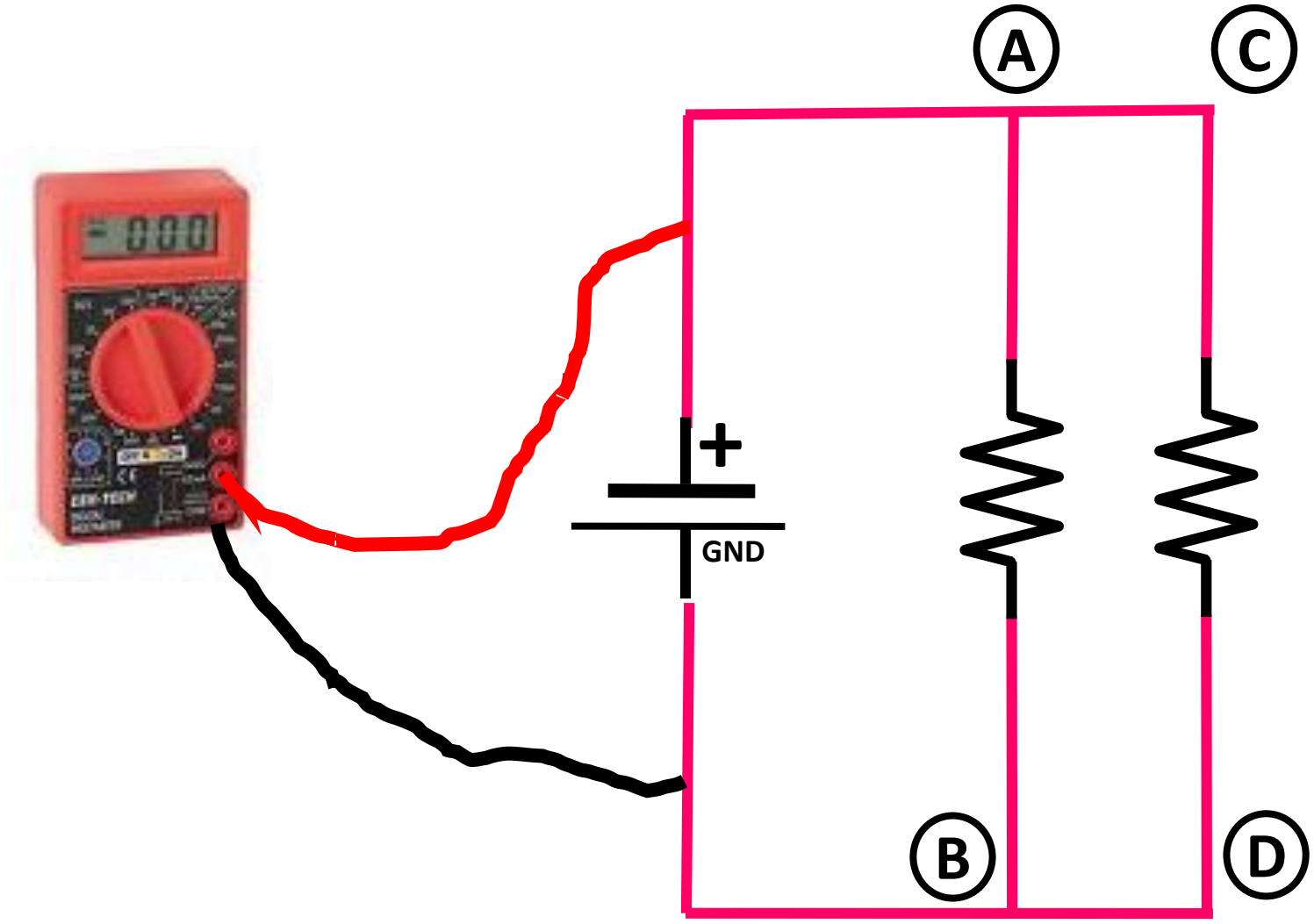


STEAM CLOWN™ & Squeaky Hinge PRODUCTIONS

MEASURING TOTAL RESISTANCE

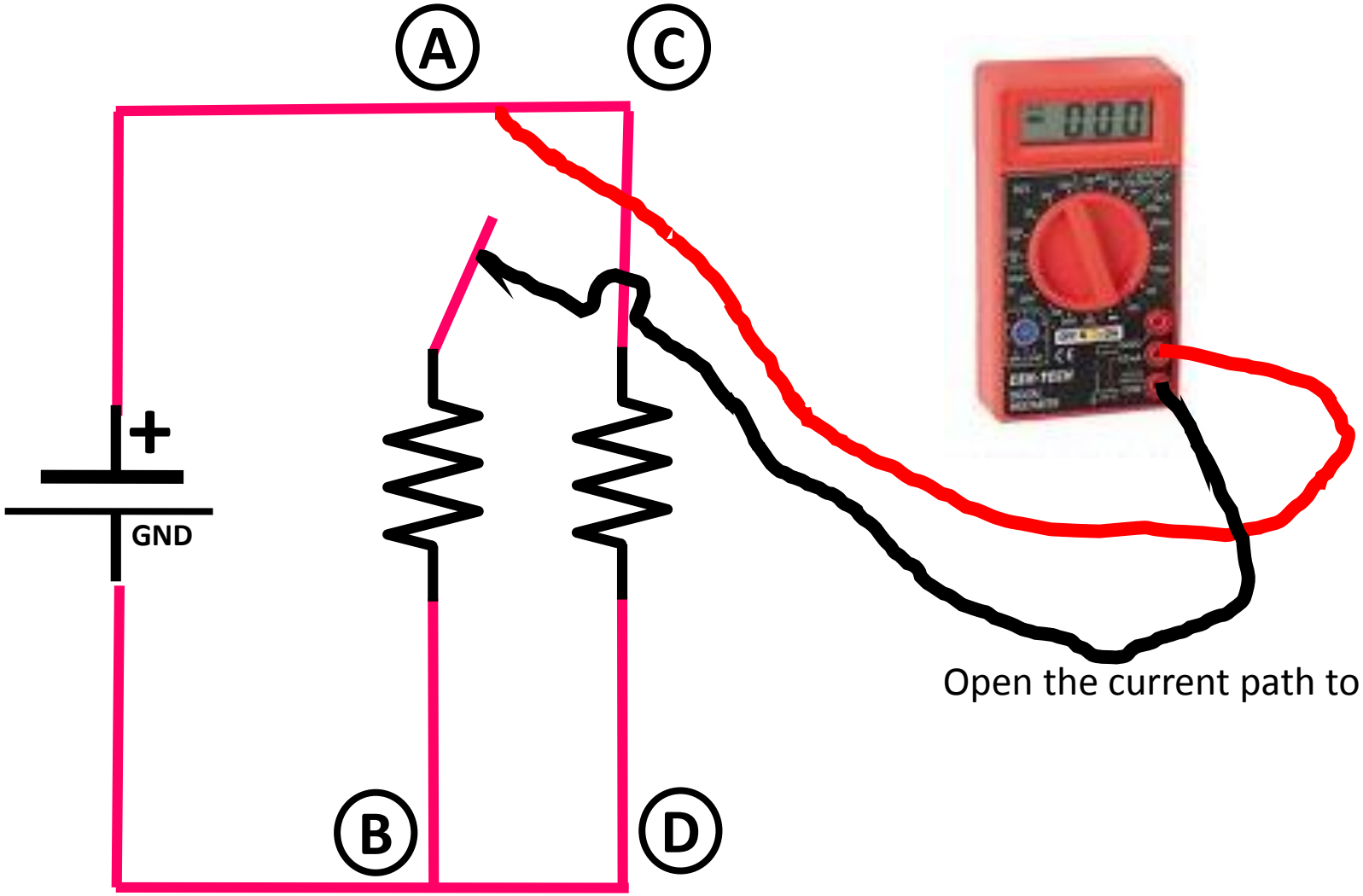


MEASURING TOTAL VOLTAGE



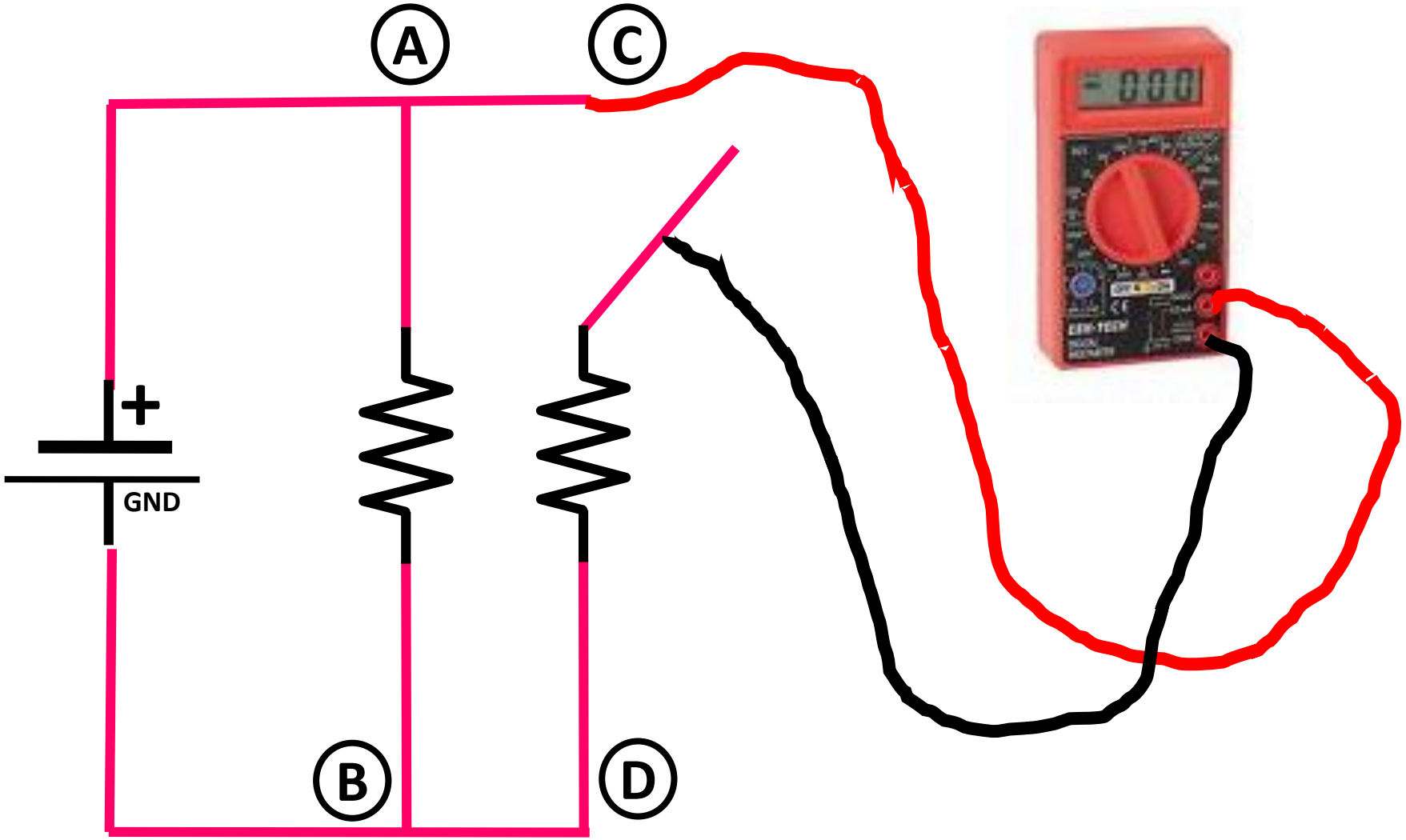
STEAM CLOWN™ & Squeaky Hinge PRODUCTIONS

MEASURING INDIVIDUAL CURRENT



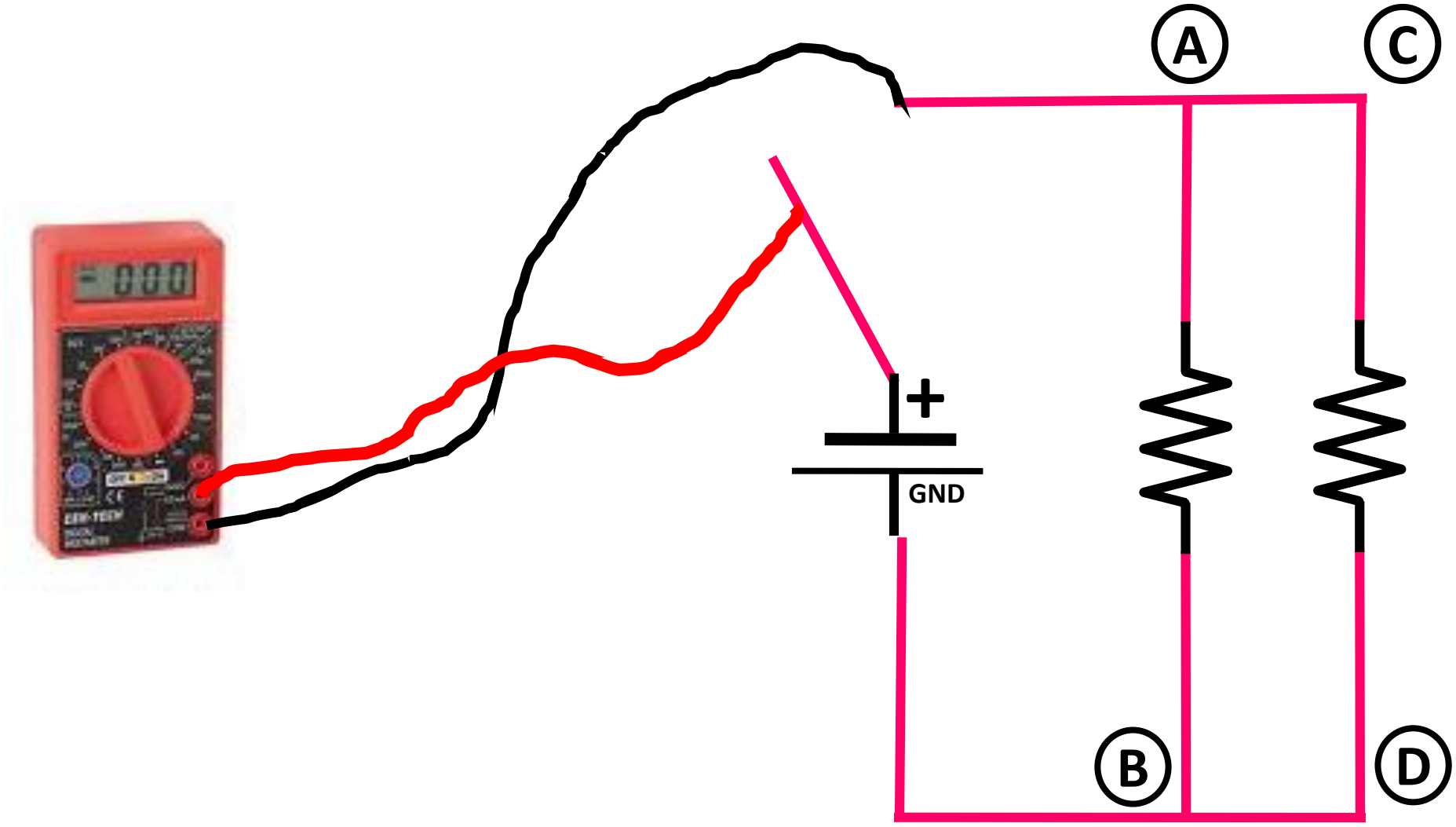
Open the current path to R1

MEASURING INDIVIDUAL CURRENT



STEAM CLOWN™ & Squeaky Hinge PRODUCTIONS

MEASURING TOTAL CURRENT?



LAB - REPEAT WITH MORE RESISTOR VALUES

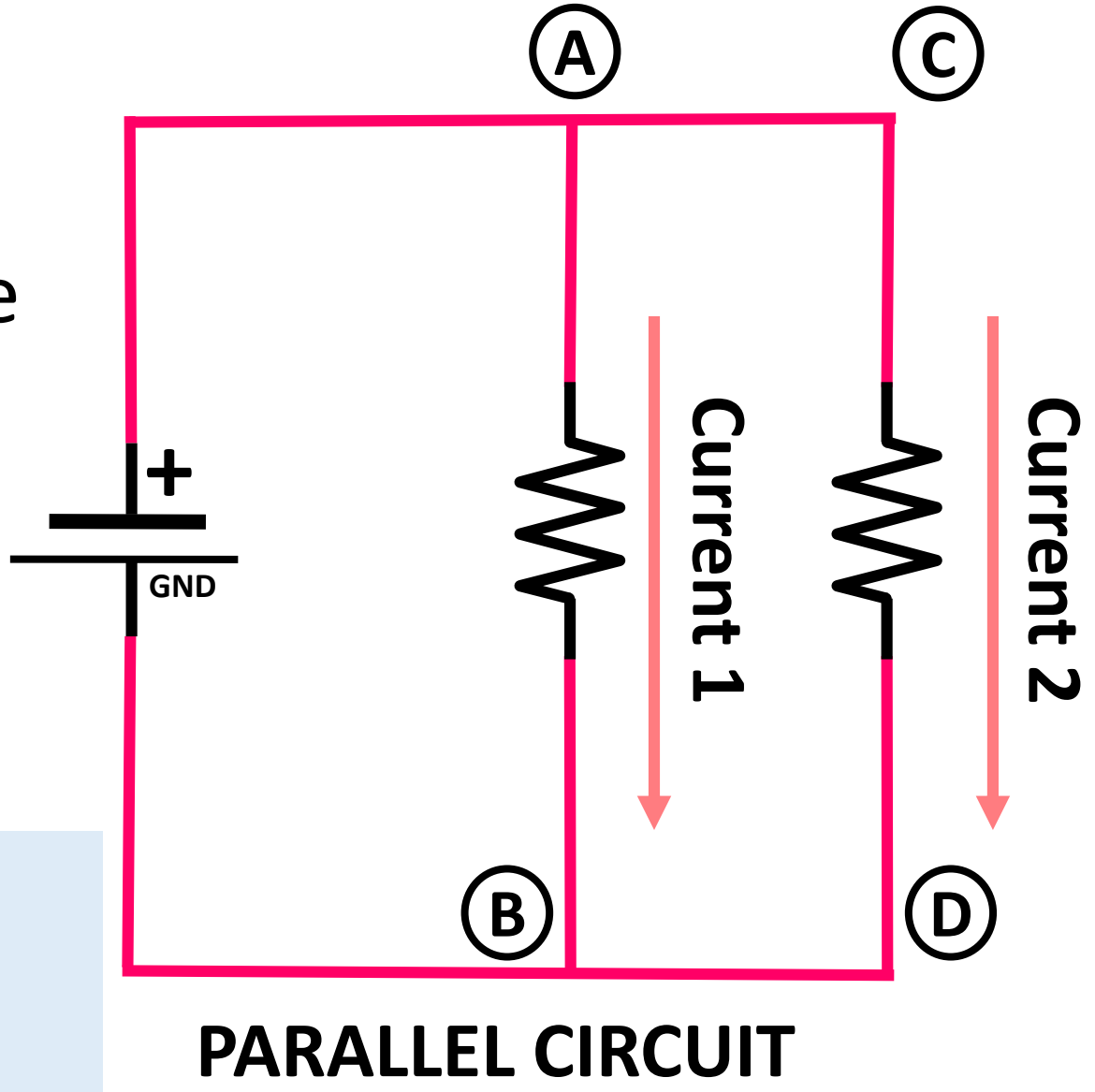
- Re-do lab measurements with different R_1 & R_2
  - R_1 = 100Ω & R_2 = 330Ω
  - R_1 = 100Ω & R_2 = 1KΩ
  - R_1 = 680Ω & R_2 = 2KΩ

Parallel Circuit Measurements	Measured Resistance	Measured Voltage	Measured Current
R1 + R2 (measure in parallel)			
R1 = 100Ω			
R2 = 330Ω			

MATH BEHIND THE MEASUREMENTS

PARALLEL CIRCUITS

- Is the Voltage across A & B the same as across C & D?
  in all paths?



The total resistance of parallel resistors is **always less** than the smallest individual resistor

Calculating Parallel Resistors

- Add the Reciprocals of the individual Resistors to get the reciprocal or the total Resistance
- If you only have 2 resistors

$$\frac{1}{R_t} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \frac{1}{R_n}$$

Parallel Circuit Resistance

$R_1 = 330\Omega$, $R_2 = 330\Omega$ $R_t =$ _____

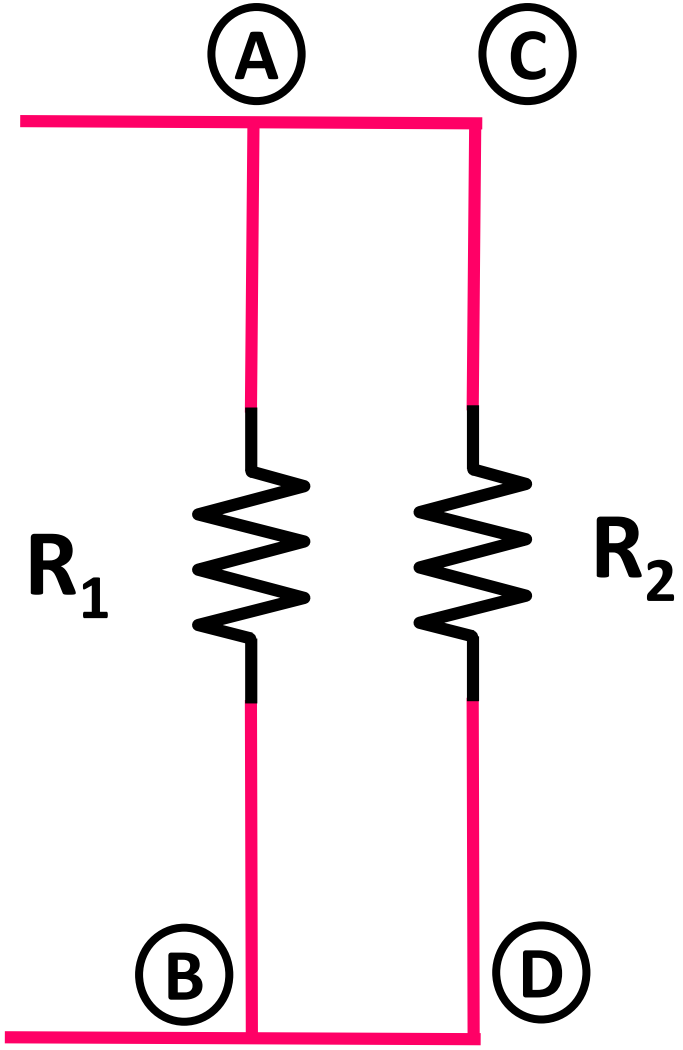
$R_1 = 330\Omega$, $R_2 = 680\Omega$ $R_t =$ _____

$R_1 = 1K\Omega$, $R_2 = 2K\Omega$ $R_t =$ _____

$R_1 = 6800\Omega$, $R_2 = 1K\Omega$ $R_t =$ _____

Put in your Lab Book

$$\frac{1}{R_t} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \frac{1}{R_n}$$

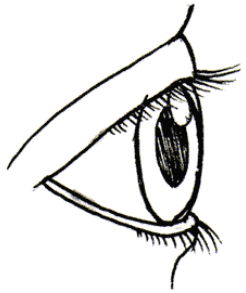


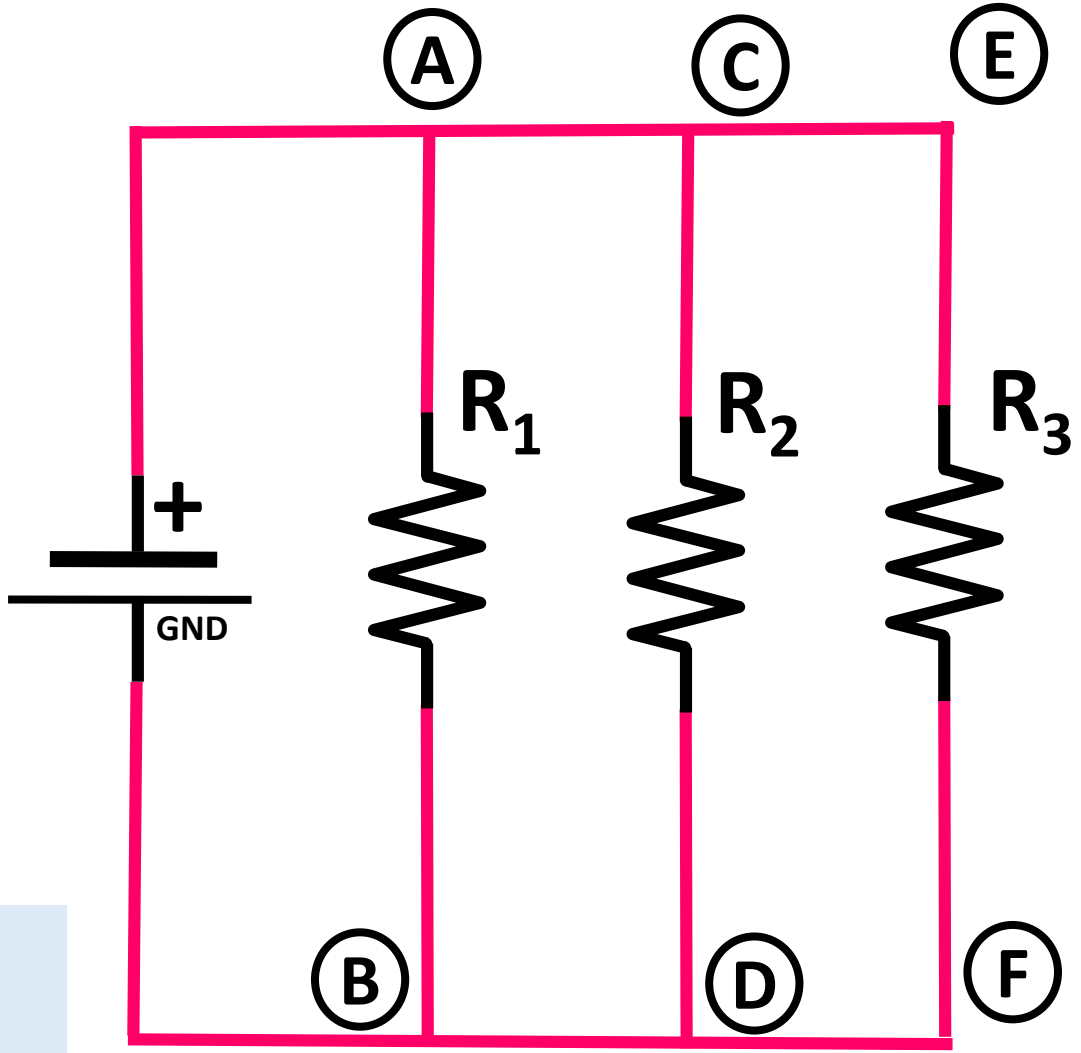
Calculate R_t

PARALLEL CIRCUITS

- **Vcc = 12v**
- **R_1** = 4KΩ
- **R_2** = 6KΩ
- **R_3** = 12KΩ

$$\frac{1}{R_t} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \frac{1}{R_n}$$





PARALLEL CIRCUIT

What is the total resistance?
What is the current in each path?

REFERENCE

SOURCES

- 30 years of electronics in my head…
- Electronic Projects for Photographers
- https://www.youtube.com/watch?v=Hck8k6ALBV8
- https://www.youtube.com/watch?v=2d8CUQokims
- https://adamcap.com/schoolwork/series-and-parallel-circuits-lab/ ← add some of the hypothesis and Questions to the labs
- http://www.thephysicsaviary.com/Physics/Programs/Labs/SeriesCircuitLab/index.html <-- maybe add a lab to prove current is the same…
- http://www.freeclassnotesonline.com/Series-Circuits-Lab.php <-- good lab work sheet… add to presentation