Geotechnical Engineering_Past Question Collection

1. For which of the following soil, plasticity index is maximum?

[Civil Er. 6th 2079/02/21]

A. Clay
B. Cobbles
C. Gravel
D. Silt

Correct Answer: A

Explanation:

✓ Plasticity Index = LL − PL
✓ Clay has very high LL and wide plastic range
✓ Silt has low to medium plasticity
✓ Gravel and cobbles are non-plastic (PI ≈ 0)

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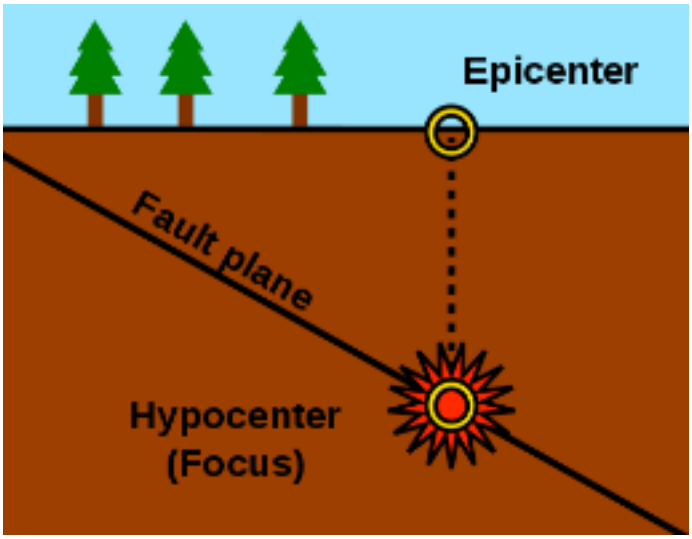
2. Most earthquakes are caused by the sudden release of accumulated.....

[2080/10/27 Koshi Province 7th Level]

A. Rainwater
B. Volcanic gases
C. Gravitational forces
D. Stress along faults

Correct Answer: D

Explanation:



- The point of origin of earthquake is known as **hypocenter** or **focus**
- The point exactly above the hypocenter on the surface of the earth is known as **epicenter**

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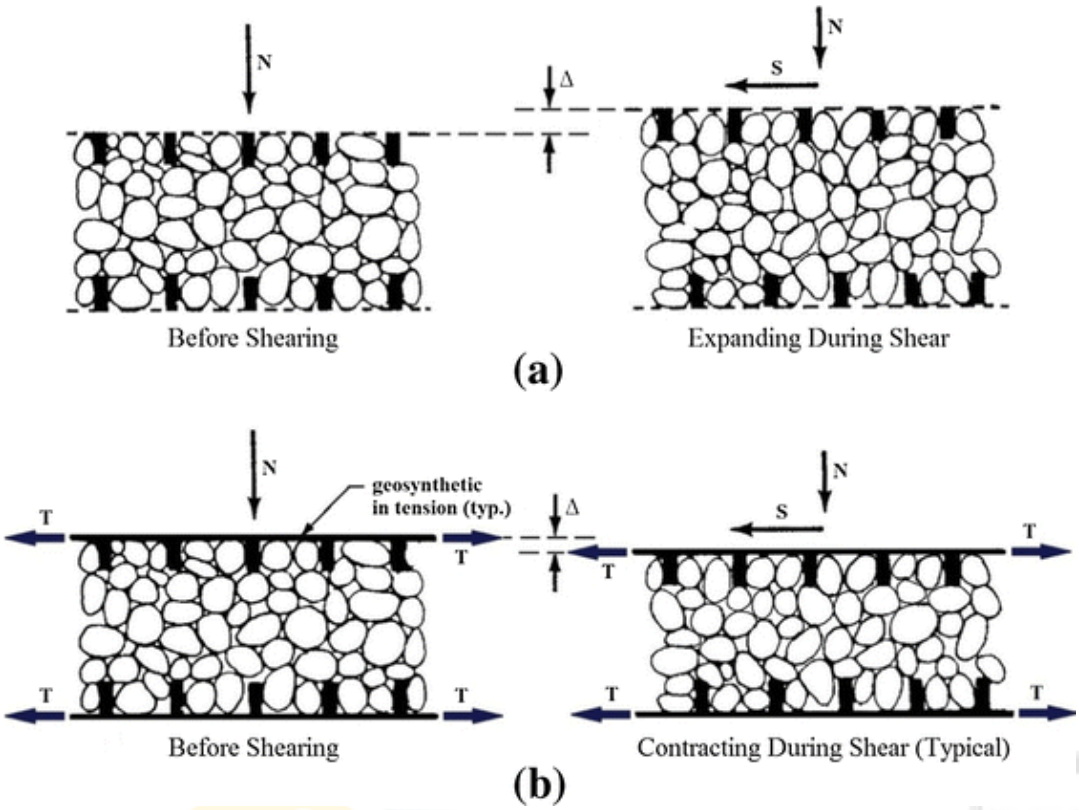
3. Expansion of soils under shear is known as.....

[2080/10/27 Koshi Province 7th Level]

A. Liquefaction
B. Volumetric deformation
C. Critical expansion
D. Dilatancy

Correct Answer: D



Explanation:

a. Liquefaction

✓ Sudden loss of shear strength of saturated sandy soil due to excess pore water pressure (often during earthquakes)

b. Volumetric deformation

✓ Change in soil volume caused by loading or unloading

c. Critical expansion

✓ Increase in soil volume when shearing starts in dense soil

d. Dilatancy

✓ change in volume (specifically, expansion or shear-induced increase in volume) that occurs when dense granular soils are sheared under confinement.

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4. Uniformity coefficient of a soil is.....

[2080/10/27 Koshi Province 7th Level]

A. Always less than 1
B. Always equal to 1
C. Equal to or less than 1
D. Equal to or greater than 1

Correct Answer: D

Explanation:

Uniformity Coefficient (Cu): Ratio of particle sizes indicating gradation of soil.

$$Cu = \frac{D_{60}}{D_{10}}$$

Key Points:

✓

$$D_{60} > D_{10}$$

by definition

✓ Hence, Cu can never be less than 1

✓ Cu = 1 → perfectly uniform soil

✓ Cu > 1 → well or poorly graded soil

✓ Therefore, Cu is always ≥ 1

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5. The most suitable soil for compressed air tunneling is.....

[2080/10/27 Koshi Province 7th Level]

A. Silt
B. Sand
C. Clay
D. Gravel

Correct Answer: C

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6. The most effective method for compacting sand is by using.....
[2080/10/27 Koshi Province 7th Level]

A. Pneumatic rollers
B. Sheep foot rollers
C. Steel tyred rollers
D. Vibratory Roller

Correct Answer: D

Explanation:

• Smooth wheel roller - for sandy and clayey soils except rocky soils
• Pneumatic tyred roller - for both sandy and clayey soils
• Sheep foot roller - cohesive soils such as clay
• Tamping foot roller - fine grained soil such as silt and clay
• Grid roller - weathered rock such as sandstone
• Vibratory roller - granular soils such as sand

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7. The upper limit of the plastic state and lower limit of the liquid state in a soil is defined by the.....
[2080/10/27 Koshi Province 7th Level]

A. Shrinkage limit
B. Liquid limit
C. Plastic limit
D. Plasticity index

Correct Answer: B

Explanation:

a. Shrinkage limit

The water content at which further loss of moisture does not cause any decrease in the volume of soil.

b. Liquid limit

The minimum water content at which soil changes from a plastic state to a liquid state and starts to flow.

c. Plastic limit

The water content at which soil just begins to crumble when rolled into threads of about 3 mm diameter.

d. Plasticity index

The numerical difference between the liquid limit and plastic limit, indicating the range of water content over which the soil remains plastic.

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8. The relationship between the volume of water, volume of solids, and volume of voids in a soil mass is given by.....
[2080/10/27 Koshi Province 7th Level]

A. Void ratio
B. Porosity
C. Specific gravity
D. Degree of saturation

Correct Answer: B

Explanation:

Porosity is a measure of the void in soil, and it's usually expressed as a percentage.

$$\text{Porosity} = \frac{V_v}{V_t}$$

Total volume can be break down into:

Vs+Vw+Va

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9. The soil transported by running water is called.....

[2080/10/27 Koshi Province 7th Level]

A. Aeolian soil
B. Marine soil
C. Alluvial soil
D. Lacustrine soil

Correct Answer: C

Explanation:

The soil transported by running water is called alluvial soil.

Similar types of soil and their formation methods:

✓ Lacustrine Soil: Formed from sediments deposited in still, fresh water of lakes.
✓ Marine Soil: Deposited from suspension in seawater.
✓ Aeolian Soil: Transported by wind. Eg: loess, dunes
✓ Glacial Soil: Formed from materials transported by glaciers. Eg: Till
✓ Colluvial Soil: Accumulated through gravitational forces.

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10. Which method is commonly used to determine the organic content of soil in the laboratory

[2080/10/27 Koshi Province 7th Level]

A. Sieve analysis
B. Atterberg limits test
C. Proctor compaction test
D. Loss on ignition test

Correct Answer: D

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11. Soil transported by wind and deposited as fine particles over large areas is classified as.....

[2080/10/27 Koshi Province 7th Level]

A. Alluvial soil
B. Colluvial soil
C. Loess soil
D. Residual soil

Correct Answer: C

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12. Which laboratory test is commonly performed to determine the specific gravity of soil particles?
[2080/10/27 Koshi Province 7th Level]

A. Atterberg limits test
B. Sieve analysis test
C. Compaction test
D. Pycnometer test

Correct Answer: D

Explanation:

Pycnometer test → Used directly to determine specific gravity of soil solids

✓ Measures volume of soil solids by water displacement

✓ Suitable for fine-grained soils (silt & clay)

✓ Other tests do not measure specific gravity

✓ Standard laboratory method in soil mechanics

Why other options are not correct:

✓ Atterberg limits test → Determines consistency limits

✓ Sieve analysis test → Determines particle size distribution

✓ Compaction test → Determines optimum moisture content & max dry density

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13. Which wave on an earthquake is produced by a rolling effect along the earth's surface?

[2080/10/27 Koshi Province 7th Level]

A. L waves
B. P waves
C. S waves
D. None of the above

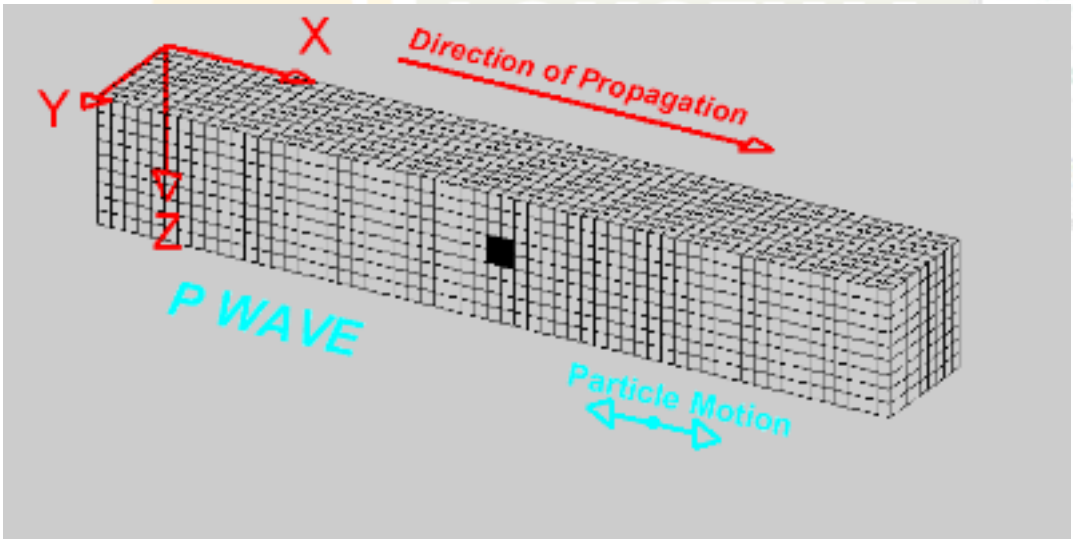
Correct Answer: D

Explanation:

The answer should be Rayleigh wave.
Types of earthquake waves:

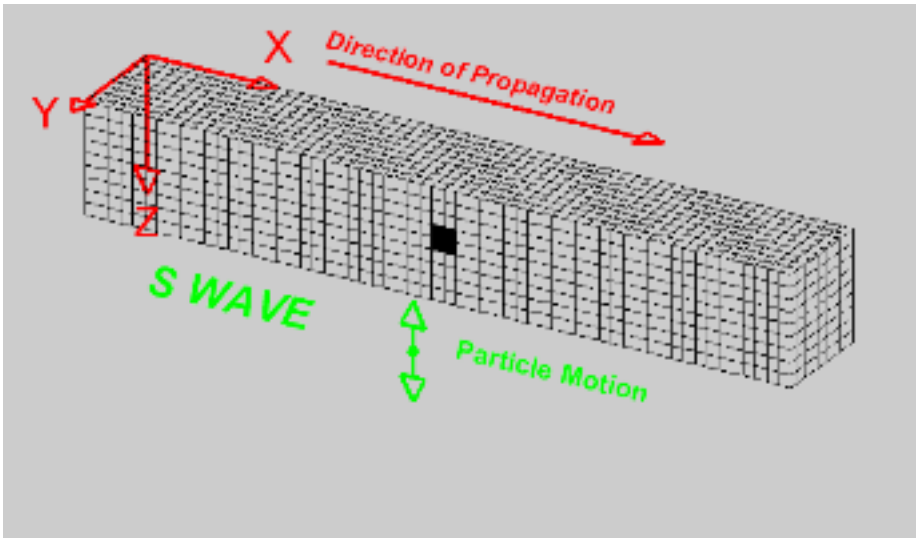
1. Body Waves (Travel through Earth's interior)

A) P-Waves (Primary Waves)



- Fastest waves; first to be detected. Velocity ~ 5-8 Km/s
- Compressional; move in a push-pull motion.
- Can travel through solids, liquids, and gases.

B) S-Waves (Secondary Waves)

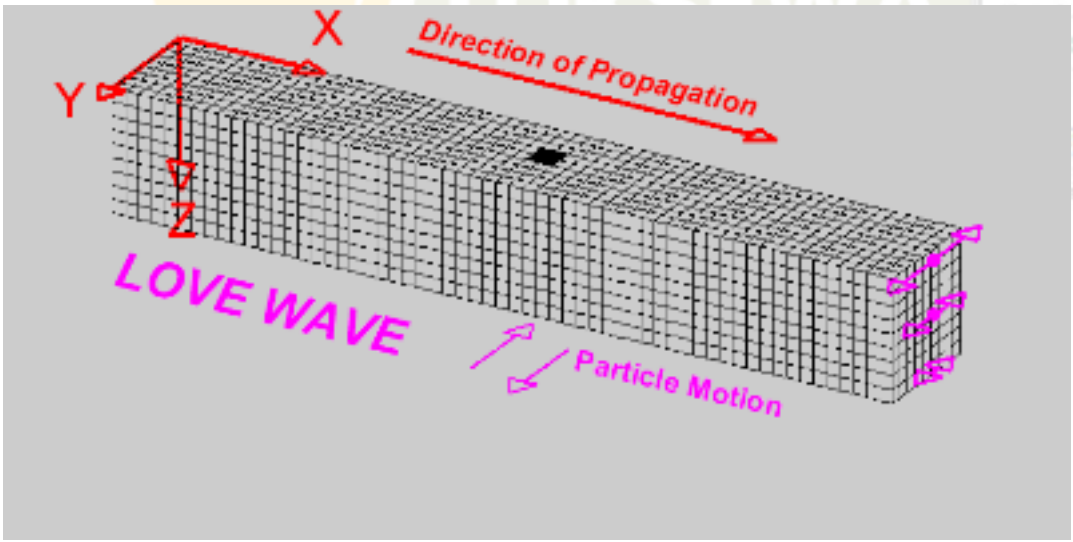


- Slower than P-waves; arrive second. P~ 1.7 S
- Shear waves; move perpendicular to the wave direction.
- Travel only through solids.

2. Surface Waves

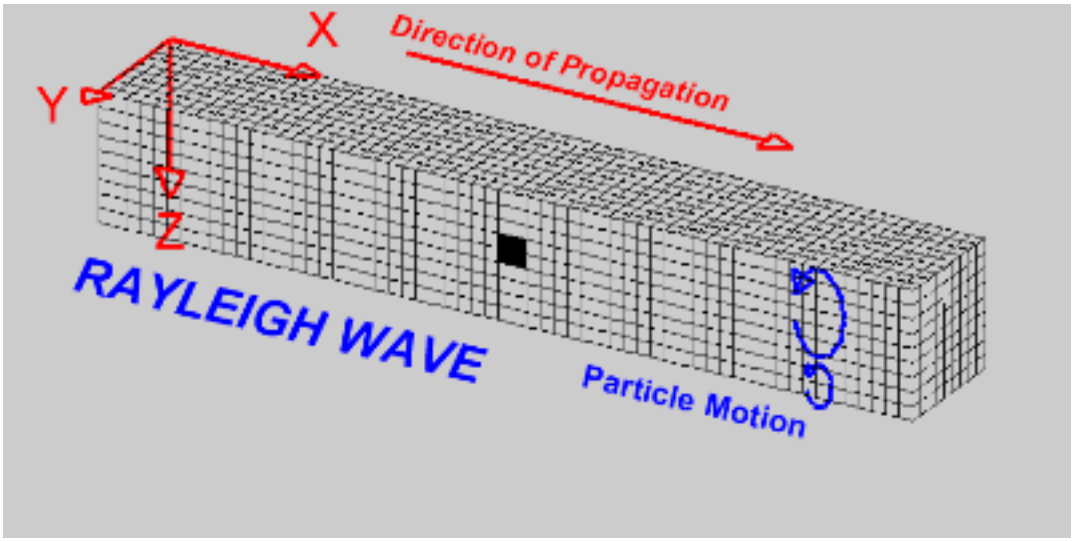
(Travel along Earth's surface. So, more destructive)

A) Love Waves



- Horizontal, side-to-side motion; like a snake
- Faster than Rayleigh waves.
- One of the Most destructive that cause significant damage to structures.

B) Rayleigh Waves



- Rolling motion (like ocean waves).
- Cause both vertical and horizontal ground movement.
- Slower but most destructive

Velocity of travel: P >S > L > R

Destructive nature: R and L > S > P

Note: After considerable research it was found that surface waves are the most destructive. Most sources do not mention which one is greater in terms of destructiveness. Between Rayleigh and Love waves, it's not straightforward to declare one universally more destructive than the other since their impact can vary based on several factors like local geology, the type of structures in the area, and the specific characteristics of the earthquake. If in exam asked with both options we recommend choosing Rayleigh because of it has both vertical and horizontal component resulting in a complex shaking as opposed to Love waves which have the horizontal shearing component only.
