# Layers of the Earth

Remember that earth is made up of 4 layers: the crust, the mantle, the outer core and the inner core.

The crust is a layer of solid rock.

The mantle is a layer of solid, HOT rock.

The outer core is a layer of **liquid** metal.

The inner core is **solid** metal.



# Earthquakes

An **earthquake** is the shaking and trembling that results from movement of rock underneath Earth's surface, called plate movement.

On average, Magnitude 2 and smaller earthquakes occur several hundred times a day world wide. Major earthquakes, greater than magnitude 7, happen more than once per month. "Great earthquakes", magnitude 8 and higher, occur about once a year.



Causes of Earthquakes

The force of plate movement causes earthquakes.

This movement causes **stress** in the crust. The energy released during an earthquake creates seismic waves - vibrations similar to sound waves.

There are 3 types of waves - P (primary) waves, S (secondary) and Surface waves.

P waves arrive first and they push and pull. They can travel through both liquids and solids.

**S waves** follow and they move from side to side and cannot move through liquid.

Surface waves happen when P and S waves reach Earth's surface and they move like waves.

Remember our live demonstration to remember how each one moves!!

## Seismic waves

An earthquake produces several types of seismic waves, each causing extensive degrees of damage.



"P" waves The initial joil comes from the primary or "P" wave. It travels in a fast, iongitudinal fashion, alternately compressing and dilating the rock. They are generally felt as a bang or thump.

Surface waves rolling through racky basins are usually long and slow-rolling waves. If strong enough, they are mostly a threat to larger structures, such as bridges and high-rises. Smaller structures are able to ride out the wave and remain intact.



"S" waves The slower and stronger secondary, or shear, wave arrives after the "P" wave, shaking the ground in a crosswise and vertical motion. "S" waves cannot travel through the outer core because these waves cannot exist in air, water or molten rock



### Surface waves

Trapped near the Earth's surface, the earthquake's energy travels horizontally. The Rayleigh wave, shown above, has the similar uniform properties of an aquatic wave and can cause severe damage to larger structures.

## EPICENTER

The point where the rocks actually break is the earthquake **focus**.

Large subduction (when one plate is pushed under another) zone earthquakes can break along a fault for hundreds of miles. The **epicenter** of these earthquakes is directly above where the earthquake actually started along the fault line.



## How Do We Measure Earthquakes?

Scientists use an instrument called a **seismograph** that can record and measure an earthquake's seismic waves.

Geologists measure the amplitude of the highest wave and give a single number to tell what the magnitude of an earthquake is.

The **Richter Scale** is the most common one used to tell us how powerful an earthquake is.

A magnitude of 5 or less means the earthquake is small and doesn't cause much damage. Magnitudes of 6 - 8 are the powerful earthquakes that cause a lot of damage.

# Understanding the Richter Scale:

Richter Magnitude	Feels like KG of TNT	Extra Information
0-1	0.6-20 kilograms of dynamite	We can not feel these
2	600 kilograms of dynamite	Smallest Quake people can normally feel
3	20,000 kilograms of dynamite	People near the epicenter feel this quake
4	60,000 kilograms of dynamite	This will cause damage around the epicenter. It is the same as a small fission bomb
5	20,000,000 kilograms of dynamite	Damage done to weak buildings in the area of the epicenter
6	60,000,000 kilograms of dynamite	Can cause great damage around the epicenter
7	20 bilion kilograms of dynamite	Creates enough energy to heat New York city for one year. Can be detected all over the world. Causes serious damage
8	20 bilion kilograms of dynamite	Causes death and major destruction. Destroyed San Francisco in 1906
9	20 trillion kilograms of dynamite	Rare, but would causes unbelievable damage!