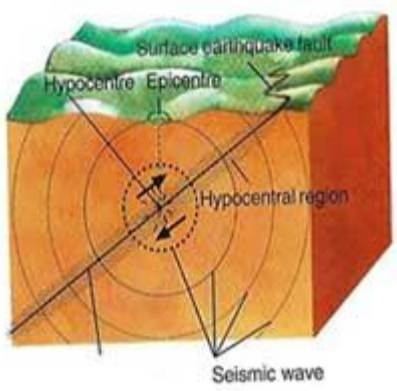
Frequently Asked Questions

Question: What is epicenter of an earthquake?

Answer: It is the point on the surface of the earth vertically above the place of origin (hypocentre) of an eartquake. This point is expressed by its geographical latitude and longitude.

Question: What is Hypocentre or Focus of an earthquake?



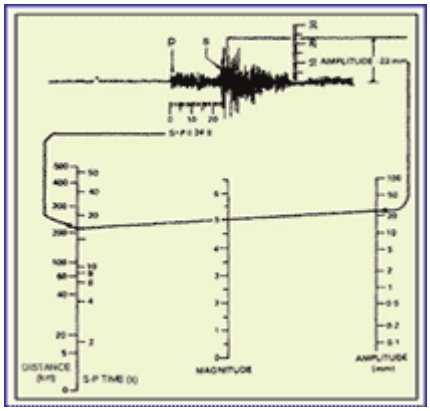
Answer: It is the point within the earth from where seismic waves orignate. Focal depth is the vertical distance between the hypocentre and epicentre.

Question: What is Magnitude and intensity of an earthquake?

Answer: Earthquakes are quantified either in terms of magnitude or intensity. The strength of an earthquake, or strain energy released by it is usually measured by a parameter called "**Magnitude**" determined from the instrumental (Seismograph) records.

Intensity of an earthquake is a subjective measure of the force of an earthquake at a particular place as determined by its effects on persons, structures and earth materials. The intensity at a point, depends not only upon the strength of the earthquake (i.e. magnitude) but also upon the distance from the earthquake to the point and the local geology at that point. While the intensity decreases with the distance from the epicenter, magnitude for an earthquake remains the same, irrespective of where it is measured.

Question: What is Richter Scale?



Answer: The local magnitude is defined as the logarithm of the maximum amplitude measured in microns on a seismogram written by Wood-Anderson seismograph with free period of 0.8 second, magnification of 2,800, damping factor of 0.8 calculated to be at a distance of 100 kms. The relative size of events is calculated by comparison to a reference event of M_L=0, using the formula, M_L =log A - log A_o

where A is the maximum trace amplitude in micrometer recorded on a standard seismograph and A_o is a standard value which is a function of epicentral distance (Δ) in kilometers.

Question: How will you classify the earthquakes?

Answer: Earthquakes can be classified as below:

Classification of earthquakes	
Slight	Magnitude upto 4.9 on the Richter Scale.
Moderate	Magnitude 5.0 to 6.9
Great	Magnitude 7.0 to 7.9
Very Great	Magnitude 8.0 and more.

Question: What is Intensity scale used in relation with Earthquakes?

Answer : The **intensity** scale used in relation with earthquakes consist of the descriptions of a series of certain key responses such as people awakening, movement of furniture, damage to chimney, and finally - total destruction. Although numerous intensity scales have been developed over the last several hundred years to evaluate to evaluate the effects of earthquakes, the one most commonly used is **Modified Mercalli (MM) Intensity scale**. It was developed by the American seismologists Harry Wood and Franke Neumann. This scale consisting of 12 increasing levels of intensity that range from imperceptible shaking to catastrophic destruction, is designated by Roman numerals (I- XII). It does not have a mathematical basis, instead it is subjective ranking based on observed effects. The lower numbers of intensity scale generally deal with the manner in which the earthquake is felt by people. The higher numbers of the scales are based on observed structural damage. Normally, damages are associated with intensity V or more.

Another intensity scale widely used for measuring the intensity is Medvedev-Sponheuer-Karnik (MSK-64) scale.

Question: What are various Magnitude scales used in relation with Earthquakes?

Answer: Depending upon the range of magnitudes, epicentral distance and the characteristics of the seismographs, there are mainly four magnitude scales are in use with earthquakes, they are:

(1) Local magnitude (Ml or ML), commonly referred to as "Richter magnitude",
(2) Surface-wave magnitude (Ms),
(3) Body-wave magnitude (mb), and
(4) Moment magnitude (Mw).

The first three magnitude scales Ml, Ms and mb mentioned above make use of amplitudes and time periods of seismic wave and suffer from the saturation effect. They have some or other limitation with regard to their applicability uniformly to all magnitude ranges, epicentral distances and focal depths. To avoid the saturation effect and standardize the magnitude scales, a magnitude scale based on seismic moment (Mo) was proposed by Kanamori (1977). The moment magnitude (Mw) scale is estimated using the formula given below:

Mw=(log Mo –16)/1.5

where Mo, is the seismic moment in dyne-cm. The static seismic moment is a product of rupture area, shear strength and fault displacement. Seismic moment can also be estimated from the displacement spectra of ground motion time histories or waveform modeling/inversion. Since seismic moment is a measure of strain energy released from the entire rupture surfaces, a magnitude scale based on seismic moment most accurately describes the size of large earthquakes. Since Mo does not saturate, so also Mw. The moment magnitude scale is the most preferred magnitude scale in case of large earthquakes.

Question: What are the causes of earthquakes?

Answer: From the concept of plate tectonics, the Indian plate is moving in a north-north-east direction and colliding with Eurasian plate along the Himalayan mountain range. This collision is responsible for the formation of faults such as Main Boundary Thrust, Main Central Thrust, etc in and along the Himalaya. Almost all the major earthquakes in India and its adjoining region occur along these faults. In brief, earthquakes occur due to forces of geological origin along weak planes called, ***faults***. The earthquakes occurring near plate boundaries such as Himalaya are known as ***interplate earthquakes***. Apart from earthquakes from the Himalayan belt, there have been earthquakes of relatively lesser magnitude and lesser frequency in the Peninsular India also. Such earthquakes are known as ***intraplate earthquakes*** and are attributed to the stresses building up in this area on account of compressive forces arising out of north-northeastward movement of the Indian plate.

Question: What are the seismic zones of India.

Answer: Bureau of Indian Standards [**IS-1893 (Part-1): 2002**], based on various scientific inputs from a number of agencies, has grouped the country into four seismic zones viz. Zone-II, III, IV and V. Of these, Zone V is the most seismically active region, while zone II is the least. The Modified Mercalli

(MM) intensity, which measures the impact of the earthquakes on the surface of the earth, broadly associated with various zones is as follows:

Seismic Zone	Intensity on MM scale
II (Low intensity zone)	VI (or less)
III (Moderate intensity zone)	VII
IV (Severe intensity zone)	VIII
V (Very severe intensity zone)	IX (and above)

Broadly, Zone-V comprises of entire northeastern India, parts of Jammu and Kashmir, Himachal Pradesh, Uttaranchal, Rann of Kutch in Gujarat, part of North Bihar and Andaman & Nicobar islands. Zone-IV covers remaining parts of Jammu & Kashmir and Himachal Pradesh, Union Territory of Delhi, Sikkim, northern parts of Uttar Pradesh, Bihar and West Bengal, parts of Gujarat and small portions of Maharashtra near the west coast and Rajasthan. Zone-III comprises of Kerala, Goa, Lakshadweep islands, remaining parts of Uttar Pradesh, Gujarat and West Bengal, parts of Punjab, Rajasthan, Madhya Pradesh, Bihar, Jharkhand, Chhatisgarh, Maharashtra, Orissa, Andhra Pradesh, Tamilnadu and Karnataka. Zone-II covers remaining parts of the country.

Question: What is Seismic Microzonation?

Answer: The 'Seismic Hazard and Risk Microzonation' (SHRM) is a process of classifying the given geographic domain into small units of likely uniform Hazard (H) level (Peak Ground Acceleration - PGA, Spectral Acceleration - Sa), nature of hazard (susceptibility to liquefaction and slope failure) and Risk. The objective of Seismic Microzonation is to provide (a) probabilistic estimate of the hazard for each microzone due to earthquake shaking, (b) extent of likely damage to the built environment (dwellings, community structures, lifelines, industrial structures, monuments, heritage structures, etc.) and define damage ratio and people living in structures susceptible to damage, (c) retrofitting measures for the existing structures to render them safe and (d) specific guidelines for designing and construction of earthquake resistant structures belonging to microzones.

Question: What is seismic hazard?

Answer: **Seismic hazard** is a physical phenomenon, such as surface faulting, ground shaking, landslides, liquefaction, tectonic deformation, tsunamis, or seiches, that is associated with an earthquake and that may produce adverse effects on the normal activities of the people.

Question: What is Vulnerability?

Answer: **Vulnerability** is the degree of damage caused by various levels of loading. The vulnerability may be calculated in a probabilistic or deterministic way for a single structure or groups of structures.

Question: What is Seismic Risk?

Answer: Conceptually, seismic risk, has been defined as Risk = Hazard(H) * Exposure(E) * Vulnerability(V) * Location(L)

The seismic risk at a given location(L) of ground/built environment in a seismotectonic domain is defined as function of likehood or probability of occurrence of ground motion(PGA,PGV,PGD and duration) and accompanied manifestation in ground shaking in linear/non linear deformation.

Question: What is Tsunami?

Answer: **'**Tusnami' is a Japanese word with English translation, "harbour wave". When an earthquake of large magnitude occurs under the sea, due to large displacements of the sea floor, the water column is disturbed and sea waves, called 'Tsunamis', are generated. Tsunamis may also be generated by submarine landslides, volcanic eruptions, explosions and meteorites. Tsunamis can savagely attack coastlines, causing devastation to property and loss of life. These waves travel long distances and when they reach shallow waters, their amplitude increases. At any given place, the amplitudes may range from a few meters to a few tens of meters depending upon several factors including the magnitude of the event, the type of faulting, depth of water column and bathymetry of the coast.

Question: Can you predict earthquakes?

Answer: No scientific technique is available anywhere in the world so far to predict the occurrence of earthquakes with reasonable degree of accuracy with regard to space, time and magnitude.