Name Key Hour _____

Circuit Notes

Background:

Voltage (ΔV): Rate at which energy is drawn from a source of electricity (like a battery). Think of it like **electric pressure pushing the electrons through the wire.**

Current (I): Movement of electrons. **Electrons move away from the negative** and towards the positive.

Resistance (R): Slows down/opposes the movement of electrons to control the voltage and current.

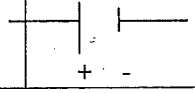
Example: a light bulb is a resistor- The filament slows down the current as it passes through. As it does it creates heat and light.

The amount of current that flows depends on the voltage provided by source of electricity and the resistance. ($\Delta V = IR$)

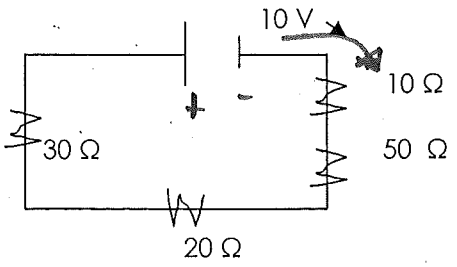
Voltage causes current. Electrons are in wires→ plug in appliance to get voltage→ energy flows from outlet to appliance→ energy causes the e- to vibrate causing current.

Circuit: Path through which electrons can flow. Need complete circuit-no gaps

Elements of a Circuit:

Circuit Element	Symbol	Explanation
Wire		Conductor of electricity (little resistance)
Resistor		Anything that slows down a current to limit/control voltage and current
Battery		Charge flows from – to +

Example of a Circuit:



Name _____ Hour _____

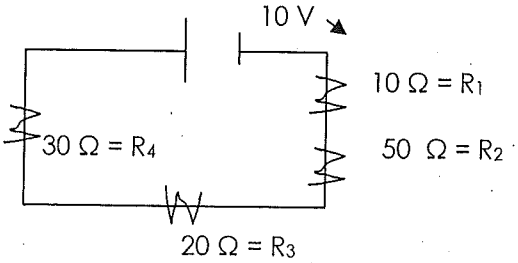
Resistors in a Series Circuit: 1 path only for current

Ex: Lights when 1 goes out, all go out

R_{eq} = Total Resistance **Find this first!**

Resistors in **Series:**

$$R_{eq} = R_1 + R_2 + R_3 + \ldots$$



$R_{eq} = 10 + 50 + 20 + 30 = 110\ \Omega$

- current (I) is the **same** for all resistors
- Different resistors have **different amounts** of voltage lost (**VOLTAGE DROPS**)
  - Higher R means more voltage lost - need more voltage to push through ↑ resistance

1. Find the **total resistance** of the circuit above:

$R_{eq} = 110\ \Omega$

2. Find the current flowing in the circuit.
(**Hint: Use Ohm's Law where R is the total resistance.**)

$\Delta V = IR$

$10 = I(110)$

$I = 0.091\ A$

3. Find the **current through** and the **voltage drop** across each resistor.

$R_{eq} = 110\ \Omega$

$I = 0.091\ A$

$R_1 - \Delta V_1 = (.091)(10) = 0.91\ V$

$R_2 - \Delta V_2 = (.091)(50) = 4.55\ V$

$R_3 - \Delta V_3 = (.091)(20) = 1.82\ V$

$R_4 - \Delta V_4 = (.091)(30) = 2.73\ V$

$10.01\ V$ ✓

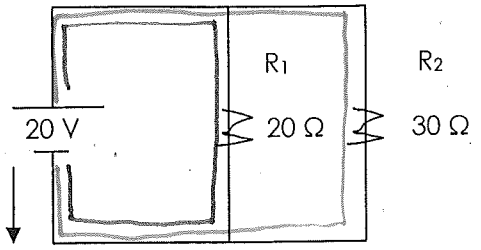
Name _____ Hour _____

Resistors in Parallel Circuit: Multiple Paths for current to flow through

Ex: Lights: 1 goes out, others stay lit

Resistors in **Parallel:**

$$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \dots$$



- Each path has **same** voltage (voltage drop) (all connected to + and – part)
- Each path has a **different amount** of current (travels more easily through low resistance)

1. Find the **total resistance** of the circuit below.

$\frac{1}{R_{eq}} = \frac{1}{20} + \frac{1}{30}$ $\frac{1}{R_{eq}} = .0833$ $R_{eq} = 12\ \Omega$

2. Find the total current for the circuit.

$\Delta V = IR$ $20 = I(12)$ $I = 1.667\ A$

3. Find the current and the voltage drop for each resistor.

$1 + .667 = 1.667\ A$ ✓

R1

$\Delta V_1 = I_1 R_1$

$20 = I_1 (20)$

$I_1 = 1\ A$

R2

$\Delta V_2 = I_2 R_2$

$20 = I_2 (30)$

$I_2 = .667\ A$

SERIES CIRCUIT: only 1 path for current

Every resistor has a different voltage ΔV

Every resistor has the same current I

PARALLEL CIRCUIT: multiple paths

Every resistor has a different current I

Every resistor has the same voltage ΔV