of the magnetic field in order to induce an emf of 1.5 V? Is this a practical generator?

43. The same student in item 42 modifies the simple generator by wrapping a much longer piece of wire around a cylinder with about one-fourth the area of the original loop (1.886×10^{-3} m^2). Again using a uniform magnetic field with a strength of 2.5×10^{-2} T, the student finds that by removing the coil perpendicular to the magnetic field lines during 0.25 s, an emf of 149 mV can be induced. How many turns of wire are wrapped around the coil?

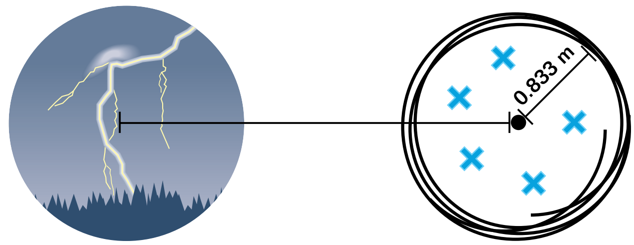
44. A coil of 325 turns and an area of 19.5×10^{-4} m^2 is removed from a uniform magnetic field at an angle of 45° in 1.25 s. If the induced emf is 15 mV, what is the magnetic field's strength?

45. A transformer has 22 turns of wire in its primary and 88 turns in its secondary.

a. Is this a step-up or step-down transformer?

b. If 110 V ac is applied to the primary, what is the output potential difference?

46. A bolt of lightning, such as the one shown on the left side of the figure below, behaves like a vertical wire conducting electric current. As a result, it produces a magnetic field whose strength varies with the distance from the lightning. A 105-turn circular coil is oriented perpendicular to the magnetic field, as shown on the right side of the figure below. The coil has a radius of 0.833 m. If the magnetic field at the coil drops from 4.72×10^{-3} T to 0.00 T in 10.5 μs, what is the average emf induced in the coil?



Graphing Calculator Practice

Alternating Current

In alternating current (ac), the emf alternates from positive to negative. The current responds to the changes in emf by oscillating with the same frequency that the emf does. This relationship is shown in the following equation for the instantaneous current:

$$i = I_{max} \sin \omega t$$

In this equation, ω is the ac frequency, and I_{max} is the maximum current. The effective current of an ac circuit is the root-mean-square current (rms current), I_{rms}. The rms current is related to the maximum current by the following equation:

$$I_{rms} = \frac{I_{max}}{\sqrt{2}}$$

In this graphing calculator activity, the calculator will use these two equations to make graphs of instantaneous current and rms current versus time. By analyzing these graphs, you will be able to determine what the values of the instantaneous current and the rms current are at any point in time. The graphs will give you a better understanding of current in ac circuits.

Visit go.hrw.com and type in the keyword **HF6EMIX** to find this graphing calculator activity. Refer to **Appendix B** for instructions on downloading the program for this activity.