What is wavefront ?

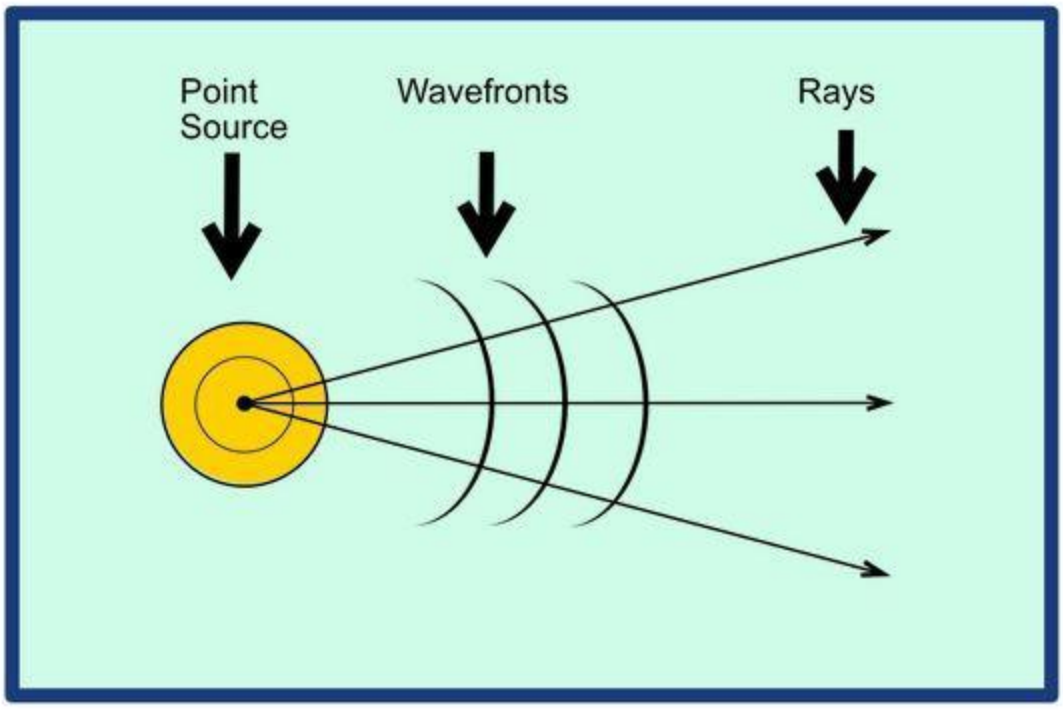
Physics classes by Nayan jha providing the complete notes of wavefront .

What is wavefront?

It is the continuous locus of all such particles of the medium which are vibrating in the same phase at any instant . So we can say wavefront is the surface of constant phase.(*An arrow drown perpendicular to the wavefront in the direction of propagation of wave is called ray*.)

There are three types of wavefront

(i) **spherical wavefront-** When light rays coming out from a point source then the wavefront drawn is spherical wavefront.



Explanation:

- A point source emits light in all directions.
- The wavefronts are concentric spheres.
- The radius of each spherical wavefront increases with time.

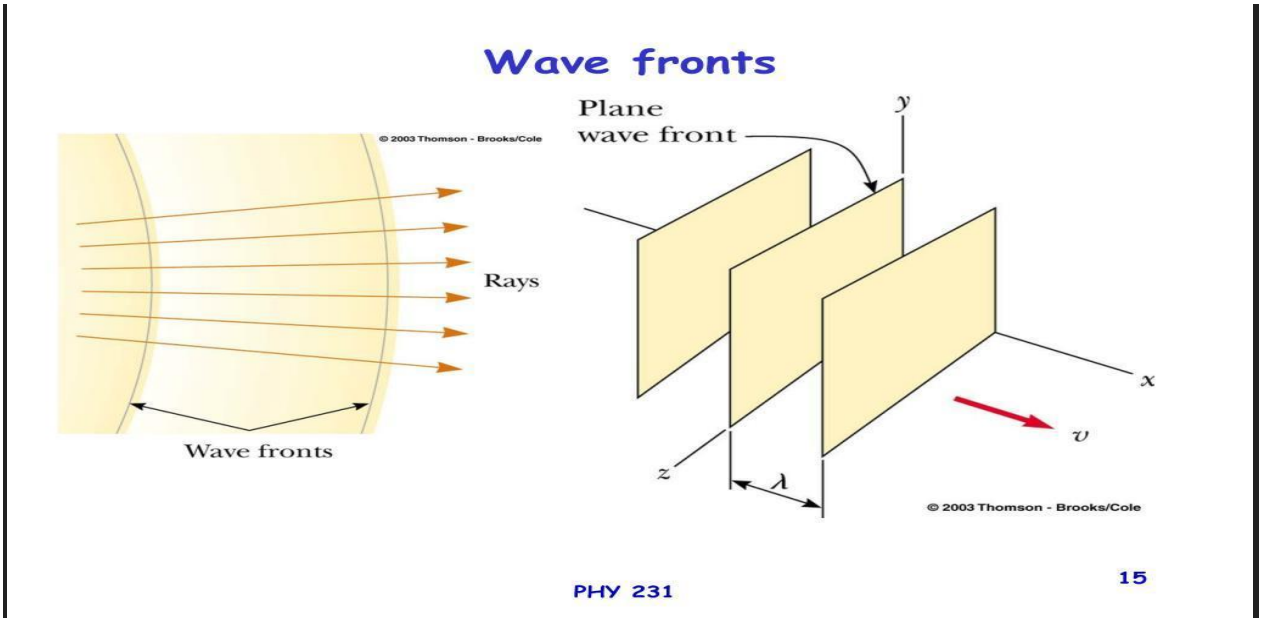
Example: Light coming from a small bulb.

2. Plane Wavefront

Light rays coming from infinity (parallel rays) form plane wavefront (The diagram of plane waavefont shown in the fig. given below.

Or,

When a spherical wavefront travels a very large distance from the source, a small portion of it can be considered as a plane wavefront.



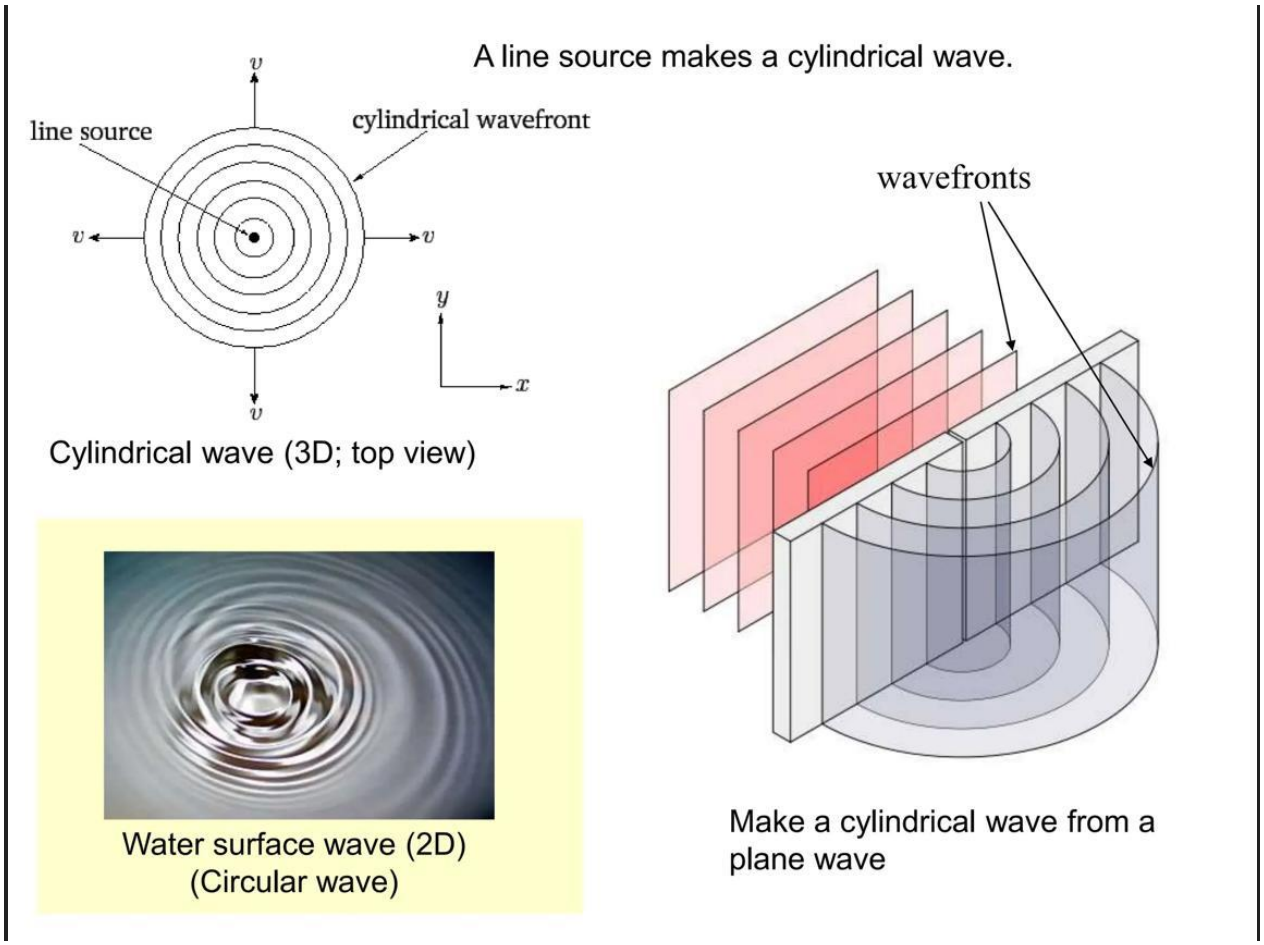
Explanation:

- The wavefront is plane in shape.
- All points on the wavefront have the same phase.
- The light rays are parallel to each other.

Example: Sunlight reaching the Earth can approximately be considered a plane wavefront.

3. Cylindrical Wavefront

When light originates from a linear source, the wavefronts are cylindrical in shape.i.e. when the source of light is linear then the wavefront so formed is cylindrical. The diagram of cylindrical wave front is given in the fig. below-



Explanation:

- A linear source produces cylindrical wavefronts.
- All points on a cylindrical wavefront have the same phase.

Example: Light emerging from a long narrow slit (approximately).

Difference between Wavefront and Ray

Wavefront	**Ray**

It is a surface joining points of the same phase.	It represents the direction of propagation of light.
It is perpendicular to the rays.	It is perpendicular to the wavefront.
It represents equal phase.	It represents the direction of energy transfer.

Some important things to keep in mind about the wavefront are -

1. A wavefront is a surface of constant phase.
2. Two wavefronts never intersect each other.
3. Light rays are always perpendicular to the wavefront.
4. The distance travelled by light between two successive wavefronts in one time period is equal to one wavelength (λ).
5. Huygens' principle is based on the concept of wavefronts.

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Question: **Why are light rays always perpendicular to the wavefront?**

Answer: Light rays represent the direction of propagation of light, whereas a wavefront is a surface of constant phase. Therefore, light rays are always normal (perpendicular) to the wavefront.

Next important topic: Huygens' Principle and the construction of secondary wavelets from a given wavefront.