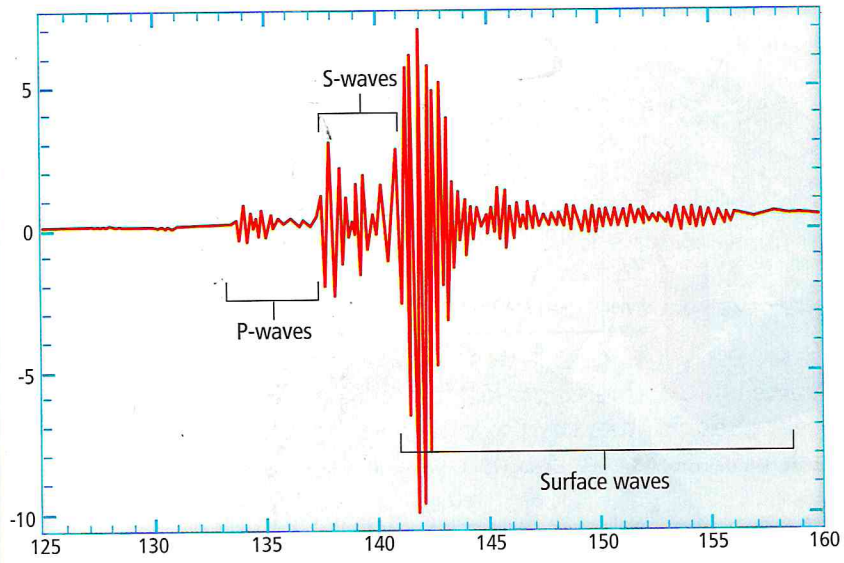

Figure 19.8 Seismograms provide a record of the seismic waves that pass a certain point.

Travel-time curves Seismic waves that travel from the focus of an earthquake are recorded by seismometers housed in distant facilities. Over many years, the arrival times of seismic waves from countless earthquakes at seismic facilities around the world have been collected. Using these data, seismologists have been able to construct global travel-time curves for the arrival of P-waves and S-waves of earthquakes, as shown in **Figure 19.9.** These curves provide the average travel times of all P- and S-waves, from wherever an earthquake occurs on Earth.

Reading Check **Summarize** how seismograms are used to construct global travel-time curves.

Distance from the epicenter Note that in **Figure 19.9,** as in **Figure 19.8,** the P-waves arrive first, then the S-waves. The surface waves arrive last. With increasing travel distance from the epicenter, the time separation between the curves for the P-waves and S-waves increases. This means that waves recorded on seismograms from more distant facilities are farther apart than waves recorded on seismograms at stations closer to the epicenter. This separation of seismic waves on seismograms can be used to determine the distance from the epicenter of an earthquake to the seismic facility that recorded the seismogram. This method of precisely locating an earthquake's epicenter will be discussed in Section 19.3.

Figure 19.9 Travel-time curves show how long it takes for P-waves and S-waves to reach seismic stations located at different distances from an earthquake's epicenter.
Determine *how long it takes P-waves to travel to a seismogram 2000 km away. How long does it take for S-waves to travel the same distance?*