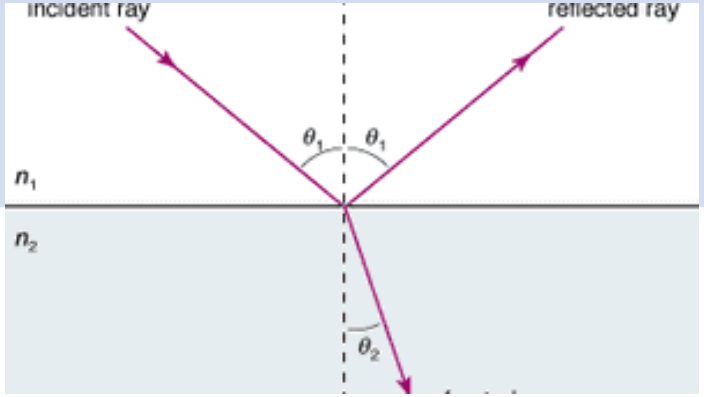
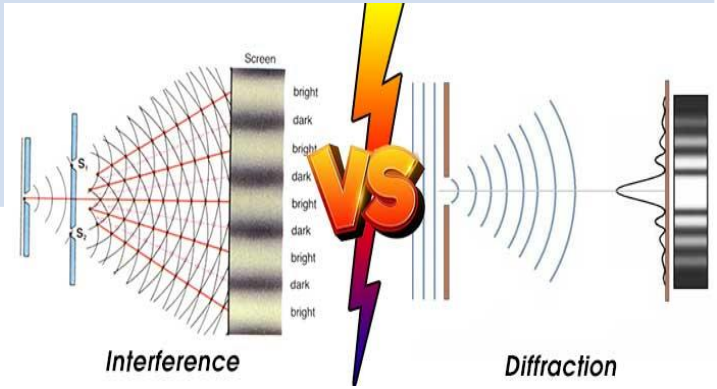
How Are Electromagnetic Waves Formed?

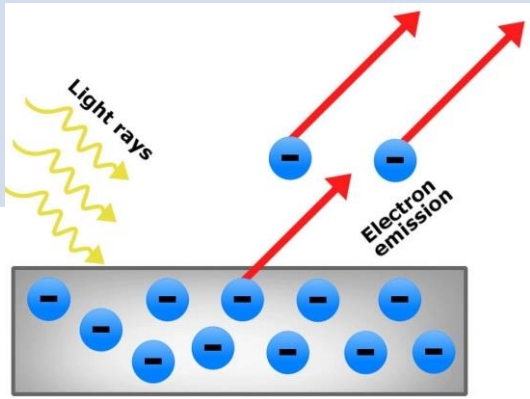
- Generally, an electric field is produced by a charged particle.
- The Magnetic field is produced by a moving charged particle.
- So, the electromagnetic field is produced by an accelerating charged particle. (An accelerating charged particle is when the charged particle oscillates about an equilibrium position.)
- Electromagnetic waves are electric and magnetic fields travelling through free space with the speed of light c.
- If the frequency of oscillation of the charged particle is f, then it produces an electromagnetic wave with frequency f.
- The wavelength λ of this wave is given by $\lambda = c/f$.
- Electromagnetic waves transfer energy through space.

Optics divided in to

1- Geometrical optics	2-Physical optics	3-Quantum optics
, treats light as a collection of rays that travel in straight lines and bend when they pass through or reflect from surfaces.	is a more comprehensive model of light, which includes wave effects such as diffraction and interference	is a branch of atomic, molecular, and optical physics dealing with how individual quanta of light, known as photons, interact with atoms





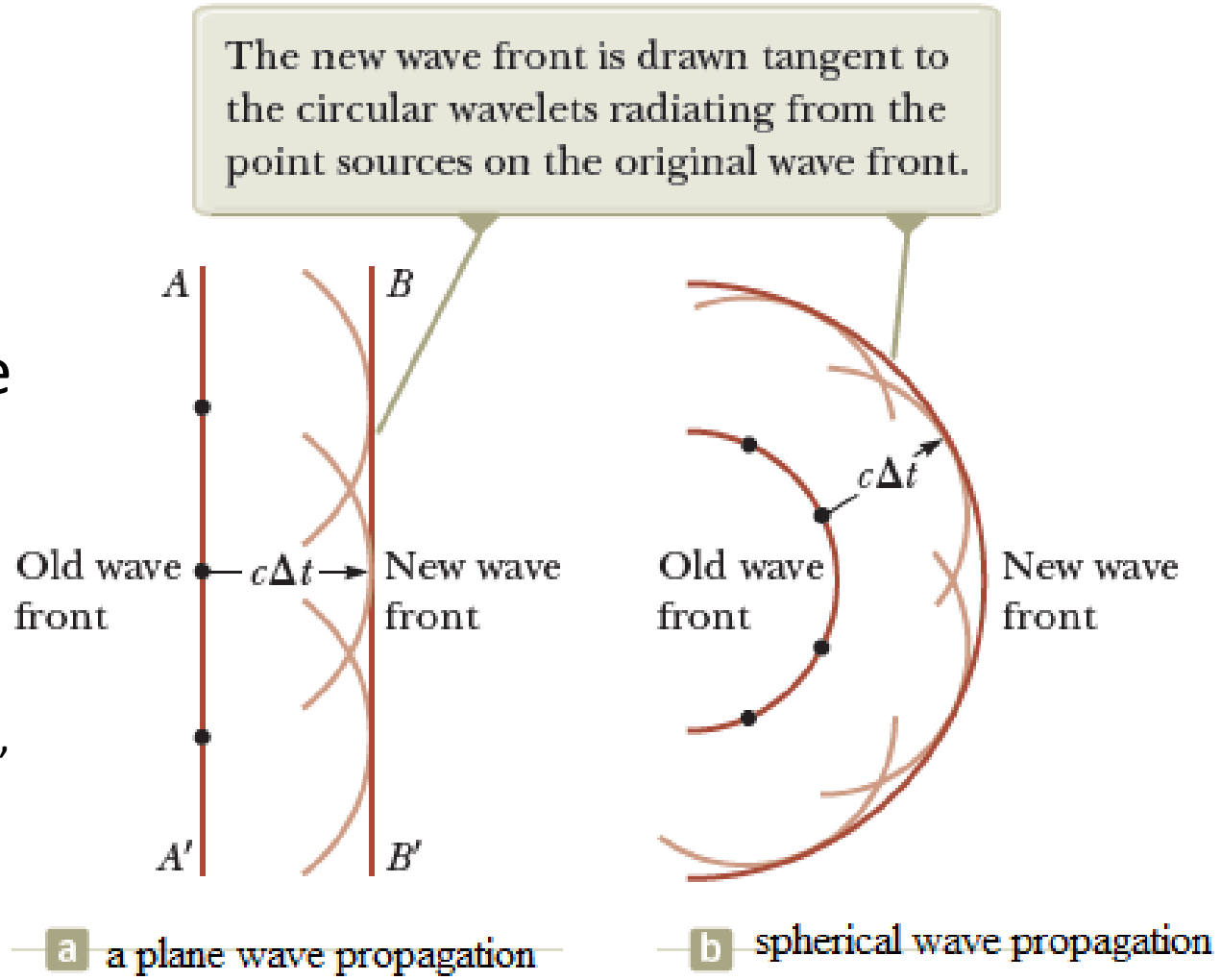


Huygens principle

Huygens's principle:
is a geometric construction for using knowledge of an earlier wave front to determine the position of a new wave front at some instant.

All points on a given wave front are taken as point sources for the production of spherical secondary waves, called wavelets., wavelets propagate outward through a medium with speeds characteristic of waves in that medium.

After some time interval has passed, the new position of the wave front is the surface tangent to the wavelets.



In geometric optics.

light is treated as a set of *rays*, emanating from a source, which propagate through transparent media according to a set of *three* simple laws.

2-Ray approximation in Geometric optics

- If the wave meets a barrier in which there is a circular opening whose diameter is much larger than the wavelength, the wave emerging from the opening continues to move in a straight line hence, the ray approximation is valid.
- If the diameter of the opening is on the order of the wavelength, the waves spread out from the opening in all directions. This effect, called *diffraction.*
- Finally, if the opening is much smaller than the wavelength, the opening can be approximated as a point source of waves.

- This approximation is very good for the study of mirrors, lenses, prisms,and associated optical instruments, such as telescopes, cameras, and eyeglasses.