UPSC Civil Services Examination

UPSC Notes [GS-I]

Topic: Earthquake - Body Waves, Causes & Types [Geography Notes for UPSC]

Earthquake

- All natural earthquakes occur in the lithosphere.
- Seismic waves studies offer a full picture of the layered interior.
- An earthquake is, simply put, shaking of the earth's crust.
- It is caused due to the energy release, which triggers waves that travel in all directions.
- The emanation of energy occurs along a fault.
- A fault is a sharp break in the crustal rocks.
- Rocks along a fault generally move in opposing directions.

Types of Earthquakes

- **Tectonic earthquakes:** These are produced due to sliding of rocks along a fault plane.
- **Volcanic earthquake:** These are confined to areas of active volcanoes.
- **Collapse earthquake:** The roofs of underground mines collapse causing minor tremors in the areas of intense mining activity.
- **Explosion earthquakes:** These occur due to the explosion of chemical or nuclear devices.
- **Reservoir-induced earthquakes:** These occur in the areas of large reservoirs.

Causes of Earthquakes

- It is caused due to the discharge of energy from faults and cracks in the crust of the earth.
- A fault in the crust of Earth is essentially a sharp break in crustal rocks.
- This energy release produces waves which travel in all directions.
- The point where energy is released is called the focus or hypocentre**.** It is generally located at the depth of 60 km.

- This causes a release of energy, and the energy waves travel in all directions.
- The point where the energy is released is called the focus of an earthquake or hypocentre.
- The point on the surface of the earth which is vertically above the focus is called epicentre. It is the first place to experience the waves.

Body Waves

- Earthquake waves are of two types — body waves and surface waves.

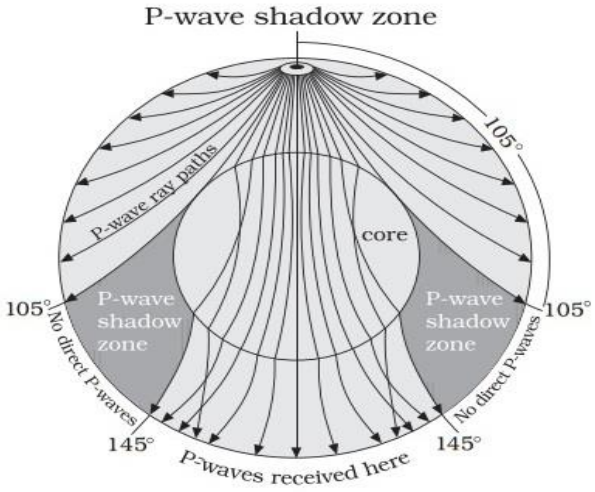
P- Waves

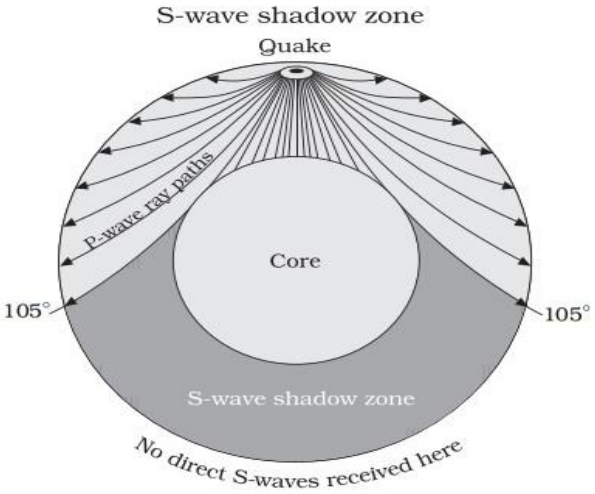
- P-waves are also known as the Primary waves. They are the first waves to arrive at the surface.
- The characteristics of P-waves are like sound waves. They travel through all three mediums- solid, liquid and gas.
- These waves have a tendency to vibrate parallel to the direction of wave propagation. This causes density differences in the material through which they travel.
- These waves are responsible for elongating and squeezing of material.

S- Waves

- S- Waves arrive after some time after the happening of Earthquake and they are called secondary waves.
- A significant characteristic of these S-waves is that they travel only through a solid medium.
- The direction of vibration of these S – wave is perpendicular to the direction of wave propagation, thereby creating crests and troughs in the material of their transmission.

Shadow Zone





- The shadow zone is the zone of the earth from angular distances of 104 to 140 degrees from a given earthquake that does not receive any direct P waves.
- The shadow zone results from P waves being refracted by the liquid core and S waves being stopped completely by the liquid core.
- A zone between 105° and 145° from the epicentre was recognised as the shadow zone for both the waves types.
- The entire zone beyond 105° does not receive S-waves.
- The shadow zone of S-wave is larger than that of the P-waves.
- The shadow zone of P-waves appears as a band around the earth between 105° and 145° away from the epicentre.

Effects of earthquake

The following are the immediate hazardous effects of Earthquake:

- Shaking of ground
- Disparity in ground settlement

- Natural disasters like Tsunami, land slide, mud slides and avalanches
- Soil liquefaction
- Ground lurching and displacement
- Floods and fires
- Infrastructure collapse.

Measurement

All earthquakes are different in their intensity and magnitude. The instrument for measurement of the vibrations is known as Seismograph.

Magnitude scale

- Richter scale is used to measure the Magnitude of the earthquake
- The energy released during a quake is expressed in absolute numbers of 0-10.

Intensity scale

- The mercalli scale is used to measure the intensity of an earthquake
- It measures the visible damage caused due to the quake.
- It is expressed in the range of 1-12.