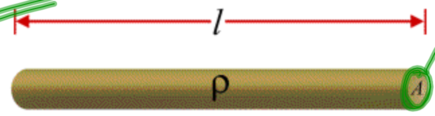
Resistance of a Wire

Pink Worksheet

$A = \pi r^2$

m^2



$$R = \frac{\rho l}{A}$$

Greek letter
ρ = rho
= resistivity value

① Long skinny wire.
↑L ∴ ↑R
↓A ∴ ↑R

② $R = \frac{\rho L}{A}$ ↑L 3X ∴ ↑R 3X

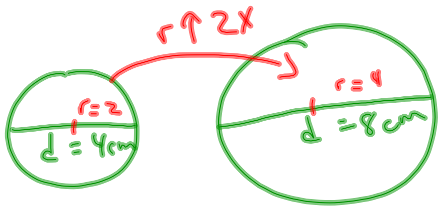
③ ↑A 3X ∴ R↓ $\frac{1}{3}$X

④ $R = \frac{\rho L}{A}$ $R = \frac{\rho L}{\pi r^2}$ $A = \pi r^2$
r ↓ $\frac{1}{2}$ X
∴ R ↑ 4X

⑤ $R = \frac{\rho L}{A}$
L↓ $\frac{1}{2}$X ∴ R↓ $\frac{1}{2}$X

⑥ $R = \frac{\rho L}{A}$ A↑2X ∴ R↓ $\frac{1}{2}$ X

⑦



$R = \frac{\rho L}{\pi r^2}$ r↑2X ∴ R↓ $\frac{1}{4}$X

Jun 16-9:07 AM

(8) $R = \frac{\rho L}{A}$

B → A: 9m → 3m

$\frac{A}{B} = \frac{3}{9} = \frac{1}{3}$

$L \downarrow \frac{1}{3} X$

$\therefore R \downarrow \frac{1}{3} X$

(9) For very ↑ I, need very ↓ R
as per $I = \frac{V}{R}$

For very ↓ R, need ↑ A
as per $R = \frac{\rho L}{A}$.

* For ↑ I need ↑ A.

Jun 16-9:44 AM

(18) Short as possible

(11) $\downarrow r \ \frac{1}{3} X$ $R = \frac{\rho L}{\pi r^2}$

$R \uparrow 9X$

$I = \frac{V}{R}$ $I \downarrow \frac{1}{9} X$

(12) If you use a wire that's too thin, the resistance will be too high. This could start a fire. Also, it would ↓ I so appliance wouldn't operate properly.

Coulomb's Law

$$F = \frac{k\, Q_1^{\times 3} Q_2^{\times 2}}{d^2}$$

F = Force between changes

Q_1 =
Q_2 =
Two different Point changes in Coulombs.

Point change

$Q_1 = {}^{-}1.2 \times 10^{-2}$ C

-1 C

$Q_2 = 1.8 \times 1$

$\uparrow Q_1$ 2X $\therefore$ F $\uparrow$ 2X

$\uparrow$ d 3X $\therefore$ d $\downarrow \frac{1}{9}$ X

$$F = \frac{K Q_1 Q_2}{d^2}$$

① a) $Q_1 \uparrow 2X \therefore \boxed{F \uparrow 2X}$

b) $d \uparrow 2X \therefore \boxed{F \downarrow \frac{1}{4} X}$

c) $Q_1 \uparrow 2X \; Q_2 \uparrow 2X \; \boxed{F \uparrow 4X}$

② a) $d \uparrow 4X \therefore F \downarrow \frac{1}{16} X$

b) $d \downarrow \frac{1}{2} X \therefore F \uparrow 4X$

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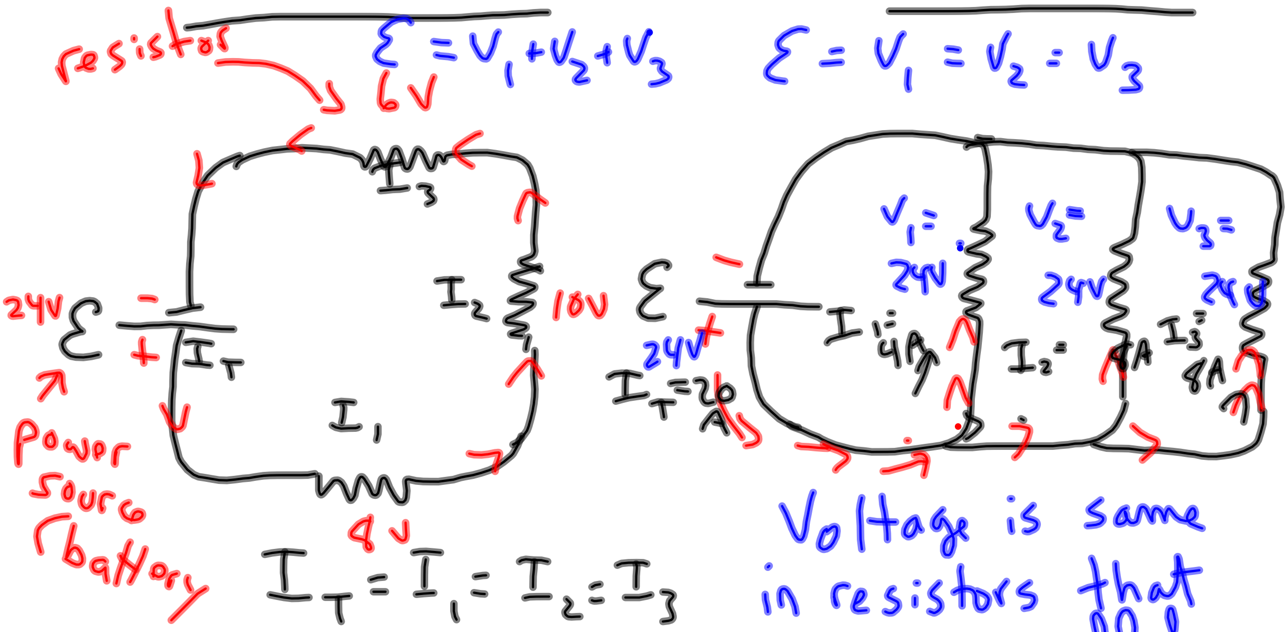
Series Circuit

$\mathcal{E} = V_1 + V_2 + V_3$

Parallel Circuit

$\mathcal{E} = V_1 = V_2 = V_3$



$I_T = I_1 = I_2 = I_3$

Voltage is same in resistors that are in parallel

actual current: flow of $\bar{e}$'s from − to +

conventional current: flow of + particles from + to −

→ We will use this

Series	Parallel
$I_T = I_1 = I_2 = I_3$	$\mathcal{E} = V_1 = V_2 = V_3$
$\mathcal{E} = V_1 + V_2 + V_3$	$I_T = I_1 + I_2 + I_3$

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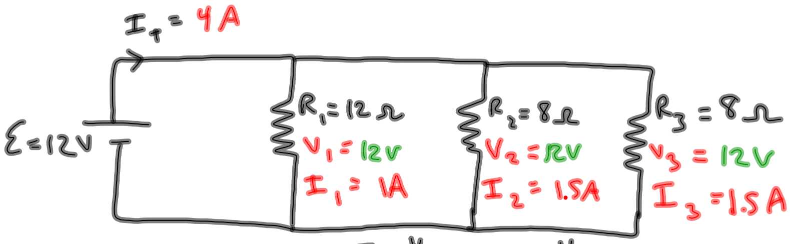
①



$I = \frac{V}{R}$ } holds true at each resistor and for the totals!

$I_T = \frac{\varepsilon}{R_{eq}}$

$I_1 = \frac{V_1}{R_1} = \frac{12V}{12\,\Omega} = 1A$

$I_2 = \frac{V_2}{R_2} = \frac{12V}{8\,\Omega} = 1.5A$

$I_3 = \frac{V_3}{R_3} = \frac{12V}{8\,\Omega} = 1.5A$

R_{eq} = "equivalent resistance"

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

$$\frac{1}{R_{eq}} = \frac{1}{12} + \frac{1}{8} + \frac{1}{8}$$

$$\frac{1}{R_{eq}} = 0.0833 + 0.125 + 0.125$$

$$\frac{1}{R_{eq}} = 0.33\bar{3}$$

$$R_{eq} = \frac{1}{0.333} = 3\,\Omega$$

x^{-1} $\frac{1}{x}$

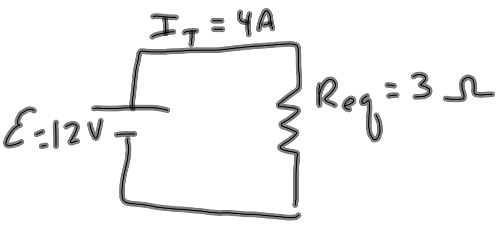
$$\frac{1}{x} = \frac{0.333}{1}$$

$$\frac{x}{1} = \frac{1}{0.333}$$

$$x = 3\,\Omega$$

OR $I_T = \frac{\varepsilon}{R_{eq}}$

$$R_{eq} = \frac{\varepsilon}{I_T} = \frac{12V}{4A} = 3\,\Omega$$



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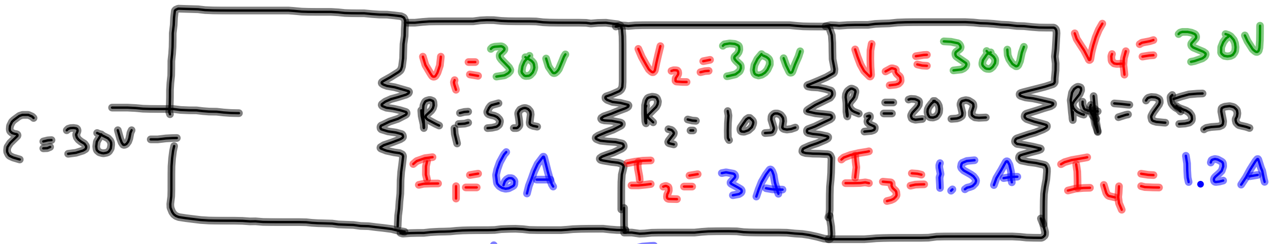
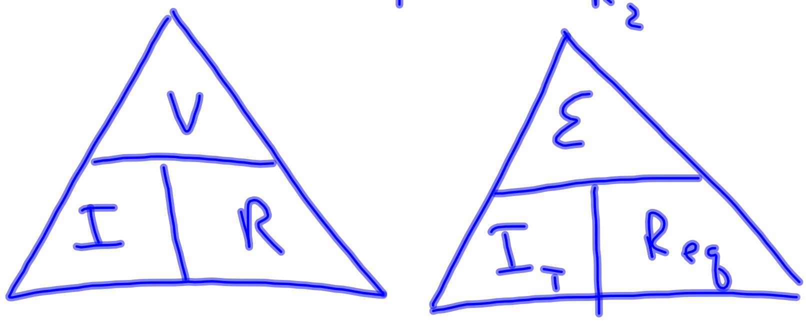
2.

$I_T = I_1 + I_2 + I_3 + I_4$
$= 11.7A$



$I_1 = \frac{V_1}{R_1}$ $I_2 = \frac{V_2}{R_2}$



OR

$R_{eq} = \frac{\mathcal{E}}{I_T}$

$$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \frac{1}{R_4}$$

$$\frac{1}{R_{eq}} = \frac{1}{5} + \frac{1}{10} + \frac{1}{20} + \frac{1}{25}$$

$$\frac{1}{R_{eq}} = 0.2 + 0.1 + 0.05 + 0.04$$

$$\frac{1}{R_{eq}} = 0.39$$

$$R_{eq} = \frac{1}{0.39} = 2.56\Omega$$

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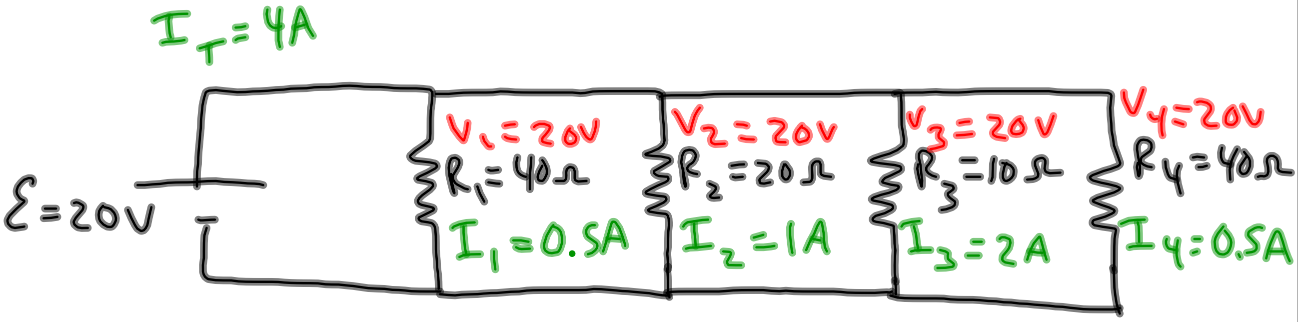
White : Parallel Circuits



$$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \frac{1}{R_4}$$

$$\frac{1}{R_{eq}} = \frac{1}{40} + \frac{1}{20} + \frac{1}{10} + \frac{1}{40}$$

$$\frac{1}{R_{eq}} = 0.025 + 0.05 + 0.1 + 0.025$$

$$\frac{1}{R_{eq}} = 0.2$$

$$R_{eq} = \frac{1}{0.2} = 5\ \Omega$$