



## PHYSICS

# TRANSFORMERS

## TRANSFORMERS (More Than Meets the Eye)



### Power Transmission Over Long Distances

As electricity moves from one place to another through a conducting wire it encounters resistance. This means, that heat is being generated which equates to a loss of power. The longer the conductor, the higher the resistance, the greater the loss of power. This relationship can be expressed as:



*P* -

*I* -

*R* -

There are two ways to reduce the amount of power lost. First, use conductors with the lowest possible resistance (Power lines are usually very thick wires with good conductivity). The second way to reduce power loss is to reduce the amount of current flowing through the wires.

If current is reduced, voltage must be increased to maintain a certain power level. Recall the relationship  $P = VI$ .

**PHYSICS****TRANSFORMERS**

Ex: If 4A of current is flowing through a conductor with 12V of electricity,  
**a)** how much power is there?

**b)** If the current is reduced to 1A, what will the voltage have to be in order to maintain the same power level found in part a)?

So when electricity is transmitted over long distances, in order to reduce the power loss, the current is reduced and the voltage is stepped up.



## PHYSICS

# TRANSFORMERS

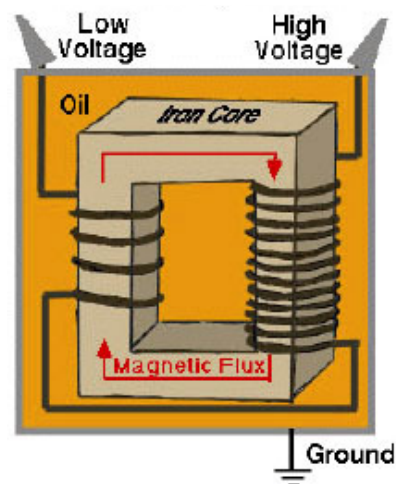
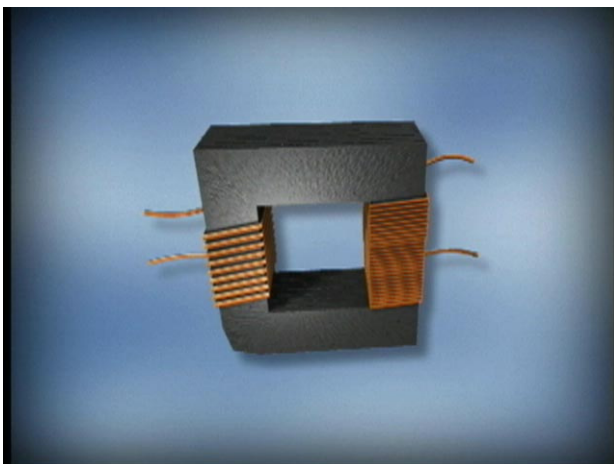
### Transformers

The technology that is used to convert electricity so it can be transmitted is called a Transformer. There are two types of transformers.

1. **Step-Up Transformer** -
2. **Step-Down Transformer** -

Ex:

A transformer (in its simplest form) is a series of coiled wires around the same metal core.





## PHYSICS

# TRANSFORMERS

A transformer works by intaking current in a coil of wires on one side of it. The coil will then induce a magnetic field in the iron core. That magnetic field will pass through the core and induce a current on the opposite side of the transformer.

Looking at the diagrams above, one can see that one side of the transformer has more windings than the other side. It is this difference in windings that changes the voltage.

The relationship between the two sides is the following formula:



$N_1$  -

$N_2$  -

$V_1$  -

$V_2$  -

$I_1$  -

$I_2$  -

Ex: If the primary coil of a transformer has 6 turns and the secondary coil has 300 turns, find the secondary voltage if 120 V are applied to the primary coil.