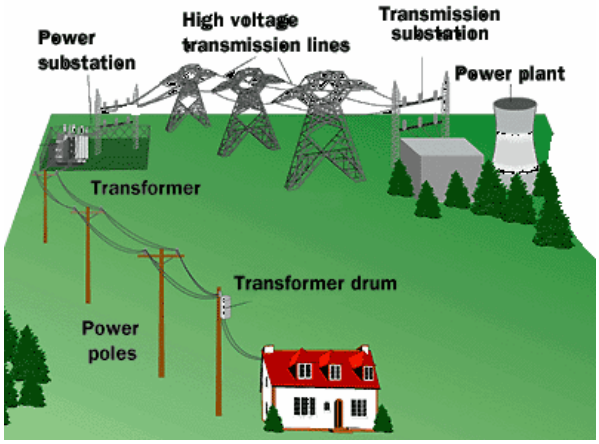
Electromagnetism Notes

7 – Transformers

When we generate power we ramp up the voltage for transmission (up to 100 000V) and then when it arrives at homes we ramp it back down for convenient use (120V).



Say we need to transmit a certain amount of power (P = IV)

- a high voltage means a low current.
- since power lost by the wire due to resistance is $P_{loss} = I^2R$
- low current means power loss is at a minimum

But how is this done?

To convert voltage to a higher or lower value we use a _____.

This is another important application of…

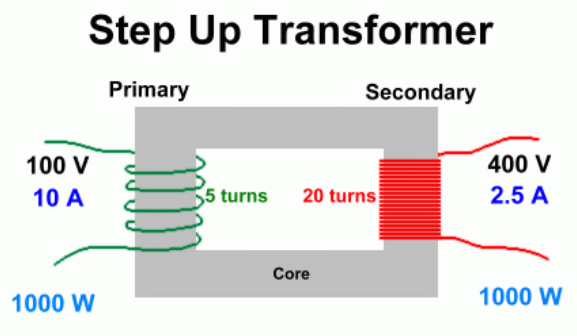
A transformer consists of a _____ coil and a _____ coil.

As current flows through the primary coil it produces a _____ _____. This magnetic field then induces an _____ _____ in the secondary coil.

Note that transformers generally only work when using _____ _____. If we use _____ _____ then we need to constantly switch the current on and off.

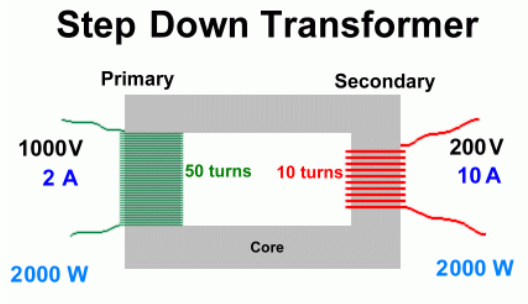
When a transformer increases voltage it is called a…

Note that a step up transformer has…



When a transformer decreases voltage it is called a…

A step down transformer has…



To determine the voltage change we use the following:

Where: V_p =

V_s =

N_p =

N_s =

Although we may change the voltage, we must conserve _____.

Therefore, _____ must also be conserved. So,

Example:
A step transformer is used to convert 120V to 1.50×10^4 V. If the primary coil has 24 turns, how many turns does the secondary coil have?

Example:
A step-up transformer has 1000 turns on its primary coil and 1×10^5 turns on its secondary coil. If the transformer is connected to a 120 V power line, what is the step-up voltage?

Example:
A step-down transformer reduces the voltage from a 120 V to 12.0 V. If the primary coil has 500 turns and draws 3.00×10^{-2} A,

a) What is the power delivered to the secondary coil?

b) What is the current in the secondary coil?