DIRECT CURRENT ELECTRICITY

AN ELECTRICAL CURRENT CAN FLOW IN EITHER OF TWO DIRECTIONS THROUGH A CONDUCTOR. IF IT FLOWS IN ONLY ONE DIRECTION, WHETHER STEADILY OR IN PULSES, IT'S CALLED DIRECT CURRENT (DC). IT'S IMPORTANT TO BE ABLE TO SPECIFY THE QUANTITY AND POWER OF A DIRECT CURRENT. HERE ARE THE KEY TERMS:

☐ CURRENT (I) — CURRENT IS THE QUANTITY OF ELECTRONS PASSING A GIVEN POINT. THE UNIT OF CURRENT IS THE AMPERE. ONE AMPERE IS 6,280,000,000,000,000,000 (6.28×10^{18}) ELECTRONS PASSING A POINT IN ONE SECOND.

☐ VOLTAGE (V OR E) — VOLTAGE IS ELECTRICAL PRESSURE OR FORCE. VOLTAGE IS SOMETIMES REFERRED TO AS POTENTIAL. VOLTAGE DROP IS THE DIFFERENCE IN VOLTAGE BETWEEN THE TWO ENDS OF A CONDUCTOR THROUGH WHICH CURRENT IS FLOWING. IF WE COMPARE CURRENT TO WATER FLOWING THROUGH A PIPE, THEN VOLTAGE IS THE WATER PRESSURE.

☐ POWER (P) — THE WORK PERFORMED BY AN ELECTRICAL CURRENT IS CALLED POWER. THE UNIT OF POWER IS THE WATT. THE POWER OF A DIRECT CURRENT IS ITS VOLTAGE TIMES ITS CURRENT.

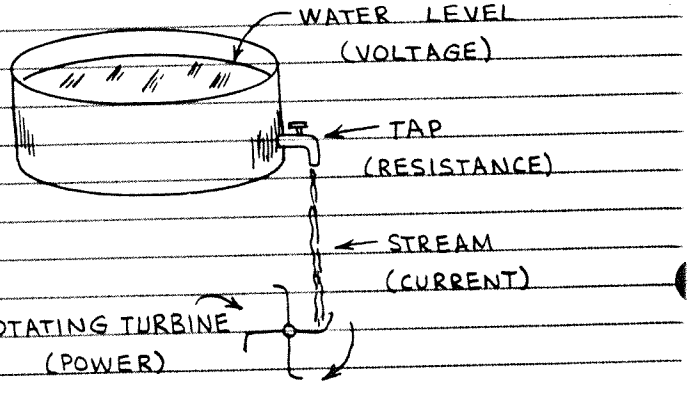
☐ RESISTANCE (R) — CONDUCTORS ARE NOT PERFECT. THEY RESIST TO SOME DEGREE THE FLOW OF CURRENT. THE UNIT OF RESISTANCE IS THE OHM (Ω). A POTENTIAL DIFFERENCE OF ONE VOLT WILL FORCE A CURRENT OF ONE AMPERE THROUGH A RESISTANCE OF ONE OHM. THE RESISTANCE OF A CONDUCTOR IS ITS VOLTAGE DROP DIVIDED BY THE CURRENT FLOWING THROUGH THE CONDUCTOR.

☐ MR. OHM'S LAW — GIVEN ANY TWO OF THE ABOVE, YOU CAN FIND THE OTHER TWO USING THESE FORMULAS KNOWN AS OHM'S LAW:

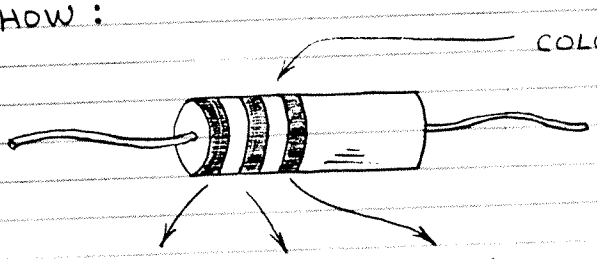
$$V = I \times R$$
$$I = V / R$$
$$R = V / I$$
$$P = V \times I \text{ (OR) } I^2 \times R$$

WE'LL REFER TO OHM'S LAW LATER IN THIS BOOK...

☐ SUMMING UP — THIS IS THE "WATER ANALOGY":



☐ RESISTOR COLOR CODE — SEE THOSE COLOR CODE BANDS ON THE RESISTOR PICTORIAL? IN REAL LIFE THEY'RE KIND OF PRETTY. BUT THEY HAVE A FAR MORE IMPORTANT PURPOSE: THEY INDICATE THE RESISTANCE OF THE RESISTOR THEY DECORATE. HERE'S HOW:



COLOR	1	2	3 (MULTIPLIER)
BLACK	0	0	1
BROWN	1	1	10
RED	2	2	100
ORANGE	3	3	1,000
YELLOW	4	4	10,000
GREEN	5	5	100,000
BLUE	6	6	1,000,000
VIOLET	7	7	10,000,000
GRAY	8	8	100,000,000
WHITE	9	9	(NONE)

NOTE: SOMETIMES THERE'S A FOURTH BAND. IT INDICATES THE TOLERANCE* OF THE RESISTOR:

GOLD = ±5 %
SILVER = ±10 %
NONE = ±20 %

* OR ACCURACY

LOOKS COMPLICATED THE FIRST TIME... BUT YOU'LL QUICKLY LEARN HOW TO USE IT. FOR EXAMPLE, WHAT'S THE RESISTANCE OF A RESISTOR COLOR CODED YELLOW, VIOLET AND RED? YELLOW IS THE FIRST COLOR SO THE FIRST NUMBER IS 4. VIOLET IS THE SECOND COLOR SO THE SECOND NUMBER IS 7. SINCE THE THIRD COLOR IS RED, THE MULTIPLIER IS 100. THEREFORE, THE RESISTANCE IS 47 × 100 OR 4700 OHMS. NO FOURTH COLOR BAND MEANS THE ACTUAL RESISTANCE IS 4700 ± 20 %. 20 % OF 4700 IS 940. THEREFORE, THE ACTUAL VALUE IS BETWEEN 3760 AND 5640 OHMS.

☐ SUBSTITUTING RESISTORS — WHAT IF YOU NEED A 6700-OHM RESISTOR BUT CAN ONLY FIND A 6800-OHM UNIT? YOU CAN ALMOST ALWAYS USE ANY VALUE WITHIN 10 OR 20% OF THE REQUIRED VALUE SO GO AHEAD AND USE IT. IF A PARTICULAR CIRCUIT REQUIRES MORE ACCURACY IT WILL TELL YOU. OF COURSE YOU CAN BUILD UP CUSTOM RESISTANCES BY CONNECTING TWO OR MORE RESISTORS IN SERIES OR IN PARALLEL. MORE ABOUT THAT LATER.