Study Guide

Coulomb's Law

$$F_E = \frac{k q_1 q_2}{d^2}$$

F_E = electrostatic force (N)

$k = 9 \times 10^9$ ← always!

q_1 = charge of 1st particle (C)

q_2 = charge of 2nd particle (C)

d = distance (m)

★ opposites attract – when the charges have a negative charge and a positive, they attract.

★ Like charges repel – when charges have positive + positive – repel
negative + negative – repel

Inverse square Law

$$F_E = \frac{k q_1 q_2}{d^2}$$

On the top of the formula: When you double the charge, it doubles the force.

On the bottom of the formula: When you double the distance, because it is squared, and on bottom, it is 1/4th the force.

Ex:

$$\frac{1}{4} \quad F_E = \frac{k q_1 q_2}{2d^2}$$

$2^2 = 4$

Ohm's Law

$$V = IR$$

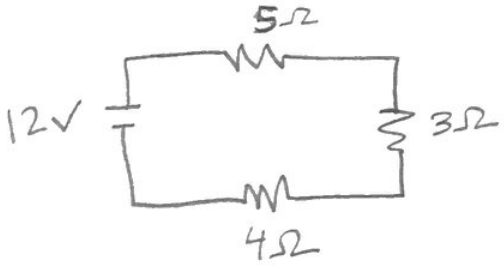
V = Voltage (V)
I = current (A)
R = Resistance (Ω)

Voltage is the "battery", current travels through the "wire", resistor is the "light bulb" in a circuit

Voltage drop = potential difference.

Series circuit

- current remains constant
- one path



To find Total resistance:

$R_T = R_1 + R_2 + R_3 \ldots$

$5 + 3 + 4 = \boxed{12\,\Omega}$

Use total voltage & total resistance to find current.

$V = IR$

$\frac{12v}{12} = \frac{(I)(12\Omega)}{12}$

$\boxed{1A = I}$

Parallel circuit

- voltage remains constant
- multiple paths

To find total resistance:

$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} \ldots$

$\frac{1}{R_T} = \frac{1}{5} + \frac{1}{3} + \frac{1}{4}$

$R_T = \boxed{1.3\,\Omega}$

To find current at each resistor: (voltage stays constant)

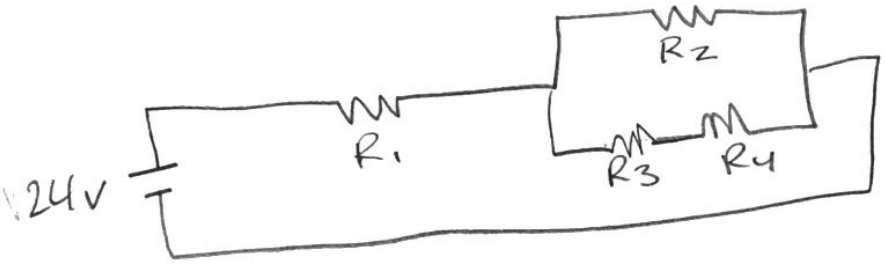
$V = IR$

$12v = I(5)$ $\quad \frac{12}{5} = \boxed{2.4A}$

$12v = I(3)$ $\quad \frac{12}{3} = \boxed{4A}$

$12v = I(4)$ $\quad \frac{12}{4} = \boxed{3A}$

Combination Circuit:



R_1 is in series

R_3 & R_4 are in series within the parallel

R_2 is in parallel

Collapse resistors to get them into a series.

Solve for total current

↓

constant in series

use current to solve for voltage at resistors

↓

constant in parallel

Build the circuit back up to solve for current and voltage at each resistor.

use $V=IR$ to solve for missing information.

Voltmeter - measures voltage

Ammeter - measures current

Fuses and circuit breakers are used to regulate.

Power

$P = IV$

P = power (watts)
I = current (A)
V = voltage (V)

Magnets

North and South pole
Opposites attract
Magnetic field - more lines, stronger field.

Electromagnets:

current running through wire.
Wrapping a wire into coils makes the magnetic field stronger → solenoid
Used to make a motor

Motors: electrical energy into kinetic energy
Generators: kinetic energy into electrical energy.