rms Current and emf

1. What is the rms current in a light bulb that has a resistance of 25 Ω and an rms emf of 120 V? What are the maximum values for current and emf?

2. The current in an ac circuit is measured with an ammeter. The meter gives a reading of 5.5 A. Calculate the maximum ac current.

3. A toaster is plugged into a source of alternating emf with an rms value of 110 V. The heating element is designed to convey a current with a peak value of 10.5 A. Find the following:
   a. the rms current in the heating element
   b. the resistance of the heating element

4. An audio amplifier provides an alternating rms emf of 15.0 V. A loud-speaker connected to the amplifier has a resistance of 10.4 Ω. What is the rms current in the speaker? What are the maximum values of the current and the emf?

5. An ac generator has a maximum emf output of 155 V.
   a. Find the rms emf output.
   b. Find the rms current in the circuit when the generator is connected to a 53 Ω resistor.

6. The largest emf that can be placed across a certain capacitor at any instant is 451 V. What is the largest rms emf that can be placed across the capacitor without damaging it?

Resistance influences current in an ac circuit

The ac potential difference (commonly called the *voltage*) of 120 V measured from an electrical outlet is actually an rms emf of 120 V. (This, too, is a simplification that assumes that the voltmeter has infinite resistance.) A quick calculation shows that such an emf has a maximum value of about 170 V.

The resistance of a circuit modifies the current in an ac circuit just as it does in a dc circuit. If the definition of resistance is valid for an ac circuit, the rms emf across a resistor equals the rms current multiplied by the resistance. Thus, all maximum and rms values can be calculated if only one current or emf value and the circuit resistance are known.

Ammeters and voltmeters that measure alternating current are calibrated to measure rms values. In this chapter, all values of alternating current and emf will be given as rms values unless otherwise noted. The equations for ac circuits have the same form as those for dc circuits when rms values are used.