

**Concept Question 1-12:** Signals are divided into three power/energy classes. What are they?

The energy and average power of a signal  $x(t)$ , defined in Eqs. (1.33b) and (1.34), are given by:

$$E = \lim_{T \rightarrow \infty} \int_{-T}^T |x(t)|^2 dt = \int_{-\infty}^{\infty} |x(t)|^2 dt$$
$$P_{\text{av}} = \lim_{T \rightarrow \infty} \frac{1}{T} \int_{-T/2}^{T/2} p(t) dt = \lim_{T \rightarrow \infty} \frac{1}{T} \int_{-T/2}^{T/2} |x(t)|^2 dt$$

An **energy signal** has finite energy  $E$ , so its average power  $P$  (which is averaged over an infinite duration  $T$ ) must be zero.

A **power signal** has finite average power  $P$ , so its energy  $E$  must be infinite. Periodic signals are power signals. For example, a sinusoid with amplitude  $A$  and nonzero frequency has infinite energy and average power  $A^2/2$ . See Eq. (1.38).

A signal with infinite power, and therefore infinite energy, is neither an energy signal nor a power signal.