# Transformers : Notes/W.S.-45

A transformer, "transforms" a high AC voltage into a low AC voltage, or a low AC voltage into a high AC voltage.

If the emf across coil A changes, an emf is induced across coil B. This emf is proportional to the ratio of the number of turns in the secondary divided by the number of turns in the primary. The transformer below is called a step-down transformer. It transforms the primary voltage into a smaller voltage.
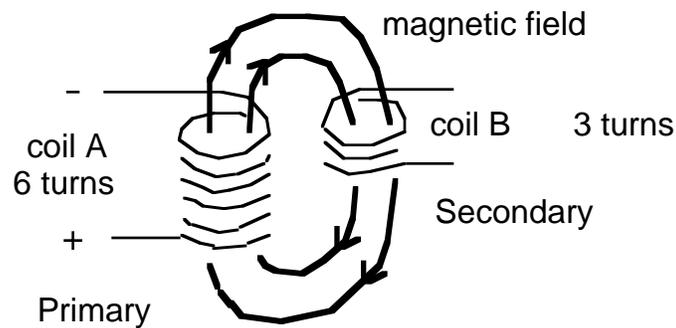
The field lines can be concentrated by inserting a piece of soft iron inside the two coils. This increases the flux linkage, making the transformer more efficient.
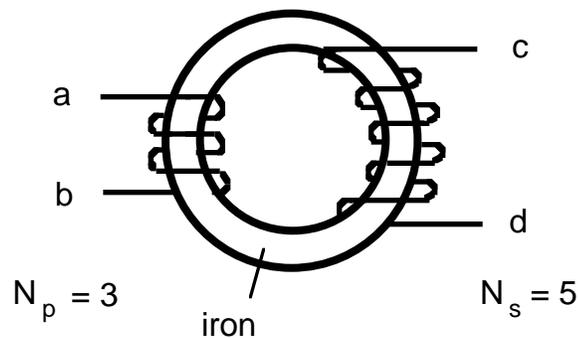
In the above transformer, an AC emf across ab becomes multiplied by a ratio of N_s/N_p = 5/3. If the AC emf across ab is 100. volts, the AC emf across cd will be 167 volts. This is called a step up transformer.

If the emf across ab is DC, there will be no emf across cd. This is because the flux will be constant. Only a changing flux through the primary can induce an emf in the secondary.

The AC emf across the primary coil creates a changing flux within it.

$$\mathcal{E}_p = N_p \frac{\Delta \Phi}{\Delta t}$$

This induces an emf in the secondary.

$$\mathcal{E}_s = N_s \frac{\Delta \Phi}{\Delta t}$$

To a very good approximation, the rate of change of flux through both coils is equal. This is because the soft iron core concentrates the magnetic field. Since B and A, are equal in both coils, the only difference is the number of turns in each coil. From the above two equations, we have:

$$\frac{\mathcal{E}_s}{\mathcal{E}_p} = \frac{N_s}{N_p}$$

Answer the following questions:

1) If the emf in a transformer primary is DC, explain why the emf in the secondary coil is zero.

2)a) In the diagram above, the ratio of the number of turns in the secondary to the number of turns in the primary is 5 to 3. Find the secondary voltage, if the primary voltage is 85.0 volts AC.

b) Is this a step-up, or a step-down transformer?

c) What should the ratio of the number secondary turns to primary turns be, if the desired output voltage is 510 volts?

3)a) If the primary voltage in a transformer is 28,000 volts AC, find the secondary voltage, if N_s/N_p is 1/50.

b) Is this transformer a step-up, or a step-down transformer?

Answers: 1) There is no change of flux in the secondary, so the emf must be zero., 2)a) 142 volts, b) step-up, c) 6 to 1, 3)a) 560 volts, b) step-down.