Electricity

1) Electricity - Form of energy involves an electrical charge.

2) Static electricity - electricity at rest.

3) Current electricity - electrical charge in motion.

4) Charge - a property attributed a matter such as electrons are negative and protons are positive.

5) Effect of Charges: ① like charges repel each other.
② unlike charges attract each other.
③ imbalance of protons and electrons creates a charge.

6) Electrical Conductors - matter that will allow the transfers of electrical energy. Ex. metals

7) Electrical insulators - matter that will not allow the transfer of electrical energy. Ex. Rubber

8) Induced charge - transfer of electrons from one object to another can charge an object.

9) Electric Field - deals with the properties of charges that always exists in the space around a charged particle.

10) Electrical potential energy - the ability to move an electric charge from one point to another and is dependant on its position in an electric field.

11) Potential difference - the change in the electrical potential energy of a charged particle divided by its charge and occurs as a charge moves from one place to another in an electric field.

12) Voltage - SI unit for potential difference and is equal to 1 Joule/coulomb. Note: Pressure on the electric charge in an electric circuit.

13) Electric current - rate at which the charges move through the wire.

14) Ampere - one coulomb of charge moving past a point in 1 second.

15) Resistance - Caused by internal friction, which slows the movement of charges through a conducting material.

16) Ohm's Law - resistance is equal to the voltage divided by the Amperage of a system.

17 Ohm's Law Calculations

$R = \frac{V}{I}$ R = electrical resistance = Ohm = $\frac{Js}{C^2} = \Omega$

V = Voltage = $\frac{J}{C}$

I = Amperage = A = $\frac{C}{s}$

Example #1 R = ____ V = 120 V I = 10 A

$= 120 \frac{J}{C}$ $= 10 \frac{C}{s}$

$R = \frac{V}{I} = \frac{120 \frac{J}{C}}{10 \frac{C}{s}} = \left(120 \frac{J}{C}\right)\left(\frac{s}{10 C}\right) = 12 \frac{Js}{C^2} = 12 \Omega$

Example #2 R = .256 Ω V = ____ I = 5.00 A

$= .256 \frac{Js}{C^2}$ $= 5.00 \frac{C}{s}$

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

$V = IR = \left(5.00 \frac{C}{s}\right)\left(.256 \frac{Js}{C^2}\right) = 1.28 \frac{J}{C} = 1.28 V$

Example #3 R = .0512 Ω V = 210 V I = ____

$= .0512 \frac{Js}{C^2}$ $= 210 \frac{J}{C}$

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

$I = \frac{V}{R} = \frac{210 \frac{J}{C}}{.0512 \frac{Js}{C^2}} = \left(210 \frac{J}{C}\right)\left(\frac{C^2}{.0512 Js}\right) = 4.10 \times 10^3 \frac{C}{s} = 4.10 \times 10^3 A$

18 Comparing Resistance of materials
1) Conductors have low resistance.
(Look at atom's electron cloud looseness.)
2) Insulator have high resistance.
(Atom's electron cloud is tight.)

19) Semiconductors - material that has properties that can act as an insulator in one situation and a conductor in another.

20) Electric circuit - a complete path for the electric charge to travel.
Electrical source → Conductor (wire) →
switch → wire → Load (light bulb) →
Wire → Electrical source.

21) Closed circuit - a complete path.

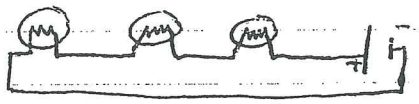
22) Open Circuit - No complete path.

23) Schematic diagram - this depicts the construction of an electric circuit.

24) Schematic Symbols
1) ⌐ - Conductor
2) —/\/\/\— - Resistor
3) —(M)— - light bulb
4) —|+ |— - Current source
5) —o o— open - Switch
6) —o—o— closed

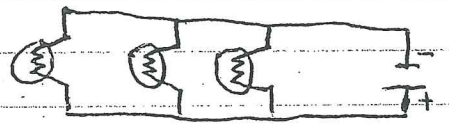
25) Series Circuit - Electrical devices are connected with only one path for the current to flow.

Example:



26) Parallel Circuit - Electrical devices are connected with each device having it's own path for the current to flow.

Example:



27) Electrical power - the rate at which electrical energy is changed.

28) Electrical Power Calculation:

$P = V I$

P = Power = $\frac{J}{s}$ = Watt

V = Voltage = $\frac{J}{C}$

I = Amperage = $\frac{C}{s}$ = A

28) Example #1 $P =$ ____ $V = 220\bar{0}\ V$ $I = 10.0\ A$

$= 220\bar{0}\ \frac{J}{C}$ $= 10.0\ \frac{C}{s}$

$$P = VI = \left(220\bar{0}\ \frac{J}{C}\right)\left(10.0\ \frac{C}{s}\right) = 2200\ \frac{J}{s} = 2200\ W$$

Example #2 $P = 60.0\ W$ $V =$ ____ $I = 5.00\ A$

$= 60.0\ \frac{J}{s}$ $= 5.00\ \frac{C}{s}$

$$P = VI$$

$$V = \frac{P}{I} = \frac{60.0\ \frac{J}{s}}{5.00\ \frac{C}{s}} = \left(60.0\ \frac{J}{s}\right)\left(\frac{s}{5.00\ C}\right) = 12.0\ \frac{J}{C} = 12.0\ V$$

Example #3 $P = 50.0\ W$ $V = 11\bar{0}\ V$ $I =$ ____

$= 50.0\ \frac{J}{s}$ $= 11\bar{0}\ \frac{J}{C}$

$$P = VI$$

$$I = \frac{P}{V} = \frac{50.0\ \frac{J}{s}}{11\bar{0}\ \frac{J}{C}} = \left(50.0\ \frac{J}{s}\right)\left(\frac{C}{11\bar{0}\ J}\right) = .455\ \frac{C}{s} = .455\ A$$

29) Relationships with Ohm's law and Electrical Power

1) $R = \frac{V}{I}$ $P = VI$

$V = IR$ $V = \frac{P}{I}$

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

30) (A) $V = IR$ $\quad V = \frac{P}{I}$ Relationship P, R, I

$V = V$

$IR = \frac{P}{I}$ $\therefore$ $P = RI^2$

(B) $I = \frac{V}{R}$ $\quad I = \frac{P}{V}$ Relationship P, R, V

$I = I$

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

31) Fuse and Circuit Breaker – device that prevents too many amperes of current from pathing through a circuit.

32) Wire gauge – Size of the wire and it help determine how many amperes of current can pass through safely.