Current Electricity

Friday, March 26, 2010
9:48 AM

The movement of charges is called CURRENT. In formulae current is symbolize with I
The units of current are Amperes (Amps) A.
The current direction is defined as the direction positive charges flow.
Electrons flow in the opposite of the current direction.
Current is the amount of charge passing a point per second

$$I = \frac{q}{t}$$

4.8×10^{-6} C of charge pass a point in 4.0 ms, determine the current or die.

$$I = \frac{q}{t} = \frac{4.8 \times 10^{-6}}{4 \times 10^{-3}} = 1.2 \times 10^{-3} \text{ A}$$

Total charge Q = # of small charges q x the size of q

$$Q = ne$$

Q: total charge; n: #; e: elementary charge

For example: what is the total charge of 1.5×10^{18} electrons?

$$Q = 1.5 \times 10^{18} (-1.6 \times 10^{-19})$$
$$= -2.4 \times 10^{-1} \text{ C}$$

What makes charges flow? A potential difference (voltage difference) between points, closed path between the points (closed using conductors).

Ω

Perfect conductors are metals like wires. Non-perfect conductors are

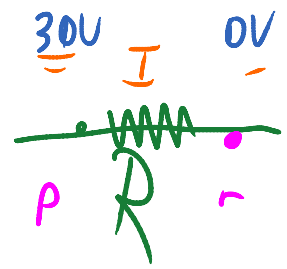
Perfect conductors are metals like wires. Non-perfect conductors are called resistors (they resist but do not stop flow of charges). Resistors transform electrical Ep into heat energy. Resistance to electrical current is called resistance. Symbol in equations R, units are ohms (Ω).

$$I = \frac{\Delta V}{R}$$ ← Ohm's Law

6.24 x 10 ^{20} electrons flow between 2 points in 2.0 s, if the voltage moving the charges was 30.0 V, calculate the current flowing and the resistance between the points.
NOTE: current is a vector so + and - only mean direction!

$$I = \frac{Q}{t} = \frac{ne}{t} = \frac{6.24\times10^{20}(-1.6\times10^{-19})}{2} = -4.99\times10^{1}\ A$$

$$I = \frac{\Delta V}{R} \qquad R = \frac{\Delta V}{I} = \frac{30}{50} = .60\ \Omega$$



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

$It = q$

We know: W = ΔE = $E_p = \Delta V q$

=

$E_p = \Delta V I t$

$P = \frac{W}{t}$

$P = \Delta V I$ ← Joule's Law

P = ΔVI

Combine Joule's Law with Ohm's Law

$P = \Delta V I$ $\qquad \Delta V = IR$

Combine Joule's Law with Ohm's Law

$P = \Delta V I$

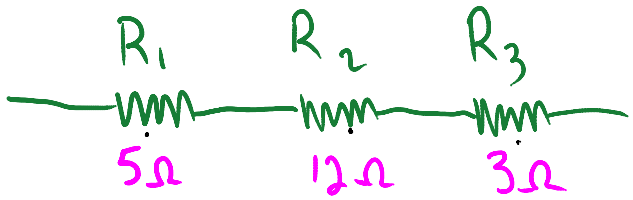
$\frac{\Delta V}{R} = I \Leftarrow \Delta V = IR$

$P = \frac{\Delta V \Delta V}{R} = \frac{\Delta V^2}{R}$

$P = IRI = I^2 R$

$.25 \times 10^{21}$

Equivalent Resistance:



SERIES

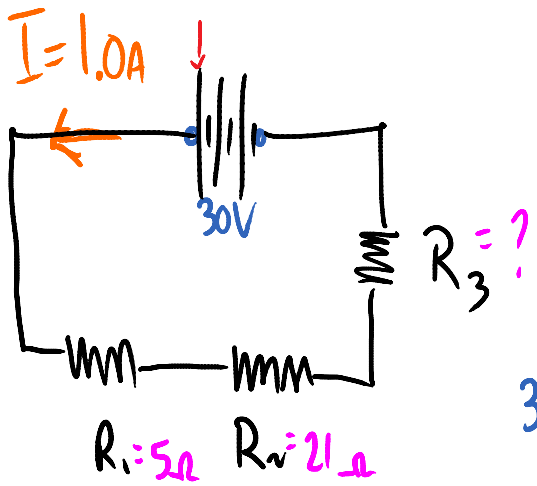
4

Find the equivalent resistance (find the total R)

in series $R_{TOT} = R_1 + R_2 + R_3 \ldots\ldots$

$R_{TOT} = \sum_{n=1}^{m} R_n$

+|- Cell



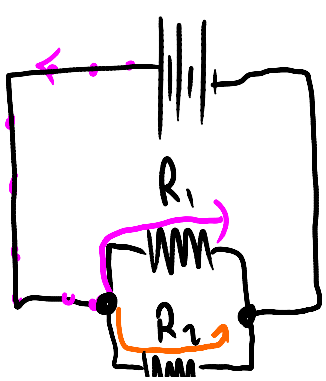
find R_3

$\frac{30V}{1A} = \frac{V_{TOT}}{I_{TOT}} = R_{TOT} = 30\Omega = R_1 + R_2 + R_3$

$30 = 5 + 21 + R_3$

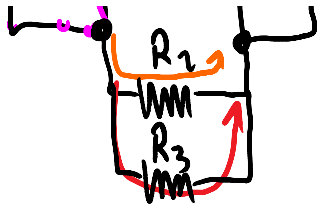
$4.0\Omega = R_3$

4



PARALLEL PATHS

$\frac{1}{\ } = \frac{1}{\ } + \frac{1}{\ } + \frac{1}{\ } \ldots\ldots$



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

$$\frac{1}{R_{TOT}} = \sum_{n=1}^{m} \frac{1}{R_n}$$

$R_1 = 10\,\Omega$

$R_2 = 20\,\Omega$

$R_3 = 30\,\Omega$

find R_{TOT} if they are connected in parallel

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

$$= \frac{6}{60} + \frac{3}{60} + \frac{2}{60} = \frac{11}{60} = \frac{1}{R_{TOT}}$$

$$R_{TOT} = \frac{60}{11}$$

$$= 5.45\,\Omega$$

$$\frac{1}{10} + \frac{1}{20} + \frac{1}{30}$$

$$10x^{-1} + 20x^{-1} + 30x^{-1} = \frac{1}{R_{TOT}} \qquad x^{-1} =$$

Now work:

1-3 p. 180 1-3 p181 1-5 p184 2 p191

A potential difference of 12 V exists between a car battery and starter motor. If the resistance of the starter is 0.12 Ω how many electrons will flow past the starter in 2.0 seconds as you ignite the gasoline in the cylinders?

$$= V = 22.3\,V$$

Combining Joule's Law with Ohm's Law:

$$P = \Delta V I$$

$$P = \frac{\Delta V \Delta V}{R} = \Delta$$

p. 180 1 - 3,
p. 184 1 - 5

Find out and record the circuits symbols for cells, batteries, wire, switches (open and closed), resistors, bulbs, voltmeters, ammeters.

120 W ← 2 60W

.12 kW × 24 h × 30 day × \$.06 =