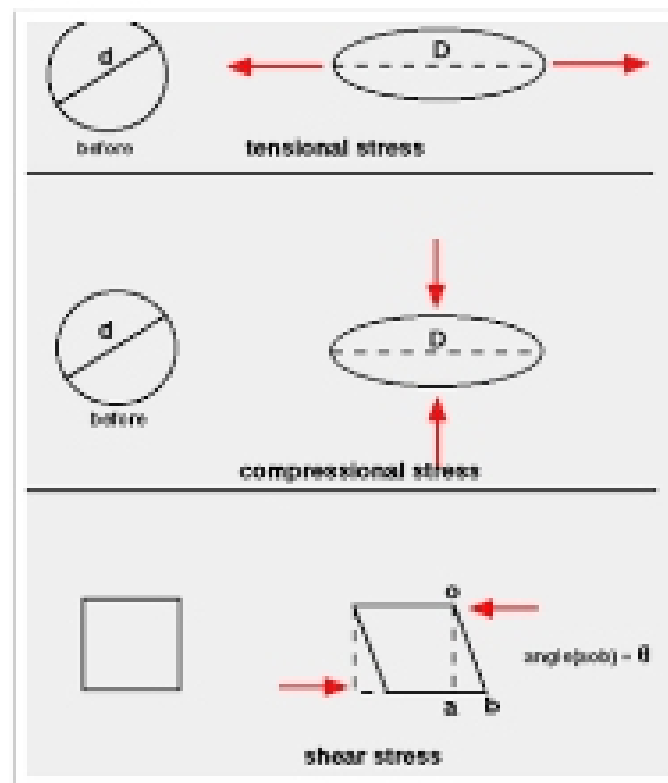


### Objectives:

- Identify the different kinds of stressors and the difference between stress and strain
- Identify the 3 kinds of faults and where they're found
- Understand what earthquakes are and where they are found
- Identify types of earthquake body waves
- Identify what an epicenter and focus are and what defines magnitude
- How earthquakes are measured and predicted
- Tsunamis and how they relate to earthquake
- Earthquakes cause by anthropogenic influences

### Review: Strains and what they can develop in a body

- **Stress:** A way of producing a deformation on a body
  - Measured as (Force/Area)
- **Strain:** A deformation of a body caused from the stress.



### **Types of Faults**

**Normal Fault:** Tensional stress cause the hanging wall (above the fault) to move down relative to the foot wall. Sierra Nevada is a normal fault

**Reverse Fault:** Compressional forces cause the hanging wall to move up relative to the footwall. The Himalayas and Rocky Mountains are examples of Reverse Fault lines

**Strike-slip Fault:** the movement of blocks along a fault is horizontal. If the block on the far side of the fault moves to the left, as shown in this animation, the fault is called left-lateral. Right movement is right lateral. Strike-Slip is caused by shear force. (Most commonly found on ocean floor).



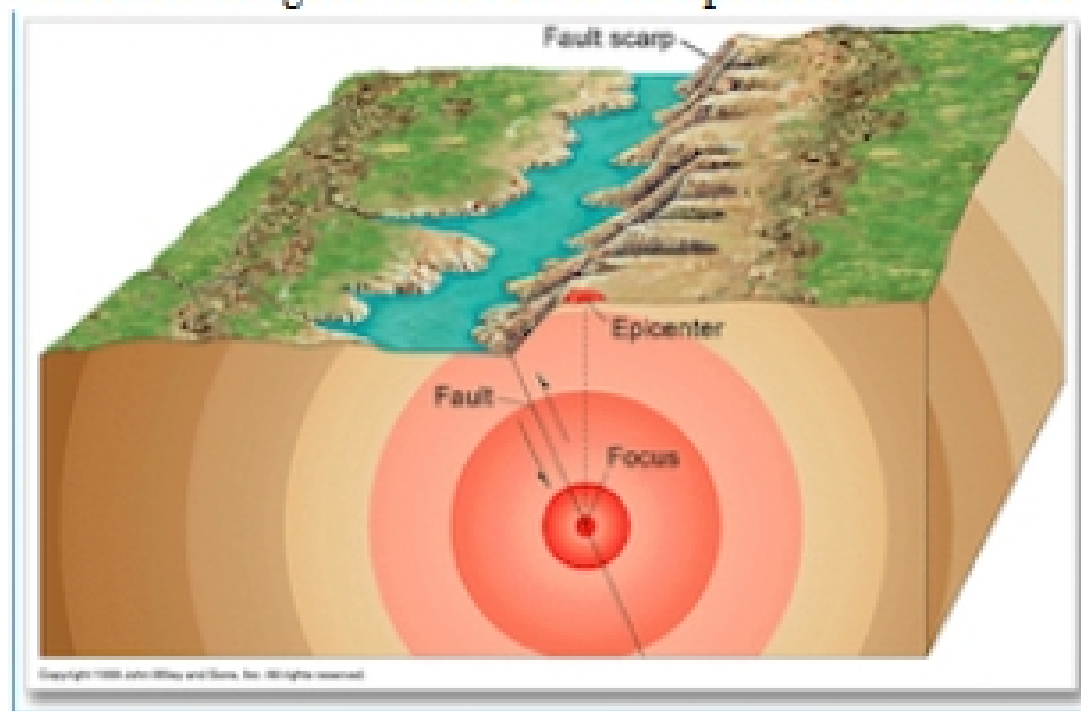
### Definition of an Earthquake

An Earthquake is when energy stored in elastically strained rocks is suddenly released with great force or by volcanic action.

They cause natural disasters and damage such as: liquefaction of soil, fires, ground displacement, subsidence lowering, flooding.

To prevent larger damage, in construction more attention has to be paid to construction materials, height of building (center of gravity), base isolation (shock absorbers), and nature of ground.

The Epicenter is the point on Earth's surface that lies vertically above the focus of an Earthquake. The Earthquake Focus is the point where an earthquake starts to release the elastic strain of surrounding rock. Lies at some depth below Earth's Surface.



A convenient way to describe the location of an earthquake focus is to state the location of its epicenter and its depth.

### Seismic Waves

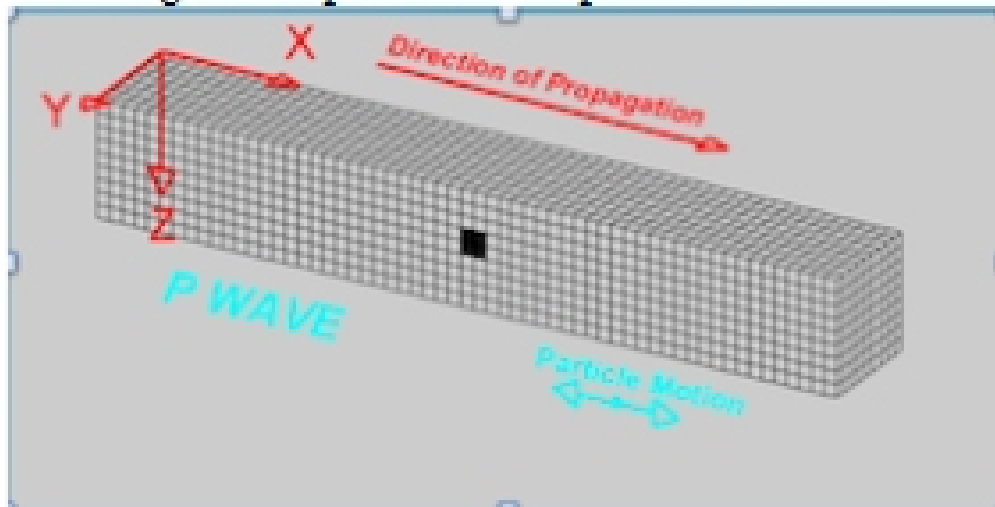
Some seismic waves travel through the Earth's interior. These are **body waves**. There are two forms of body waves. These are referred to as P waves and S waves. P stands for

Primary: this is the first wave recorded by seismographs, since it travels faster than the S or Secondary waves.

*P-Waves: A kind of body wave also known as Primary Wave of Compressional Wave. It was the first kind of wave detected by a seismograph. They vibrate in the same direction that they travel consisting of alternating compression and dilation.*

*(Travel faster than S-waves)--> Speed depends on elastic moduli and density of the transmitting medium*

Particle motion is parallel to the direction of propagation (longitudinal). Material returns to its original shape after wave passes.



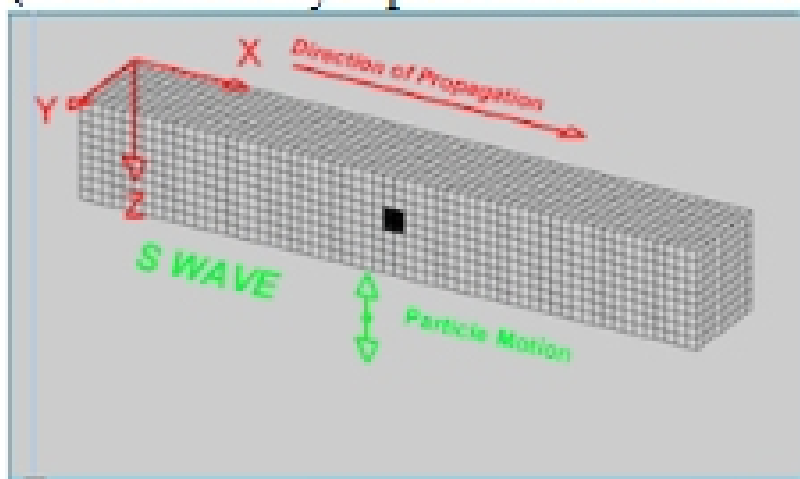
$$V_p = \sqrt{\frac{B + \frac{4}{3} S}{d}}$$

*(it travels slower through liquids and solids).*

*S-Waves: Also known as secondary or transverse wave. It is a shear wave, slow than P-waves. Vibrate transverse or perpendicular to the direction of travel.*

Transverse particle motion shown here is vertical but can be in any direction; however Earth's layers tend to cause mostly vertical (SV) or horizontal (SH) shear motions. Not transmitted through liquids. Material returns to original shape after wave passes.

*(S waves velocity depends on shear modulus and the density of the transmitting medium)*



$$V = \sqrt{\frac{S}{d}}$$

There are other types of seismic waves that travel on the surface of the Earth, analogous to ripples on the surface of water that are set up by dropping a stone in the pond. These are referred to as **surface waves**. These cause the ground to rise and fall as the wave passes, and frequently are responsible for the greatest damage during earthquakes.