47. The potential difference in the lines that carry electric power to homes is typically 20.0 kV. What is the ratio of the turns in the primary to the turns in the secondary of the transformer if the output potential difference is 117 V?

48. The alternating emf of a generator is represented by the equation emf = (245 V) sin 560*t*, in which emf is in volts and *t* is in seconds. Use these values to find the frequency of the emf and the maximum emf output of the source.

49. A pair of adjacent coils has a mutual inductance of 1.06 H. Determine the average emf induced in the secondary circuit when the current in the primary circuit changes from 0 A to 9.50 A in a time interval of 0.0336 s.

50. A generator supplies 5.0×10^3 kW of power. The output emf is 4500 V before it is stepped up to 510 kV. The electricity travels 410 mi (6.44×10^5 m) through a transmission line that has a resistance per unit length of $4.5 \times 10^{-4}\ \Omega$/m.

a. How much power is lost through transmission of the electrical energy along the line?

b. How much power would be lost through transmission if the generator's output emf were not stepped up? What does this answer tell you about the role of large emfs (voltages) in power transmission?

Alternative Assessment

1. Two identical magnets are dropped simultaneously from the same point. One of them passes through a coil of wire in a closed circuit. Predict whether the two magnets will hit the ground at the same time. Explain your reasoning. Then, plan an experiment to test which of the following variables measurably affect how long each magnet takes to fall: magnetic strength, coil cross-sectional area, and the number of loops the coil has. What measurements will you make? What are the limits of precision in your measurements? If your teacher approves your plan, obtain the necessary materials and perform the experiments. Report your results to the class, describing how you made your measurements, what you concluded, and what additional questions need to be investigated.

2. What do adapters do to potential difference, current, frequency, and power? Examine the input/output information on several adapters to find out. Do they contain step-up or step-down transformers? How does the output current compare to the input? What happens to the frequency? What percentage of the energy do they transfer? What are they used for?

3. Research the debate between the proponents of alternating current and those who favored direct current in the 1880–1890s. How were Thomas Edison and George Westinghouse involved in the controversy? What advantages and disadvantages did each side claim? What uses of electricity were anticipated? What kind of current was finally generated in the Niagara Falls hydroelectric plant? Had you been in a position to fund these projects at that time, which projects would you have funded? Prepare your arguments to re-enact a meeting of businesspeople in Buffalo in 1887.

4. Research the history of telecommunication. Who invented the telegraph? Who patented it in England? Who patented it in the United States? Research the contributions of Charles Wheatstone, Joseph Henry, and Samuel Morse. How did each of these men deal with issues of fame, wealth, and credit to other people's ideas? Write a summary of your findings, and prepare a class discussion about the effect patents and copyrights have had on modern technology.