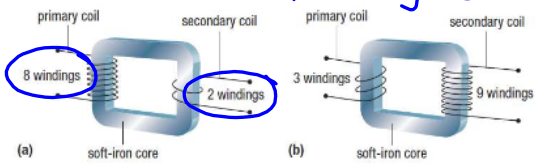
SPH3U 13.5 Transformers

1. How transformers work

Transformer:	a device that can raise or lower voltage.
AC	transformers only work in AC!
how it works	like a Faraday's Ring. a coil of wire on the left induces current in a coil on the right. the AC means a constantly changing magnetic field!



$P_p = P_s$

$V_p I_p = V_s I_s$

Step-down transformer:	reduces voltage (increases current). primary windings > secondary windings
Step-up transformer:	increases voltage (reduces current). primary windings < secondary windings.
Conservation of energy:	$\therefore P_p = P_s$ $\because P = VI$, $V_p I_p = V_s I_s$.
Equations:	$\frac{V_p}{V_s} = \frac{N_p}{N_s}$, $\frac{I_s}{I_p} = \frac{N_p}{N_s}$, $\frac{I_s}{I_p} = \frac{V_p}{V_s}$.

N = # of windings.

A step-down transformer used in an adapter for a laptop has a primary voltage of 120 V. There are 250 windings in the primary coil and 25 windings in the secondary coil. Calculate the voltage in the secondary coil.

$$\frac{V_p}{V_s} = \frac{N_p}{N_s} \rightarrow V_p = V_s \times \frac{N_p}{N_s} \rightarrow V_s = V_p \times \frac{N_s}{N_p} = 120 \times \frac{25}{250} = 12\,V.$$

A step-down transformer used in the adapter for a cellphone charger has a primary voltage of 120 V and a secondary voltage of 5.0 V. The current in the primary coil is 0.10 A. Calculate the current in the secondary coil.

$$\frac{I_s}{I_p} = \frac{V_p}{V_s} \rightarrow I_s = I_p \times \frac{V_p}{V_s} = 0.1 \times \frac{120}{5} = 2.4\,A.$$

Homework: page 609: #2, 7-9