

# Noise Pollution



# Noise Pollution

## Definition

- *“Noise is define as any undesirable human or machine created noise which disturbs the activity or balance of human or animal life”.*



# Terminology used in noise pollution

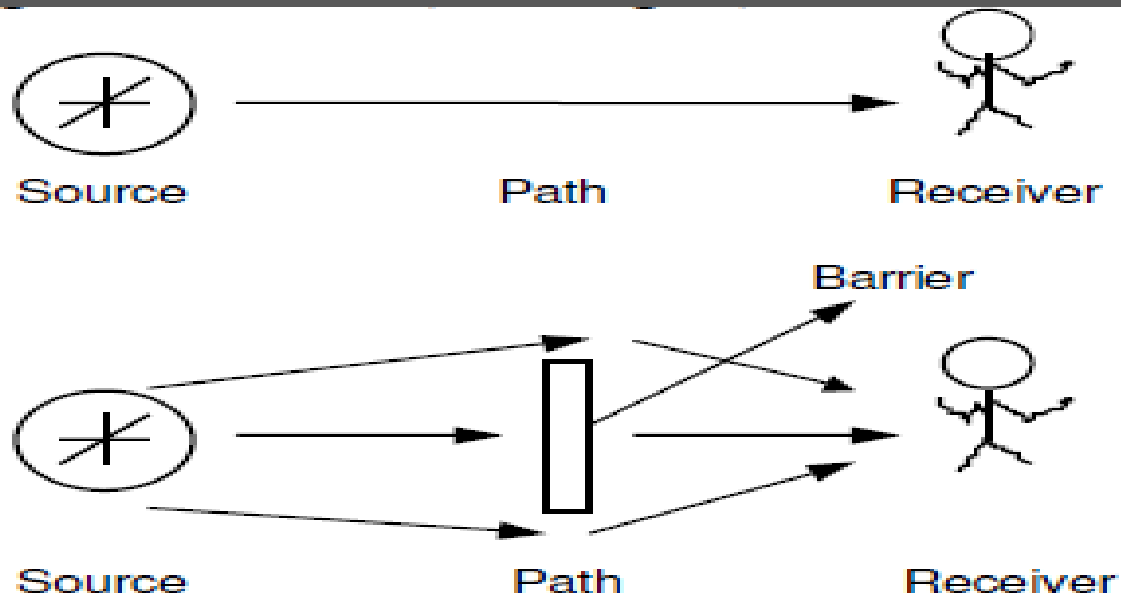
- **Frequency:** Frequency is the no of cycles repeated in unit time duration. Its unit is cycle/sec or Hz ( 1 Hz= 1 Cycle /sec)
- **Intensity:** Amount of sound energy received / sec is known as intensity of sound. Its Unit is decibel ( dB).

- **Decibel:** Decibel is define as the logarithm to the base 10 to ratio of two intensities
  - $L_t = 10 \log_{10} (I/I_0) \text{ dB}$
  - Where, I= Measured Intensity
  - $I_0$ = Reference Intensity
  - $L_t$ = Level of noise in dB



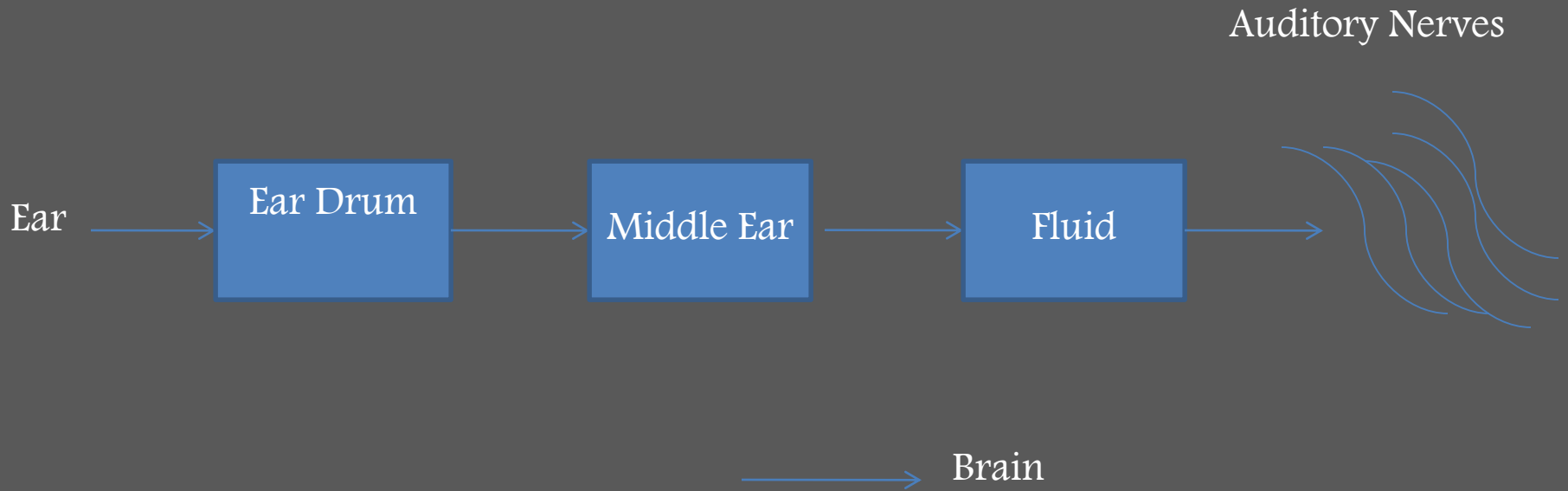
# What is Noise?

- In simple terms, noise is **unwanted sound**. Sound is a form of energy which is emitted by a vibrating body and on reaching the ear causes the sensation of hearing through nerves.
- Sounds produced by all vibrating bodies are not audible. The frequency limits of audibility are from 20 HZ to 20,000 HZ.
- A noise problem generally consists of three inter-related elements– the source, the receiver and the transmission path. This transmission path is usually the atmosphere through which the sound is propagated, but can include the structural materials of any building containing the receiver

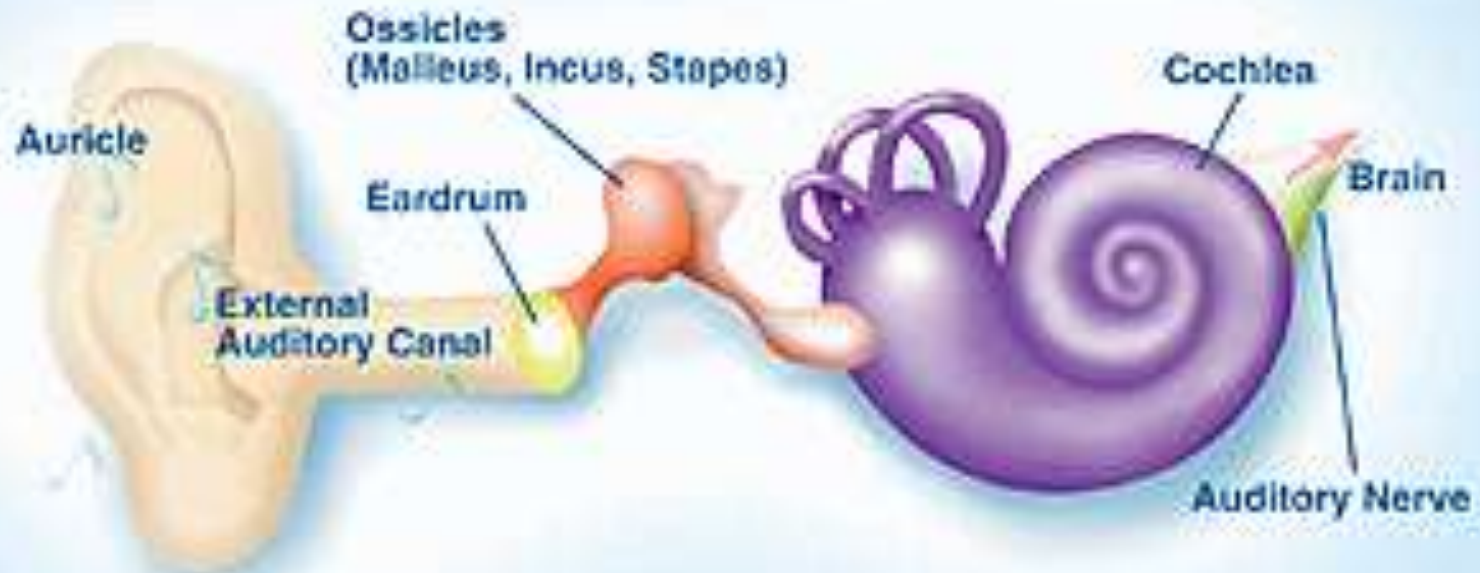


The Sound of Human Speech is mainly in the range of 300 to 3000 Hz

# Mechanism of Hearing



# Mechanism of Hearing



Sound    External ear    Middle ear    Inner ear    Auditory Brain nerve

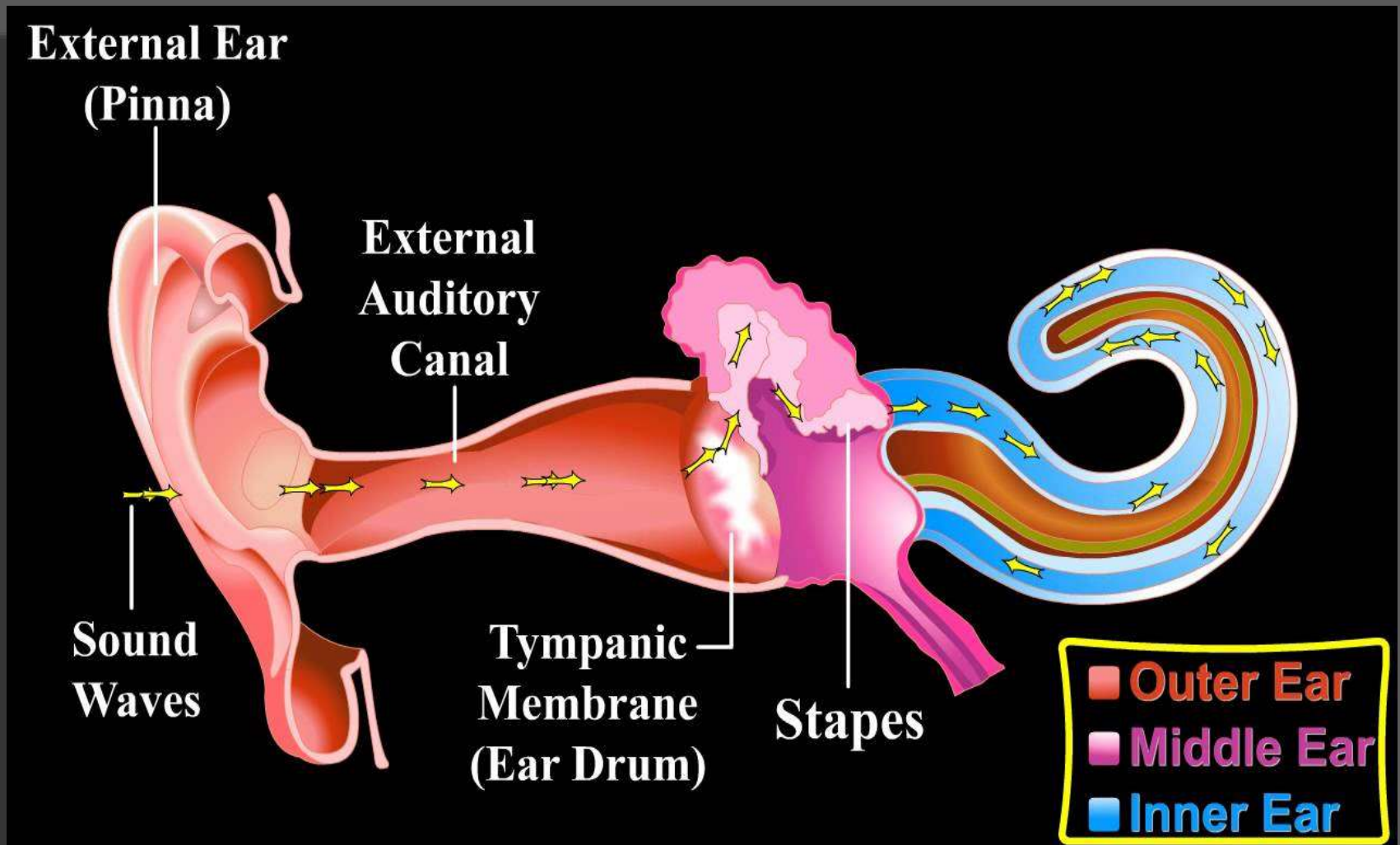
**Conductive hearing loss**

**Sensorineural hearing loss**

**Mixed hearing loss**



# Mechanism of Hearing



# Mechanism of Hearing

- The Science of Human hearing and sound is called human acoustics. Sound waves set vibration in the ear drum which is made up of membrane In the upper ear. The vibration in the Ear drum induces movement of three small soft bones in the middle ear behind the ear drum.
- The movement of the soft bones pass through viscous fluid in the inner ear creating oscillation of Fluid. These oscillation then reaches the auditory nerves and finally transmitted to the brain.
- The oscillation or sound are identified and interpreted in the brain, which has capacity to analyze sound into different frequency.
- Human detectable frequency range is 20 to 20000 Hz.
- Sensitivity of the Ear varies from person to person, with aging hearing power decreases. The ear is susceptible to damage if it receives high intensity noise.

# Measurement of Noise ( Sound)

- The Intensity of Sound is measured in terms of Sound pressure Level and common unit is decibel
- Decibel (dB) =  $10 \log_{10} (I/I_0)$
- Thus dB measures how much intense is the sound as compared to reference intensity
- The Sound pressure level ( SPL) in dB is Def<sup>n</sup> as
- $SPL = 20 \log_{10} (P/P_0)$
- Where,
- P= Measured pressure
- P<sub>0</sub>= reference pressure (  $2 \times 10^{-5} \text{ N/m}^2$ )

- Noise Level in Decibel is measured with an instrument called sound level meter. It consists of 3 internationally accepted weighing network
- The weighing networks are electronic filter circuits build into the meter to weaken certain frequency. They permit the sound level meter to respond more to some frequency than to others with prejudice something like human ears
- There are 3 weighing scales
- **A weighing scale**– Severely filters the frequency
- **B weighing scale**– Moderately filters the frequency
- **C weighing Scale**– Hardly filters frequency

# A weighing Scale (dB A)

- The sensitivity of human ears depends on the frequency or pitch of the sound. We hear some frequency better than others. e.g. If a person hears two sounds of same sound pressure but different intensity one sound may appear louder than the other. This happens when we hear high frequency much better than lower frequency noise.
- An A-weighting filter, adjusts the measured sound level to correspond to this peculiarity of human hearing. It filter out low frequency or pitches.

# Measurement of Noise ( Sound)



# Sources Of Noise

## Major Sources of Noise:

**Traffic Noise:** Automobile revolution in urban areas are proved to be a big source of noise pollution. Increase in traffic has given rise to traffic jams, where the repeated hooting of horns by drivers create noise pollution. Air crafts creates serious problems in big cities like Mumbai & Delhi

- Heavy truck, buses, trains, motorcycles, jeeps, other vehicles are responsible for traffic noise.



## Industrial And Construction Machinery Noise:-

- Factory equipments, generators, drills, road rollers, and similar machinery also make lot of noise.
- **Public address System:-** Public system contribute in its own ways towards noise pollution by using loud speakers for religious functions, birth, marriage, election for commercial advertising
- **Household:-** The household activities will contribute for indoor noise pollution domestic gadgets like pressure cookers, A.C, Vacuum cleaners, mixers, washing machines are major source of noise at house hold level. Entertainment equipments like radio, music system, T.V. Will contribute toward noise pollution





**Defense Exercises:-** Tanks, launching of rockets, explosion, military exercises, aero planes, shooting ranges are adding toward noise pollution.

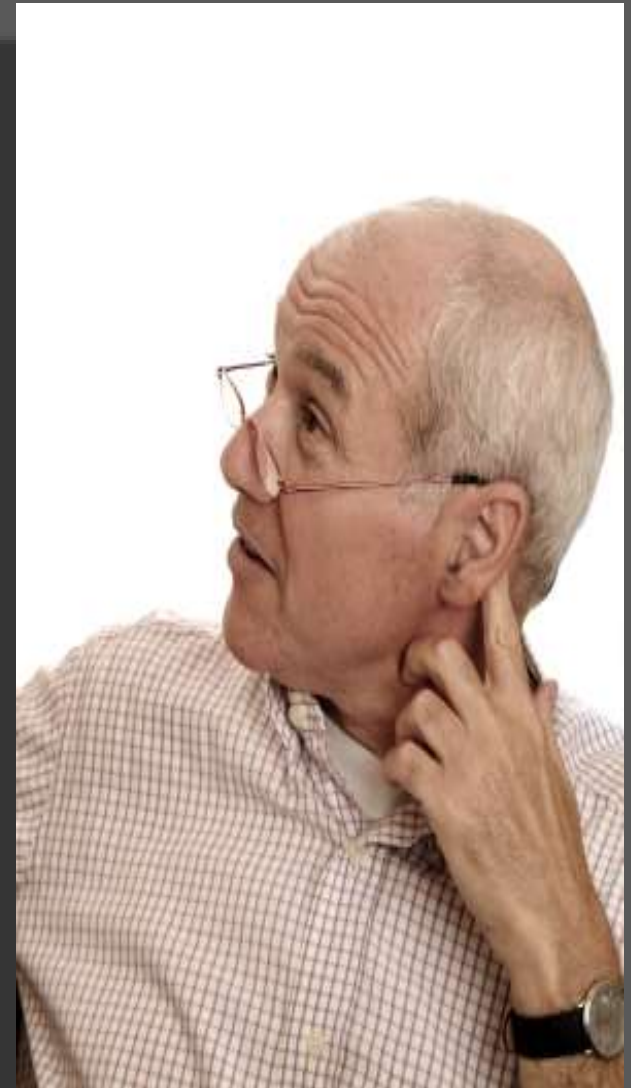


# Typical noise levels of some point sources

Source	Noise level dB(A)	Source	Noise level, dB(A)
Air compressors	95-104	Quiet garden	30
110 KVA diesel generator	95	Ticking clock	30
Lathe Machine	87	Computer rooms	55-60
Milling machine	112	Type institute	60
Oxy-acetylene cutting	96	Printing press	80
Pulveriser	92	Sports car	80-95
Riveting	95	Trains	96
Power operated portable saw	108	Trucks	90-100
Steam turbine (12,500 kW)	91	Car horns	90-105
Pneumatic Chiseling	118	Jet takeoff	120

# Effects of Noise pollution

- Noise can do Physiological and or / Psychological damage if the volume is high or if exposure is prolonged.
- Common effects of Noise pollution are:
- **Hearing Loss:** Loud noise damages fine hair cell in the ear. The vibration of these hair cells is responsible for hearing of Sound by us, Since our body cannot replace damaged hair cells. Permanent Hearing loss is caused by long term exposure to loud noise.



**Annoyance:** It creates annoyance to the receptor due to sound level fluctuations

### **Physiological effects:**

- The Physiological effects like breathing difficulty, rise in blood pressure, migraine, headaches, constriction of blood vessels and even heart attacks.

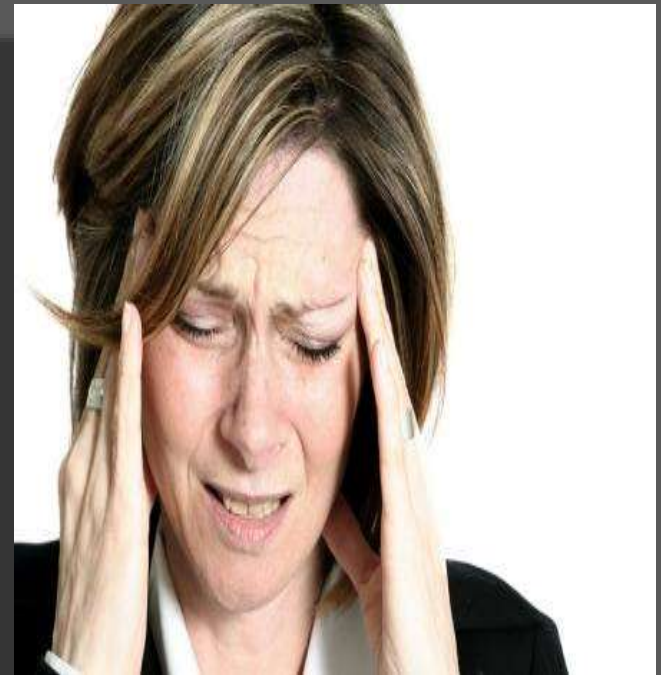


# Effects of Noise pollution

**Human performance:** The working of humans will be affected as they will lose their concentration

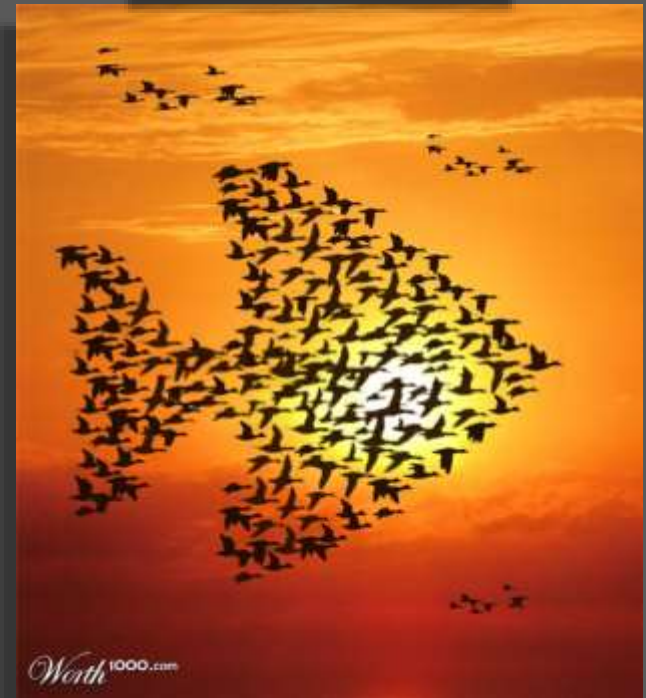
**Nervous System:** It causes pain ringing in ears, feeling of tiredness, thereby effecting functioning of human system

**Sleeplessness:** It affects the sleeping thereby inducing the people to become restless and loose concentration and presence of mind during their activities.



# Effects on animals

- Noise can cause serious damage to wild life. Ways in which animals are adversely affected by noise pollution includes.
- **Hearing loss**
- **Masking:** Masking is the inability to hear important environmental clues and animal signals
- **Physiological effects:** such as increase in heart rate, respiratory difficulties and stress.
- **Behavioral effects:**–Which could result in abandonment of territory and loss of ability to reproduce.
- **Ecological effects:** It leads to migration of birds which disturbs the ecosystem



## Effects on plants

- The production capacity or growth of plant is affected due to high level noise.

## Damage to material.

The building and material may get damage by exposure to infrasonic/ ultrasonic waves and even get collapsed.





# Control of Noise Pollution

- Noise is not only a nuisance but a serious environmental problem and a health hazard. Like all other pollution, noise pollution is needed to be controlled.
- Noise pollution can be effectively controlled by taking following measures.



# Control of Noise Pollution

## Control at receivers end

- For people working in noisy areas ear protection aids like ear plugs, muffs, noise helmets, head phones etc should be provided it reduces occupational exposure.

## Controlling at source

This is only possible if working method is improved.

Design new machines to replace noisy ones. Proper lubrication and better, maintenance of machines. Installing noisy machines with sound absorbing materials. Using Silencer to control noise from automobiles etc.

# Zoning

- Increased distance between source and receiver by zoning of noisy industrial areas like bus stand and railway stations away from silence zones near residential areas, educational institutions and hospitals.

# Sound Insulation

- A) Sound insulations can be done by constructing windows with more than one panes of glass and filling the gap with sound absorbing material.
- B) Acoustical tiles, perforated plywood can be fixed on wall, ceilings, floors to reduce noise.

# Control of Noise Pollution



# Control of Noise Pollution

## Planting of Trees

- Planting of trees and shrubs along roads, hospitals, educational institutions help in noise reduction to a considerable extent.

## Legislative measures

- Strict legislative measures need to be enforced to control the nuisance of noise pollution some of the measures are
  - A) Minimum use of loud speakers, near silence zones.
  - B) Banning Pressure horns in automobiles
  - C) Framing a separate noise pollution act.

# Planting of Trees



# Sound level for human response

Sr.No.	Sound Level (dB)	Source	Effects	
1	140	Jet Plane	Traumatic Injury	Painful
2	130	Maximum recorded rock music	Irreversible damage	
3	110	Riveter	Loss of hearing	Uncomfortable Loud
4	100	Press	Loss of hearing	
5	80	Truck	Damage begins after long term exposure	Very Loud
6	70	Vacuum cleaners	Damage begins after long term exposure	
7	60	A.C.		Moderately loud
8	50	Light traffic		
9	40	Average living room		Quite
10	30	Library soft whisper		
11	20	Studio		Very Quite
12	10	Rustling of leaves		
13	0	Threshold of hearing		Barely Audible

# Damage risk criteria for hearing loss (OSHA regulations)

Maximum allowable duration per day hours	Sound pressure level, dB (A)
8	90
6	92
4	95
3	97
2	100
1.5	102
1	105
0.75	107
0.5	110
0.25	115



# Indian Standards for ambient noise levels

Area	Noise Limits, Leq, dB (A)	
	Day Time <sup>2</sup>	Night Time <sup>3</sup>
Silence zone <sup>4</sup>	50	45
Residential area	55	45
Commercial area	65	55
Industrial area	75	65

1. Ministry of Environment and Forest (MOEF) Guidelines vide Environment (Protection) Act, 1986 third amendment rules, dated 26/12/89 (Ref. 6)
2. Day time from (600 hrs to 2100 hrs, IST)
3. Night time from (2100 hrs to 600 hrs IST)
4. Silence zone: Up to 100m around hospitals, educational institutions and courts. The zones are to be declared by competent authority. Use of vehicle horns, loud speakers and bursting of crackers shall be banned in these zones.

# Noise Pollution Standards

## CPCB Standards of Noise Levels

Rural	Sub Urban	Residential (Urban)	Urban (Residential & Business)	City	Industrial
25-35	30-40	35-45	40-50	45-50	50-60

Work hard  
in silence  
let success  
make the noise