Electricity Review

Electrical Concept	Symbol	Unit
VOLTAGE	V	V (VOLTS)
CURRENT	I	A (AMPS)
RESISTANCE	R	Ω (OHMS)
POWER	P	W (WATT)

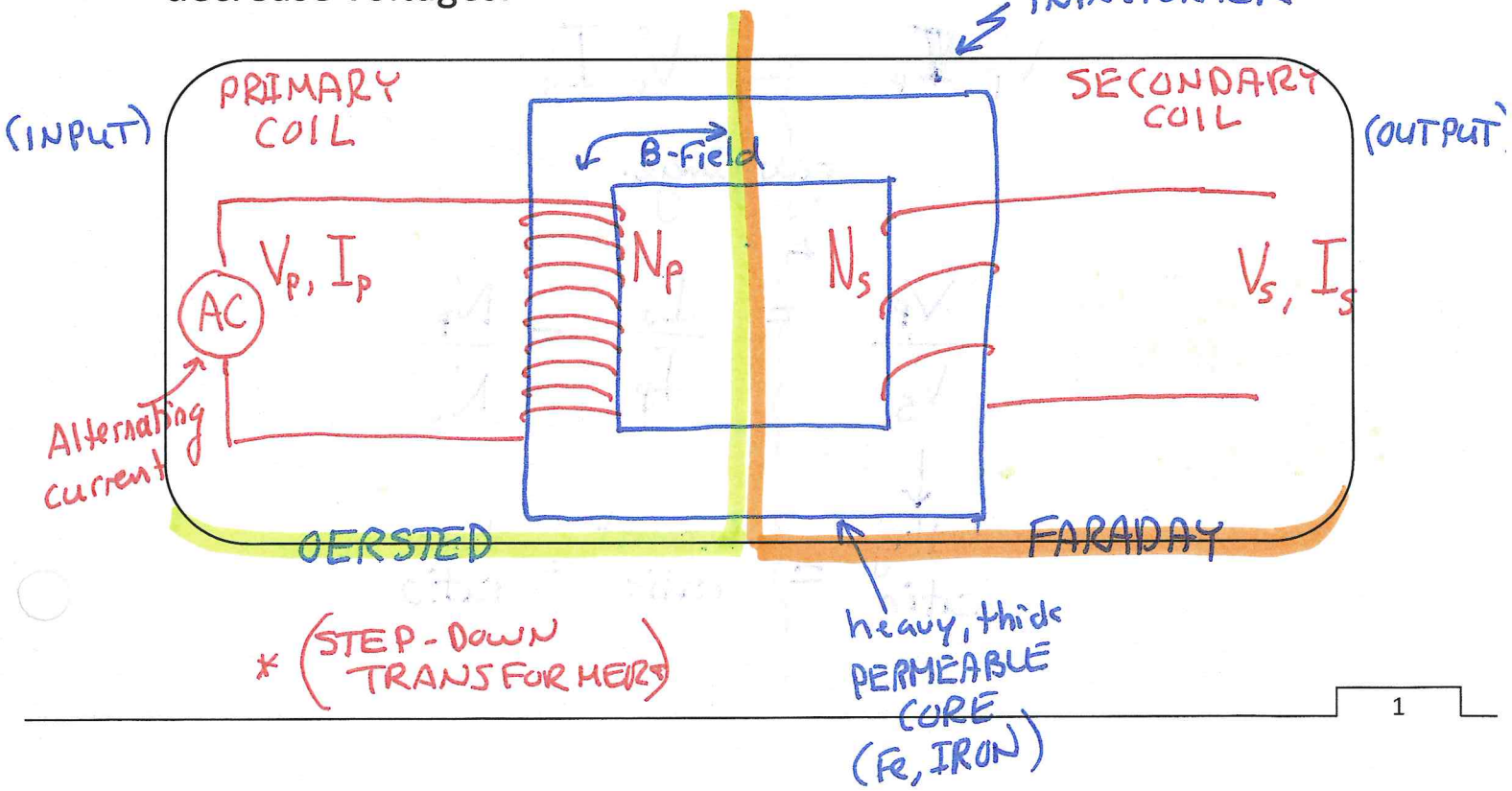
Ohm's Law: $V = IR$ VOLTAGE = CURRENT × RESISTANCE

Power: $P = VI = I^2R$

power = voltage × current = current squared × resistance.

Transformers

Transformers are used to change (transform) voltages from one value to another value. They are used to either increase or decrease voltages.



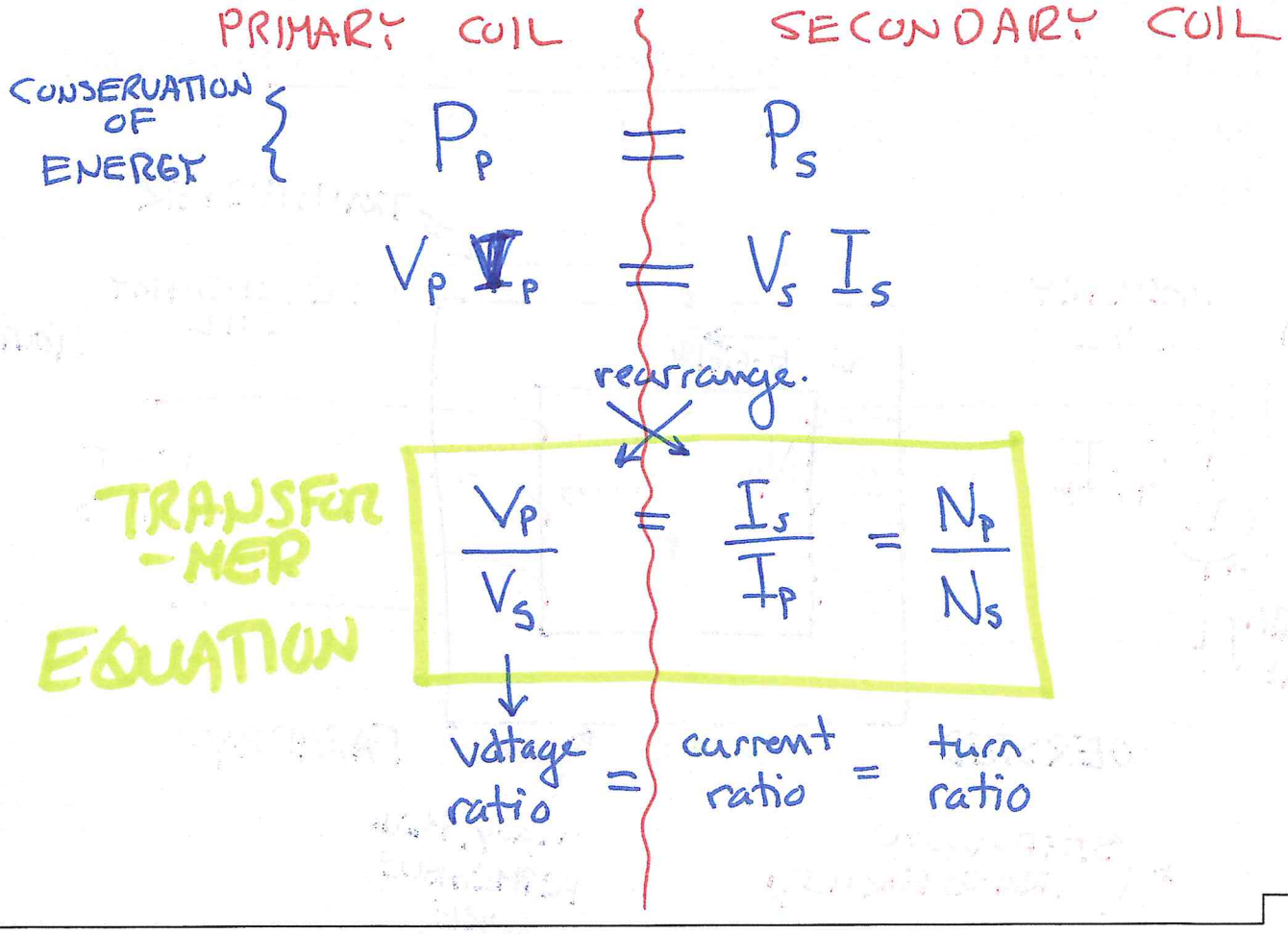
Principle Explanation:

- The alternating current (AC) in the primary coil produces a changing magnetic field around that coil **[Oersted's Principle]**
- The changing magnetic field around the primary coil induces a current in the secondary coil **[Faraday's Law]**

** if the coils have different number of turns in the coils the voltage will be either increased or decreased.

Mathematically:

Energy cannot be created or destroyed. So the energy and hence the power in each of the coils must be equal.



Transformer Examples

Name: TEACHER Date: 2013

1. A transformer is made to convert 20 V AC (V_p) to a higher voltage (V_s). The current in the primary side (I_p) was found to be 6 A and on the secondary side it is 2 A. (I_s)

   a) Calculate the secondary voltage as well as the secondary number of coils if there are 50 primary coils.

– STEP-UP TRANSFORMER –

$V_p = 20V$
$V_s = ?$
$I_p = 6A$
$I_s = 2A$
$N_p = 50$
$N_s = ?$

$$\frac{V_p}{V_s} = \frac{I_s}{I_p} = \frac{N_p}{N_s}$$

$$\frac{20}{V_s} = \frac{2}{6} = \frac{50}{N_s}$$

$V_s = \frac{20 \times 6}{2}$ $\quad$ $N_s = \frac{50 \times 6}{2}$

$\boxed{V_s = 60V}$ $\quad$ $\boxed{N_s = 150}$

STEP-UP → $V_s > V_p$ and $I_s < I_p$

STEP-DOWN → $V_s < V_p$ and $I_s > I_p$

} POWER MUST BE THE SAME!

∴ V_s is 60V and N_s is 150 based on the current ratio.

   b) Calculate the power on both sides as well.

$$P_p = P_s$$

$$V_p I_p = V_s I_s$$

$$(20)(6) = (60)(2)$$

$$120W = 120W \checkmark$$

THE SAME!

} $I_p^2 R_p = I_s^2 R_s$

$P_p = I_p^2 R_p$ OR $P_s = I_s^2 R_s$

$120\,W = (6)^2 R_p$ $\quad$ $120\,W = (2)^2 R_s$

$3.3\,\Omega = R_p$ $\quad$ $30\,\Omega = R_s$

primary resistance. $\quad$ secondary resistance