***P15.6.** A bar magnet is inserted into a single-turn coil as illustrated in Figure P15.6. Is the voltage v_{ab} positive or negative as the bar approaches the coil?

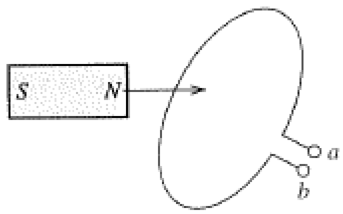

Figure P15.6

P15.6* By Lenz's law, the polarity of the induced voltage is such that the current flowing through a resistance placed across the terminals of the coil tends to oppose the change in flux linkages. As the magnet approaches, the coil would produce a field pointing toward the magnet. This requires a current from *a* to *b* through the coil. Thus, we find that *b* must be positive so v_{ab} is negative.

P15.10. Use the right-hand rule to find the direction of the magnetic flux for each coil shown in Figure P15.10. Mark the *N* and *S* ends of each coil. Do the coils attract or repel one another?

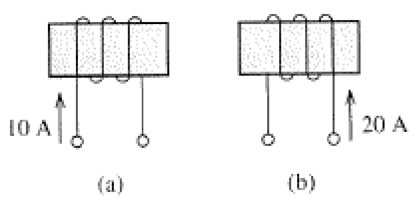

Figure P15.10

P15.10 Using the right-hand rule, we find that the north magnetic poles are at the left-hand ends of the coils. The coils attract one another.

P15.18. Suppose that, in designing an electrical generator, we need to produce a voltage of 120 V by moving a straight conductor through a uniform magnetic field of 0.5 T at a speed of 30 m/s. The conductor, its motion, and the field are mutually perpendicular. What is the required length of the conductor? It turns out that in generator design, a conductor of this length is impractical, and we must use N conductors of length 0.1 m. However, by connecting the conductors in series, we can obtain the required 120 V. What is the number N of conductors needed?

P15.18 Solving Equation 15.9 for the conductor length, we have:

$$\ell = \frac{e}{Bu} = \frac{120}{0.5 \times 30} = 8\text{ m}$$

$$N = \frac{\ell}{0.1} = 80\text{ conductors}$$

P15.60. Consider the circuit shown in Figure P15.60. Find the secondary voltage V_{2rms}, the

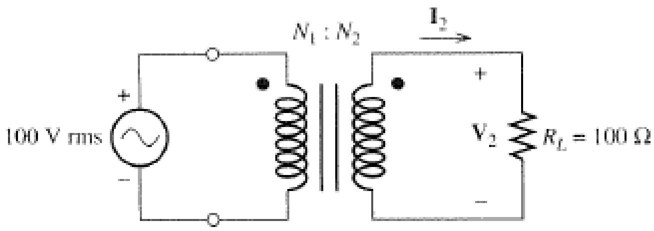

Figure P15.60

secondary current I_{2rms}, and the power delivered to the load if the turns ratio is $N_1/N_2 = 10$. Repeat for $N_1/N_2 = 1$ and for $N_1/N_2 = 0.1$.

P15.60 For the ideal transformer, we have:

$$V_{2rms} = \frac{N_2}{N_1} \times V_{1rms}$$

The load current is

$$I_{2rms} = \frac{V_{2rms}}{R_L}$$

The load power is given by

$$P_L = V_{2rms} I_{2rms}$$

The results for the various turns ratios are:

Turns Ratio (N_1/N_2)	V_{2rms}	I_{2rms}	P_L
10	10 V	0.1 A	1 W
1	100 V	1.0 A	100 W
0.1	1000 V	10.0 A	10 kW