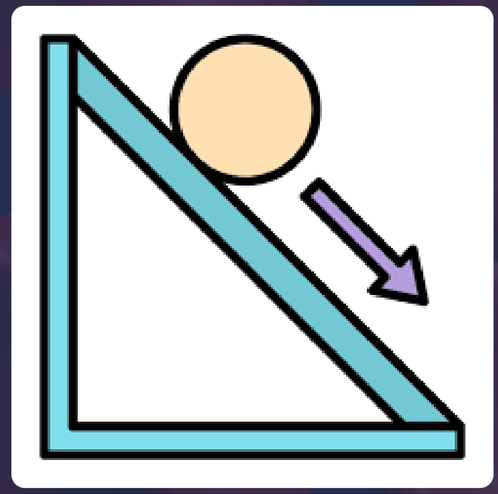
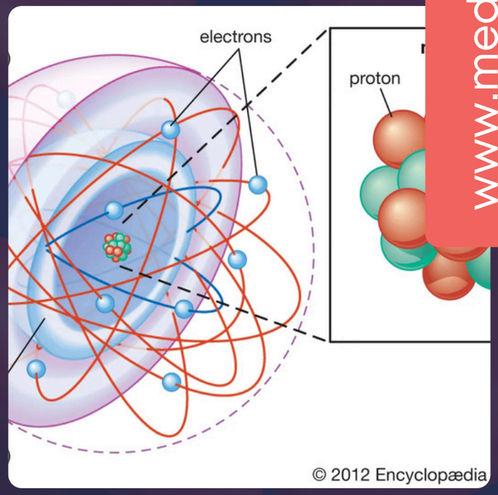
FSC-MIT-1

LEC#6 ( 30/10/2024 )

# FIRST-YEAR PHYSICS
# FOR RADIOGRAPHERS

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## CHAPTER# 1 & 4

## HEAT
## TRASFER OF HEAT

H/ DR. AYESHA RAUF

Amplitude and frequency are two properties of waves that are inversely proportional to each other:

- Amplitude
- The distance between a wave's resting position and its maximum displacement. Amplitude is measured in meters.
-

Frequency

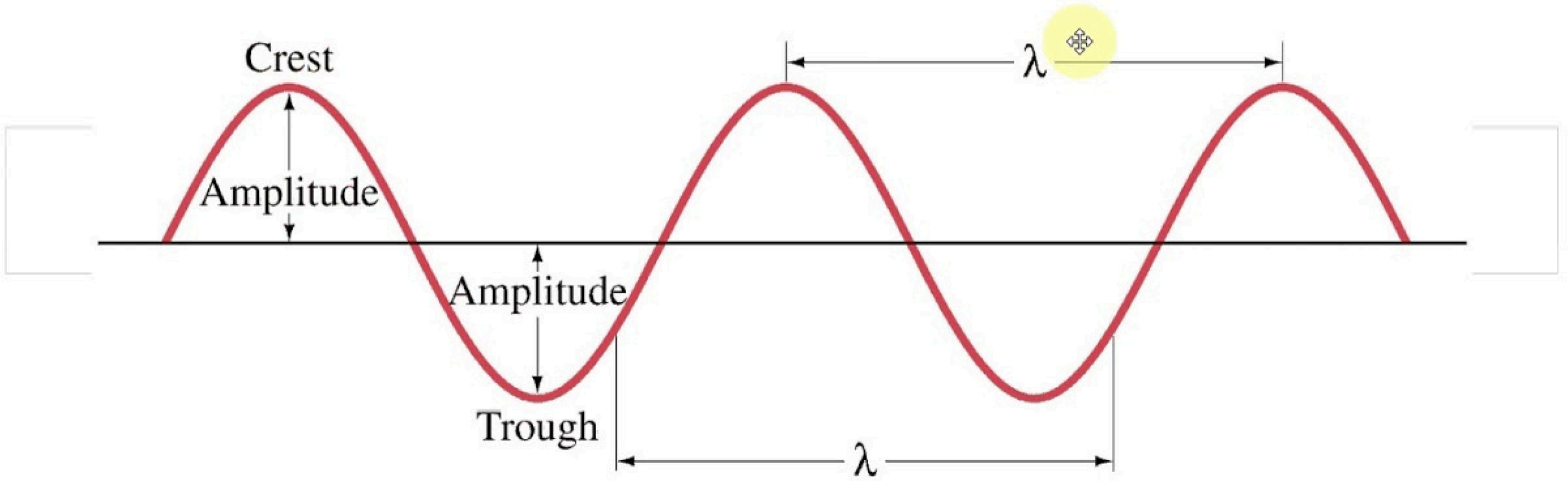
The number of waves that pass a specific point in one second. Frequency is measured in Hertz (Hz)

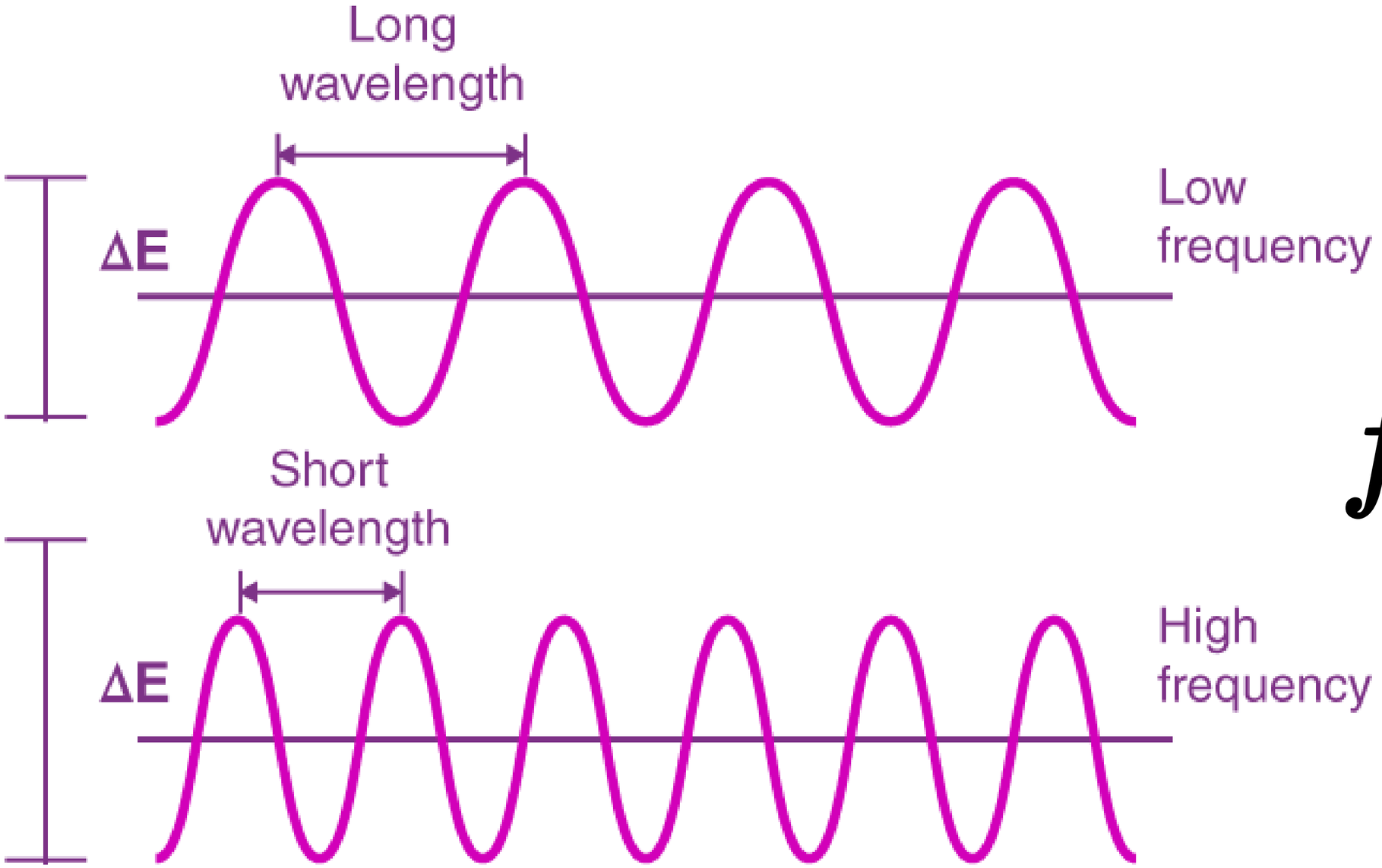
- Amplitude
- Loudness or volume, measured in decibels (db). High amplitude is loud, and low amplitude is quiet.
-
-
- Frequency
- Pitch, measured in Hertz (Hz) and kilohertz (kHz). High frequency is a high-pitched sound, and low frequency is a low-pitched sound. Humans can only hear frequencies between 20 Hz and 20,000 Hz.

# Parts of a wave

Crest: “Top” of wave
Trough: “Bottom” of wave

Amplitude: “Height” of wave (from centerline)
Wavelength: How long wave is - symbol λ



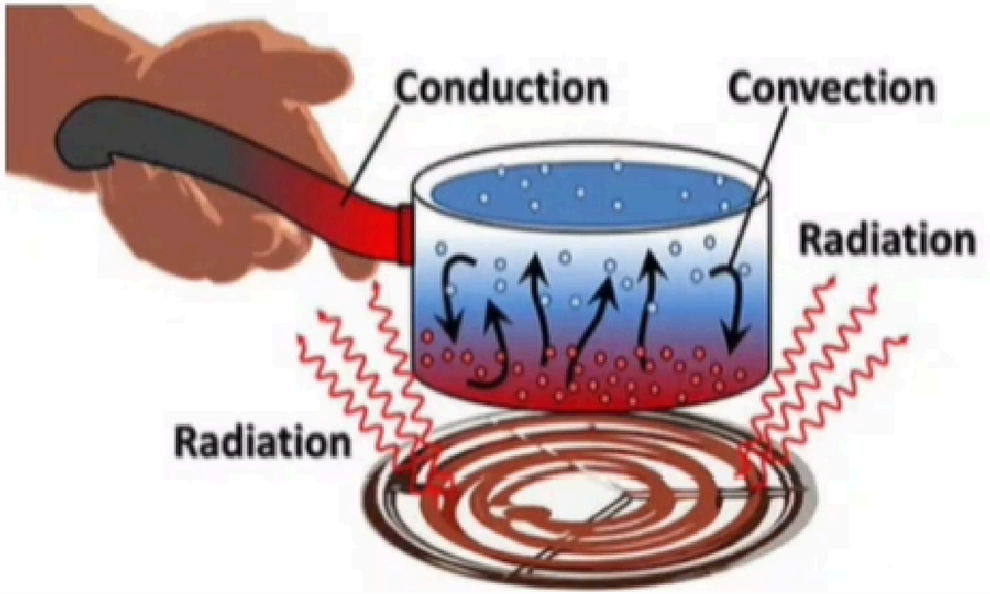

Long
wavelength
ΔE
Low
frequency
Short
wavelength
ΔE
High
frequency

$$f = \frac{1}{T}$$

# Various Methods of Transmission of Heat

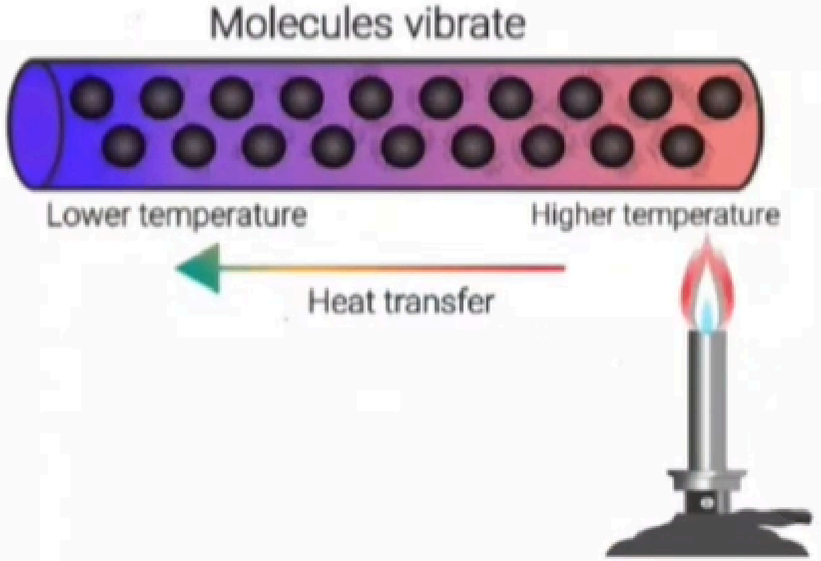
- Also called methods of heat dissipation.
- There are 3-types of of methods of heat transfer :-

1. Conduction
2. Convection
3. Radiation



# Heat Energy

- *Heat is a form of energy.*
- *Heat energy is produced due to the motion of subatomic particles like atoms, ions, and molecules to solids,*
- *gases, and liquids*
- *Heat is defined as the net amount of thermal energy of a system.*
- *Heat is transferred from a substance having a higher temperature to a substance having a lower temperature..*
- *SI Unit :- Joule (J)*



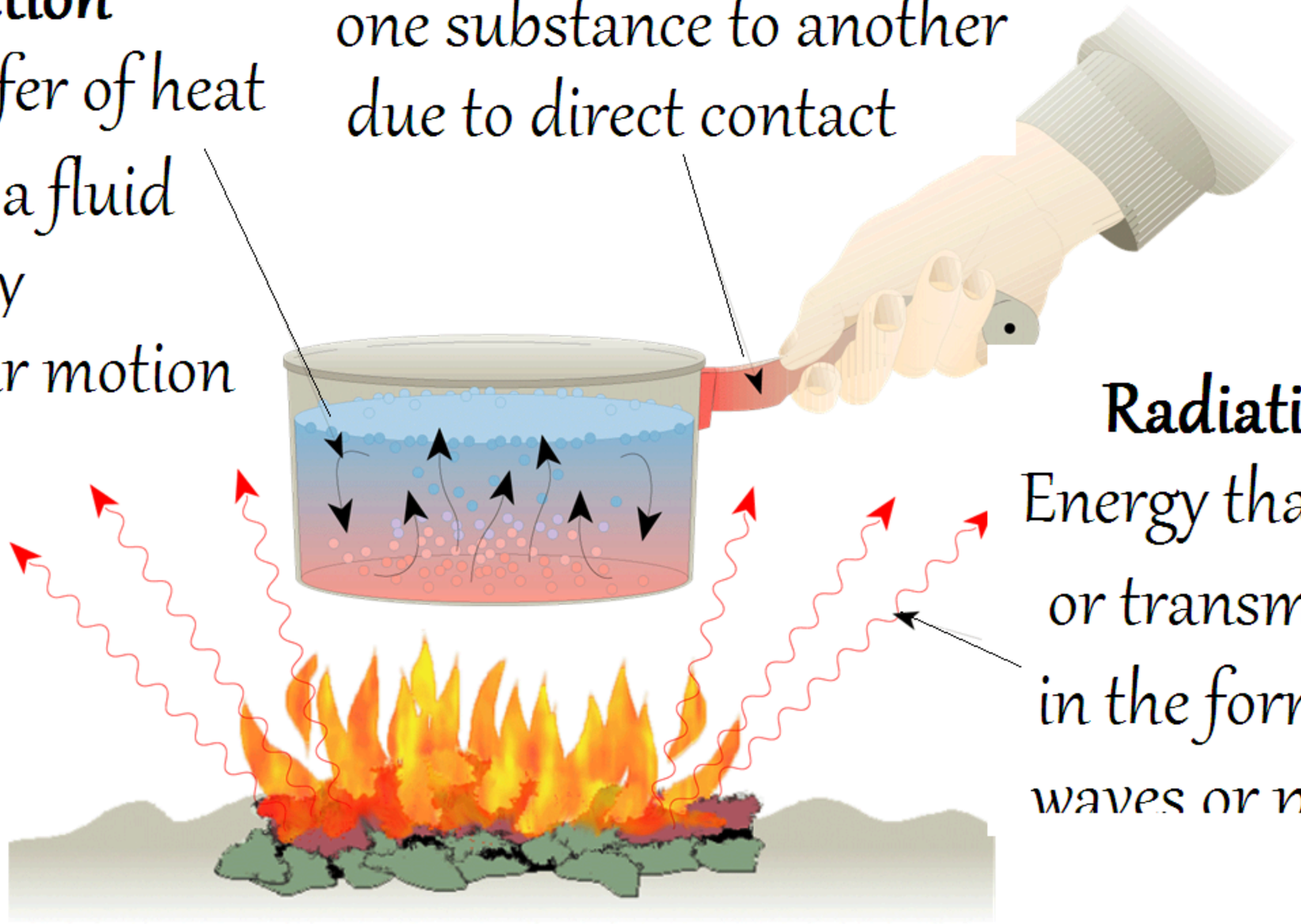
| Conduction (via direct contact) | Convection (via fluid) | Radiation (via electromagnetic Radiation) |
| --- | --- | --- |
| • Conduction is the direct flow of heat through a material resulting from physical contact. | • heat transfer between a surface and adjacent fluid (gas, air or liquid) and by the flow of fluid from one place to another, induced by temperature | • No transfer medium required<br>• It's the transfer of thermal energy through matter of space by electro-magnetic waves. |

## Conduction

The transfer of heat from one substance to another due to direct contact

## Convection

The tranfer of heat trought a fluid caused by molecular motion



## Radiation

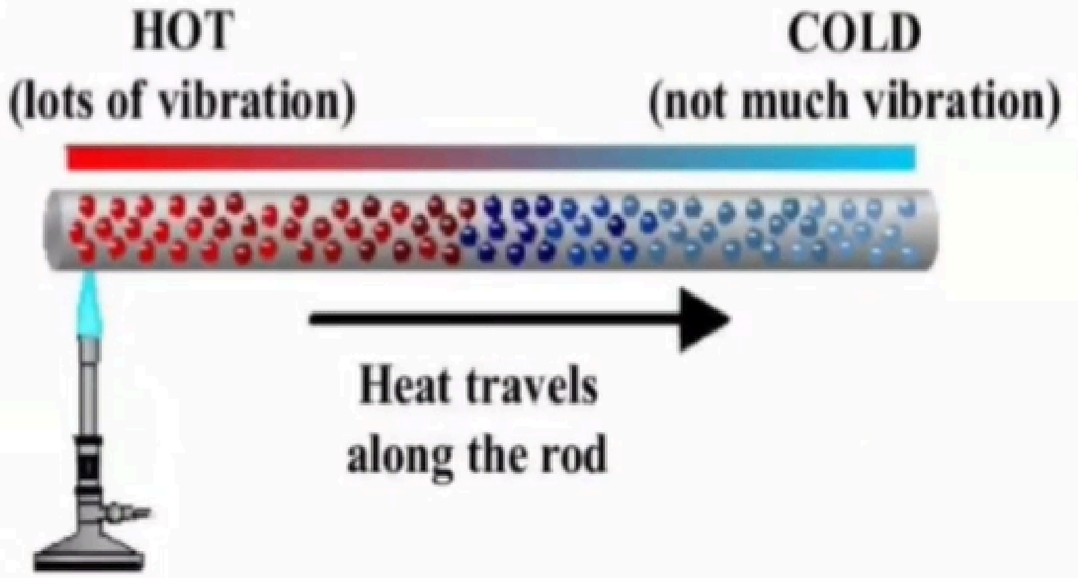
Energy that is radiated or transmitted in the form of rays or waves or particles

# 1. Conduction

- *Also known as thermal conduction.*
- *Process in which the heat transferred without the visible motions of the particles of the heated body is called conduction of heat.*
- *In this process the particles of the heated body are in physical contact and vibrate during heating.*
- *Conduction occurs in solids, liquids and gases.*
- *Good conductor of heat :-*

  *Metals ( ex- Silver & Copper )*
- *Bad conductorof heat :-*

  *Non metals ( Wood & Glass )*



# Thermal Conductivity

- *Thermal conductivity is the inherent ability of a given material to conduct/transfer heat.*

$$\frac{dQ}{dt} = kA\left(\frac{\theta_1 - \theta_2}{L}\right)$$

*dQ/dt = rate of flow of heat*

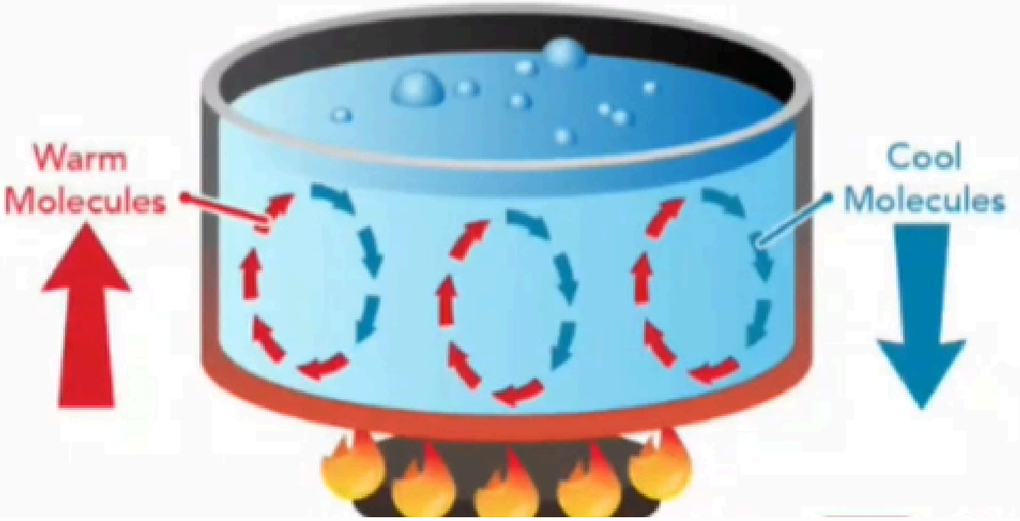
*01-02/L = temprature gradient*

*A = cross section area of the material*

*K = thermal conductivity*

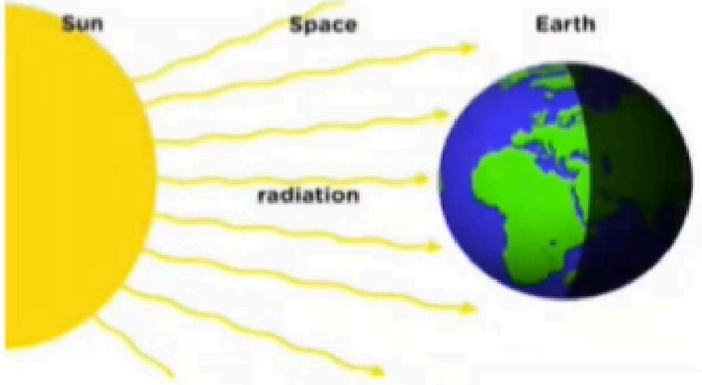
# 2. Convection

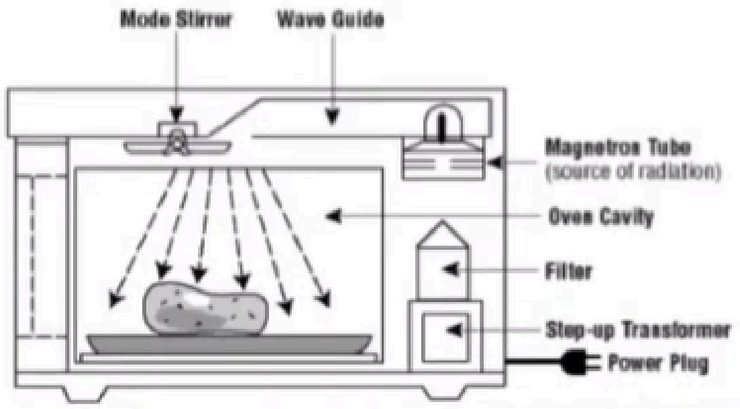
- *Process in which heat energy is transferred by the actual motion of the particles/molecules of the body is called convection of heat.*
- *Convection occurs in :- Liquids and gases.*
- *Ex : - Boiling water*
  *- Heating of oil in x-ray tube*
  *- AC*



# 3. Radiation

- *Process by which heat energy is transferred from one place to another place without any medium.*
- *When a body has internal energy, its atoms and molecules vibrate and emits electromagnetic radiatiowhis also called thermal radiation, which can be transports across a vacuum.*
- *Ex: - Heat(intrared radiation) reaches at the earth from the sun*
  *- Microwave radiation emitted in the oven is an example of radiation*

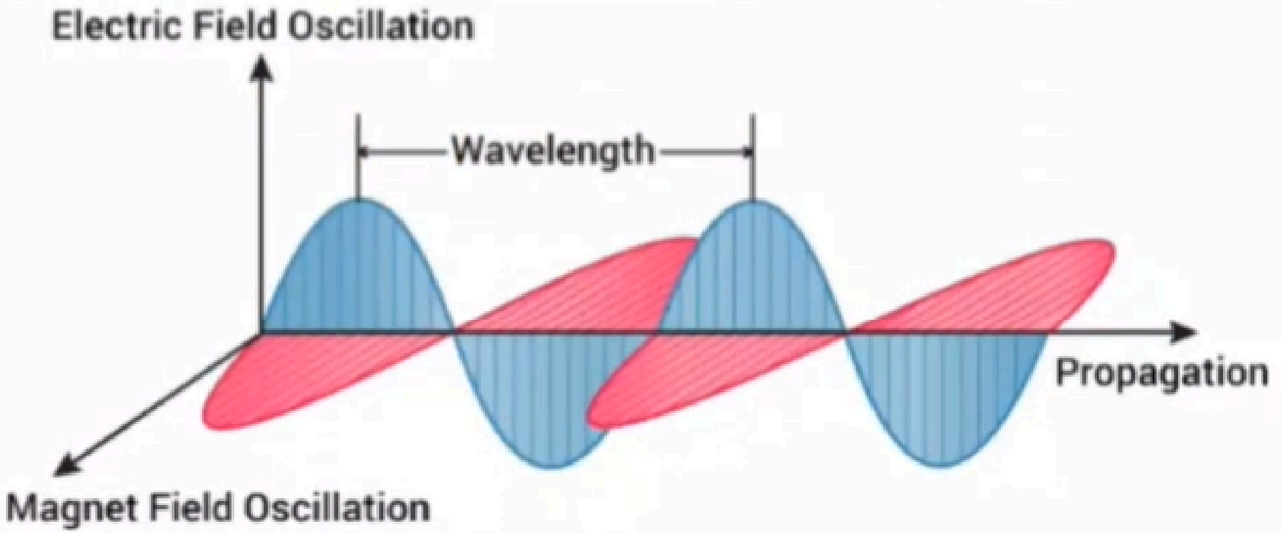


# Electromagnetic Radiation

- *Meaning of electromagenetic :- Have both electrical & magnetic properties.*

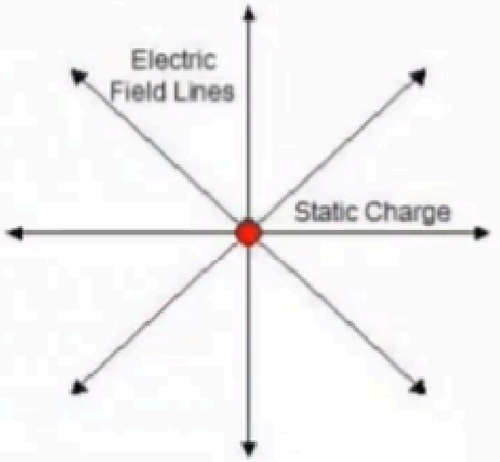
- *Electromagnetic radiation is the form of energy which can be travel through the free space or through a medium in the form of electric & magnetic field with the speed of light ( 3X10-¹⁰ m/s).*

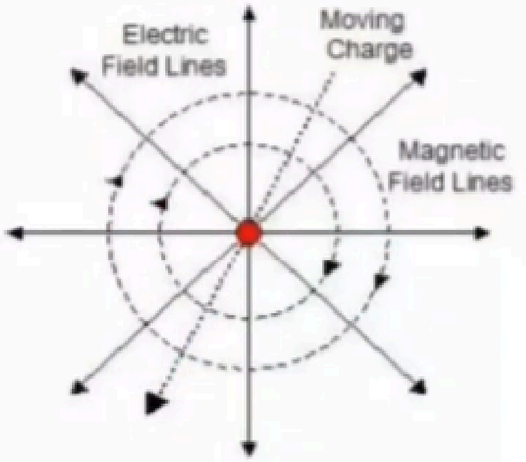


- *When a charge is in rest it generate electric field and if Charge is in motion it generate magnetic field.*

- *when charge change its velocity during motion then its electric field and magnetic field are vary (change).*

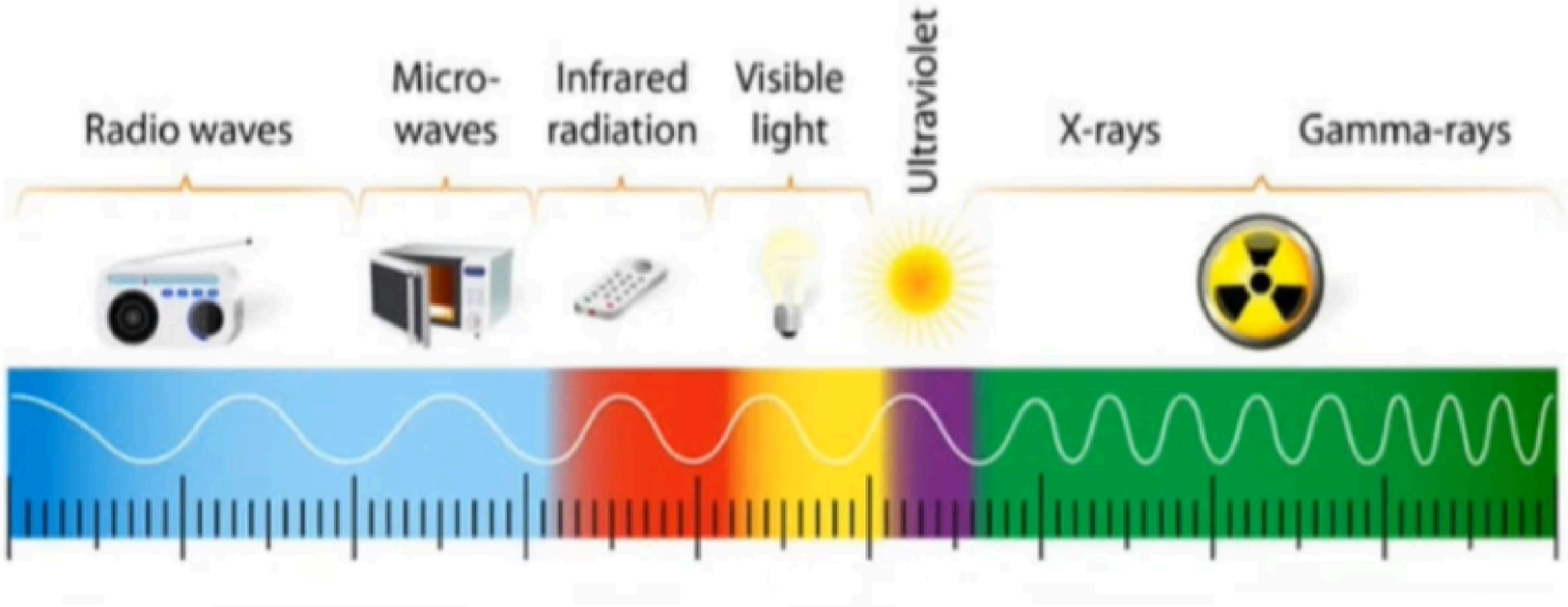
- *The combined variation in electric & magnetic field results in loss of energy, the charge radiate (emits) this energy in the wave form known as electromagnetic radiation.*



# Examples of EM Radiation :-

1. Gamma rays
2. X-rays
3. Ultraviolet rays
4. Visible light
5. Infrared rays
6. Micro-waves
6. Radio-waves

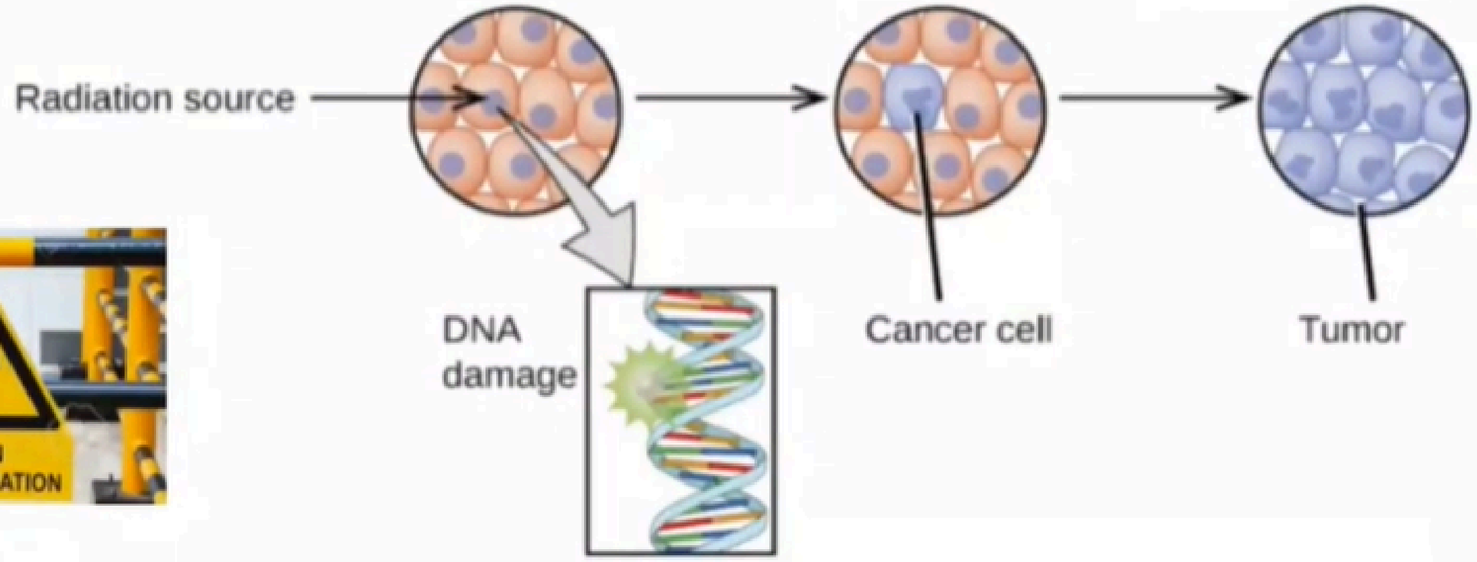


# Types of EM radiation

- *On the basis of ionizing property of EM radiation it is two type :-*

*1. Ionizing Radiation: - Cause ionization of atoms in the medium or matter.*
*- Therefore this radiation is responsible for biological effects ofradiation in living being.*

*Ex: Cosmic rays*
*Gamma rays*
*X-rays*
*UV-rays*

*2. Non-ionizing Radiation: - These radiations do not have sufficient energy to cause ionization.*

*- Hence this radiation does not cause biological effect of radiation in living beings*

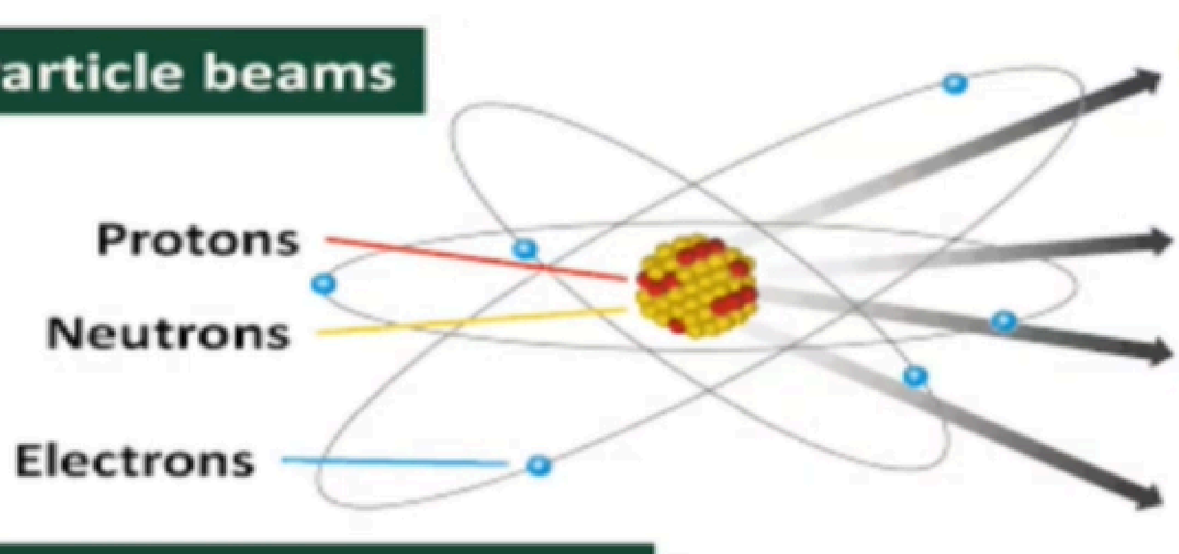
*Ex: Visible light*
*Infrared*
*Micro-waves*
*Radio-waves*

Radiation

# Types of Ionizing Radiation

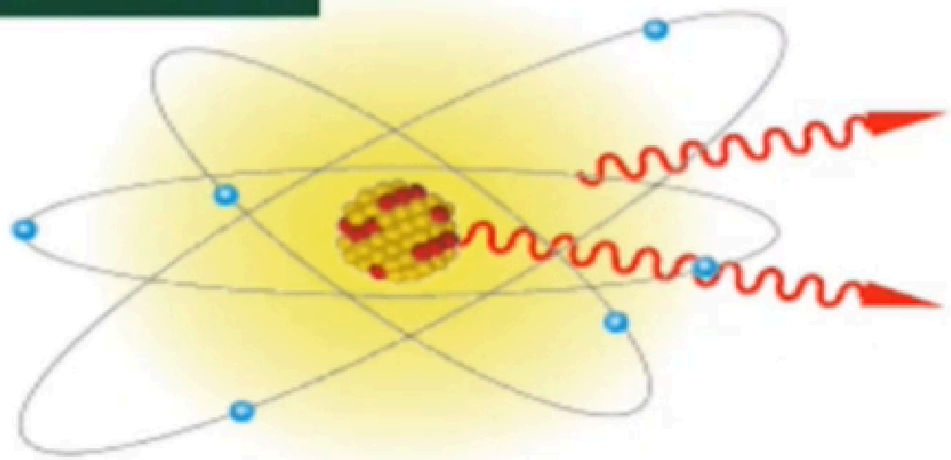
**Ionizing radiation** — Radiation that causes ionization

## Particle beams




- **α-particles** (helium nuclei ejected from a nucleus)
- **β-particles** (electrons ejected from a nucleus)
- **Neutron beams** (produced in nuclear reactors, accelerators, etc.)
- **Proton beams** (produced in accelerators, etc.)

## Electromagnetic waves



- **X-rays** (generated outside a nucleus)
- **γ-rays** (emitted from a nucleus)

# Electromagnetic Spectrum Of EM-Radiation

- *The EM spectrum of EM radiation is the range of all EM radiations in the terms of its wavelength and frequency.*

- *EM spectrum includes:-*
  1. *Gamma rays*
  2. *X-rays*
  3. *Ultraviolet rays*
  4. *Visible light*
  5. *Infrared rays*
  6. *Micro-waves*
  7. *Radio-waves*

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