

When seismic waves travel through the Earth they will encounter different densities.

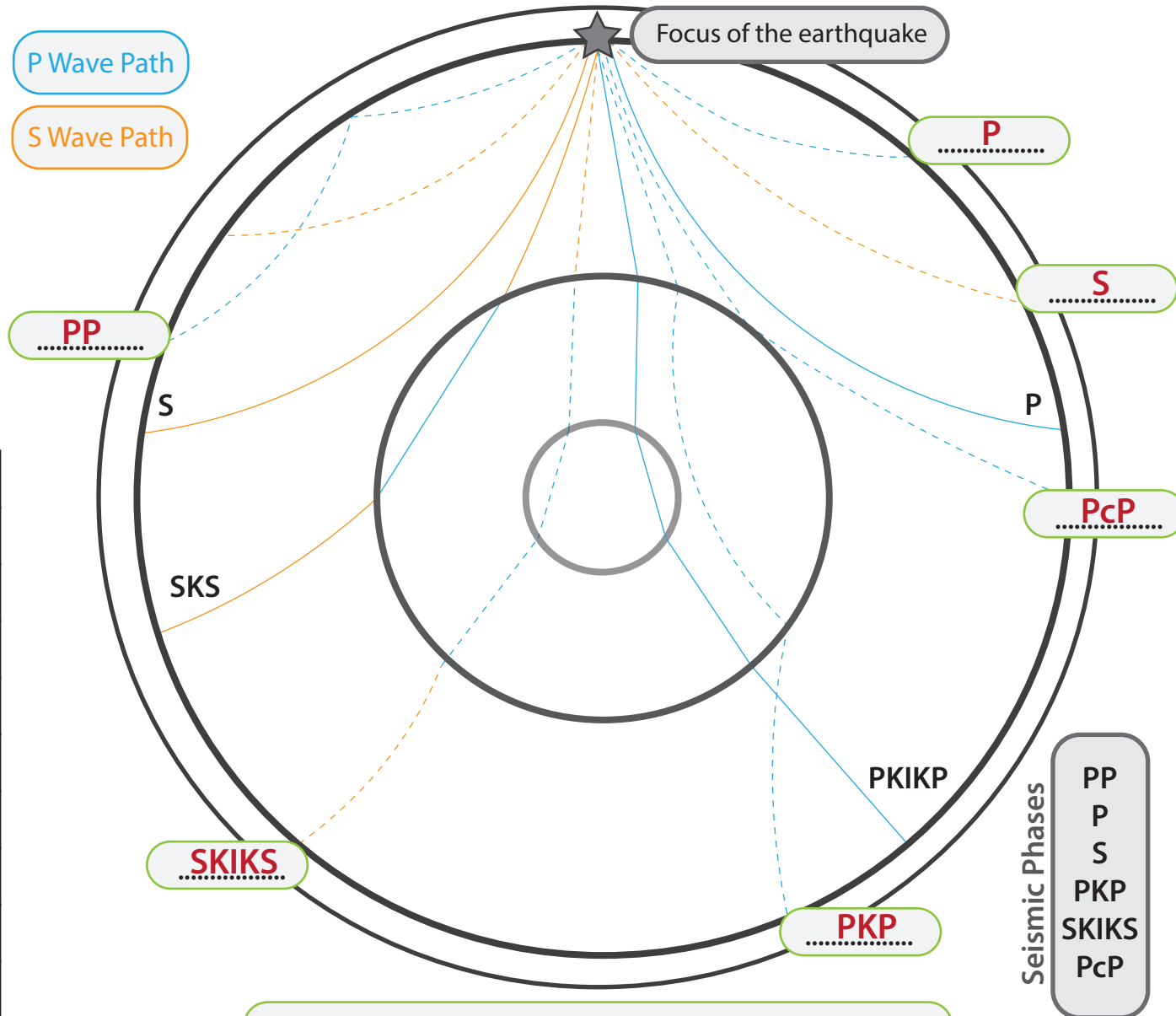
A change in density results in a change in velocity of the wave and causes seismic waves to refract, reflect or even convert into a different type of seismic wave!

There are many possible paths a wave can take through the Earth, e.g. through the mantle, reflected off the core and then travelling through the mantle again. Each unique path will create a separate seismic phase which can be identified on a seismogram.

A seismic phase can be described by one or more letters that describes its path through the Earth.

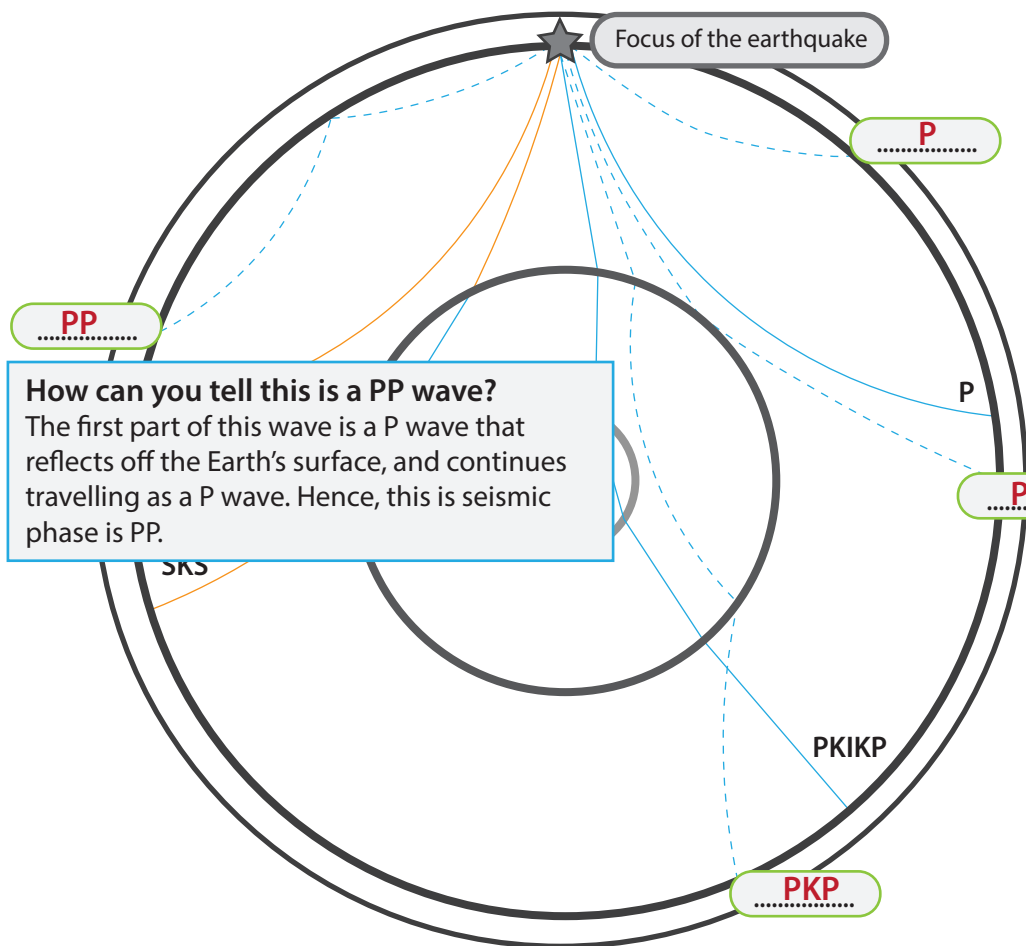
Seismograms can be used to identify P and S waves but also each of the separate phases, so they can be used to identify waves and tell where that wave has been in the Earth!

Follow the seismic paths shown below and fill in the correct seismic phase in each box. Use the table and examples shown to help you identify the seismic phases.



Symbol	Definition
<i>P</i>	A P wave in the crust or mantle.
<i>S</i>	An S wave in the crust or mantle.
<i>p</i>	A P wave travelling upwards from the focus of the earthquake and reflected down from the Earth's surface.
<i>s</i>	An S wave travelling upwards from the focus of the earthquake and reflected down from the Earth's surface.
<i>c</i>	Reflection at the mantle-core boundary.
<i>K</i>	A P wave in the outer core.
<i>I</i>	A P wave in the inner core.
<i>i</i>	Reflection at the outer core-inner core boundary.
<i>J</i>	An S wave in the inner core.

Challenge yourself: Draw the following seismic phases on the diagram above: pPcS, pSSS, PKiKP, sPcS, sSS.



How can you tell this is a PP wave?
 The first part of this wave is a P wave that reflects off the Earth's surface, and continues travelling as a P wave. Hence, this seismic phase is PP.

How can you tell this is a PKP wave?
 This is a P wave that travels through the outer core. A P wave travelling through the outer core is denoted as K, and then the P wave continues travelling through the mantle. Hence, P (initially a P wave), K (P wave in the outer core), P (detected wave is a P wave) = PKP.

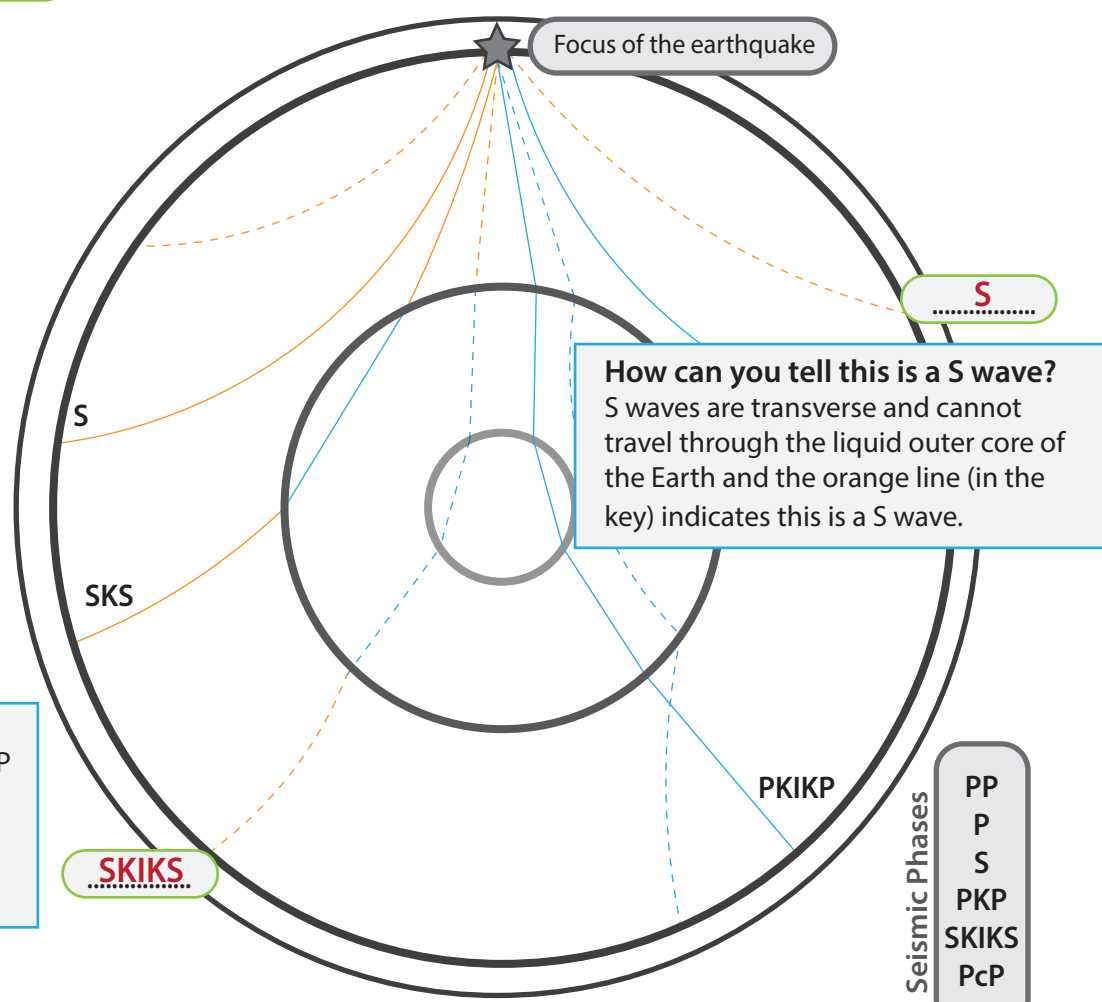
How can you tell this is a SKIKS wave?
 This is a S wave that refracts at the core-mantle boundary. The refracted wave is a P wave in the outer core, denoted as K. The wave continues its journey through the inner core, denoted as I, travels back through the outer core (K) and finally refracts at the core-mantle boundary and continues as an S wave through the mantle. Hence, this will be a SKIKS wave.

How can you tell this is a P wave?
 P waves are longitudinal and can travel through each layer of the Earth and the blue line (in the key) indicates this is a P wave.

How can you tell this is a PcP wave?
 This is a P wave that reflects off the core-mantle boundary. The reflection is denoted as c, and then the P wave continues travelling through the Earth. Hence, P (initially a P wave), c (reflection), P (reflected wave is a P wave) = PcP.

P Wave Path

S Wave Path



How can you tell this is a S wave?
 S waves are transverse and cannot travel through the liquid outer core of the Earth and the orange line (in the key) indicates this is a S wave.

- Seismic Phases
- PP
 - P
 - S
 - PKP
 - SKIKS
 - PcP