# PURE TONE AUDIOMETRY

## TUNING FORK TESTS

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# PURE TONE AUDIOMETRY

Pure tone audiometry: measures your ability to hear sounds that reach the inner ear through the ear canal (**AC**) or through bone (**BC**).

**Requirements:**

- ❑Sound proof room.
- ❑Pure tone audiometer.
- ❑Audiograph paper.

# Terminology

- **Air conduction**: Sound is given to the external ear. It measures sensitivity of the entire hearing mechanism: external, middle and the sensory neural mechanism of the cochlea and auditory nerve
- **Bone Conduction**: Sound is transmitted through the bone. By oscillating the skull the cochlea, which is embedded in the skull is stimulated, bypassing the outer and middle ear.

It measures the sensitivity of the sensorineural mechanism

- **Conductive hearing loss**: Impaired sound transmission to the inner ear.
- The ability to hear air-conducted sound is decreased or lost.
- It doesn't affect the ability to hear bone conducted sounds that do not pass through the outer or middle ear.
- **Sensorineural hearing loss**: Occurs when there is damage to the inner ear (cochlea) or to the nerve pathways from the inner ear to the brain.
- Cannot hear better by either conduction route
- **Mixed hearing loss**: conductive & sensorineural.

# Pure tone audiometer

Is the instrument used by audiologists to measure hearing thresholds.

Threshold = the minimum level at which a signal can be detected

# Components of audiometer

- **Frequency selector dial**: selection of different pure-tone frequencies.

  Range 125 to 8000Hz
- **Hearing level dial**: Controls the intensity of the signal

  100dB range in 5dB steps
- **Presentation button**: presents tone to the listener
- **Output selector**: AC /BC

- **Electronic vibrator** for testing bone conduction from the mastoid process to the cochlea.
- **Masking level dial**: controls the intensity of the masking noise presented to the non test ear.

## Calibration:

**Zero intensity (0dB) level of sound at each frequency is the loudness that can be bearly heard by the normal person.**

# Audiograph paper:

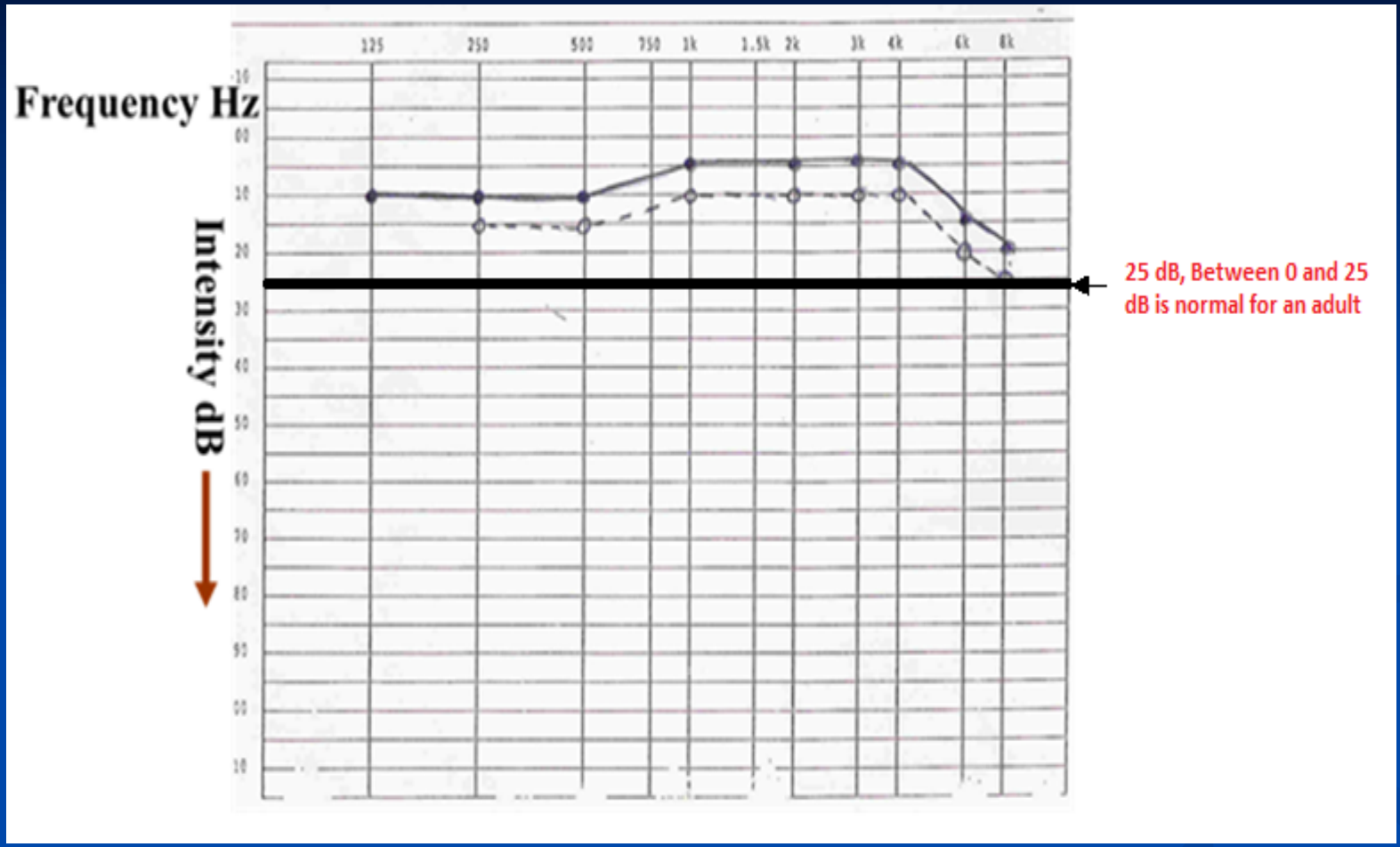
The graph is designed so that:

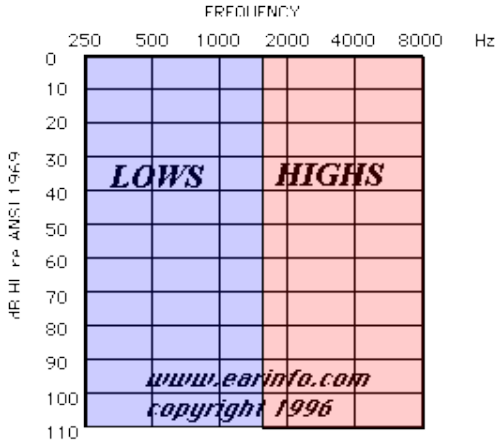
- **x axis**: Frequencies

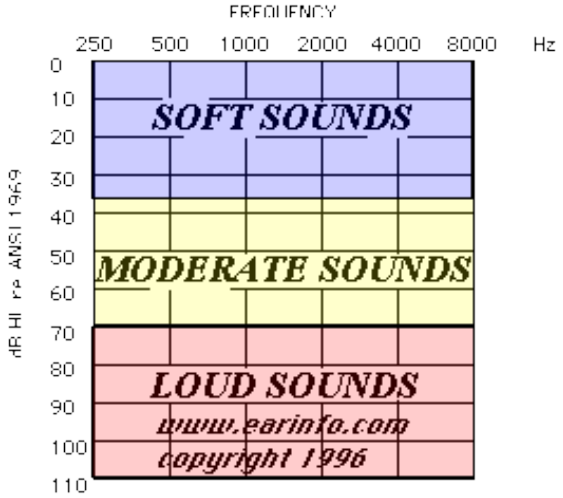
  With 125 Hz near left and 8000Hz near right

- **y axis**: Hearing level (intensity) in dB

  With 0 dB near the top and 110 dB near the bottom.


Frequency Hz
Intensity dB
125
250
500
750
1k
1.5k
2k
3k
4k
6k
8k
25 dB, Between 0 and 25 dB is normal for an adult


FREQUENCY
250 500 1000 2000 4000 8000 Hz
0 10 20 30 40 50 60 70 80 90 100 110
dB HL re ANSI 1969
LOWS
HIGHS
www.earinfo.com
copyright 1996


FREQUENCY
250 500 1000 2000 4000 8000 Hz
0 10 20 30 40 50 60 70 80 90 100 110
dB HL re ANSI 1969
SOFT SOUNDS
MODERATE SOUNDS
LOUD SOUNDS
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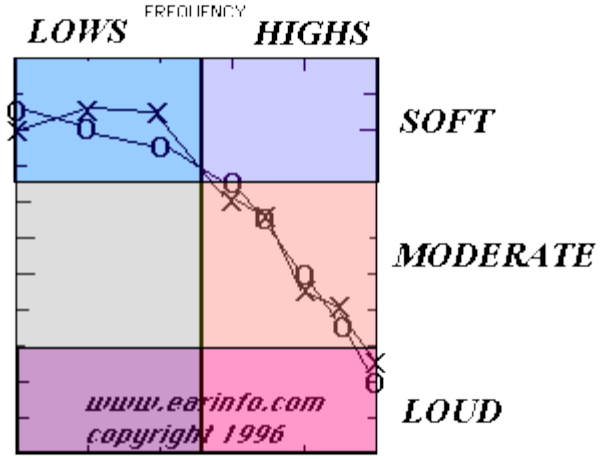
FREQUENCY
LOWS
HIGHS
SOFT
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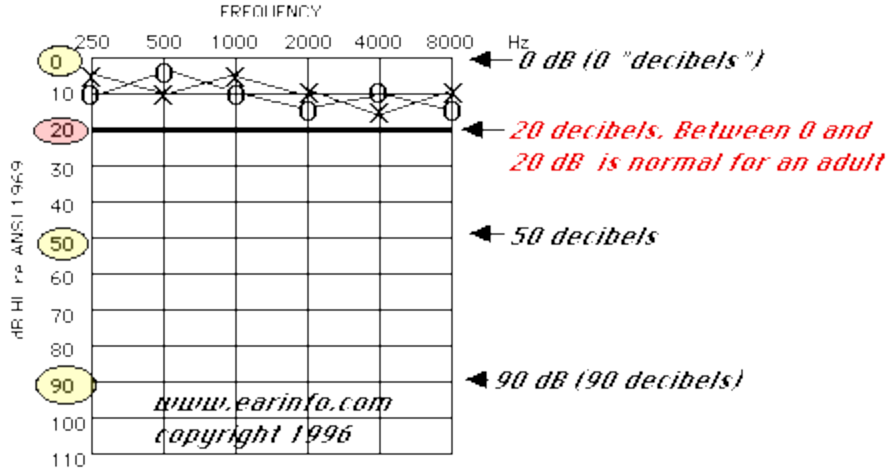

FREQUENCY
250 500 1000 2000 4000 8000 Hz
0 10 20 30 40 50 60 70 80 90 100 110
dB HL re ANSI 1969
0 dB (0 "decibels")
20 decibels. Between 0 and 20 dB is normal for an adult
50 decibels
90 dB (90 decibels)
www.earinfo.com
copyright 1996

The decibel is the unit used to express magnitude of hearing loss

- The horizontal line at 0 dB hearing level (Hl) represents Nl hearing sensitivity for the average young adult.

- The amount of hearing loss: on the vertical axis.

# Prodcedure

1. Patient comfortably seated in a sound proof room, earphones on;

   **Red** → Right ear

   **Blue**→ Left ear

2. Select the test ear (start by the better ear)

3. Deliver masking noise to the other ear

4. Pure tones are delivered: Start with a frequency of 125Hz. & 0 dB.
5. Gradually increase the dB. till person hears the sound & responds: (Ask him to raise a finger as soon as the very least sound is heard)

# Prodcedure (continued)

6. Mark the threshold intensity on the chart.

   O →Right  X →Left

8. Repeat the procedure for frequencies 250Hz to 8000Hz

9. Join the threshold points from 125Hz to 8000Hz (AC audiogram)

12. Switch to the opposite ear and repeat the procedure.

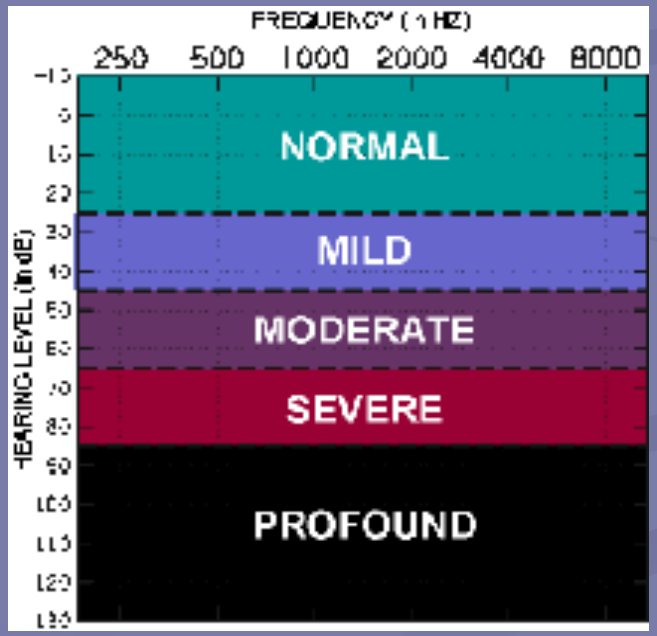
# Placement of the bone vibrator

- Place the vibrator over the mastoid process
- Switch from AC to BC
- Follow the same procedure as for AC
- Use different colors or signs for BC audiogram

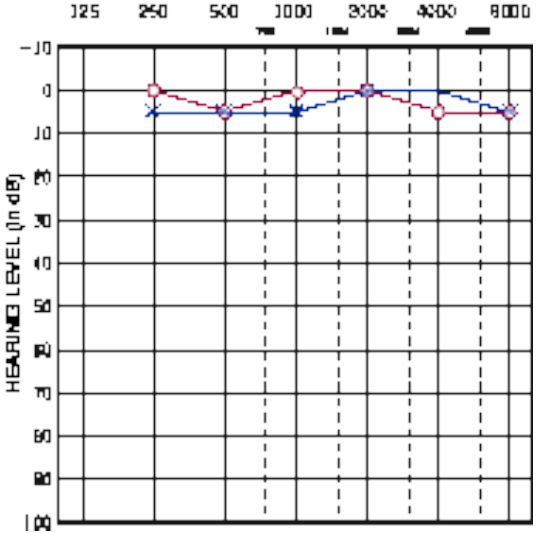
R ear [ L ear ]

# Audiogram Interpretation

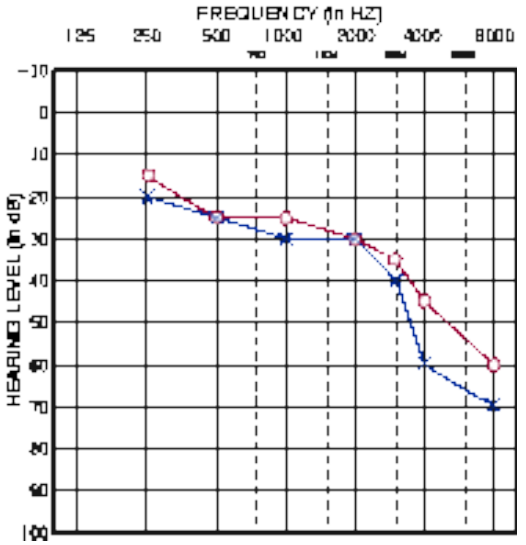
- Degree of hearing impairment in each ear.
- Deafness: Hearing loss of any degree from a slight loss to a total inability to hear a sound.
- Hearing thresholds better than a hearing level of 25dB HL are considered Nl.



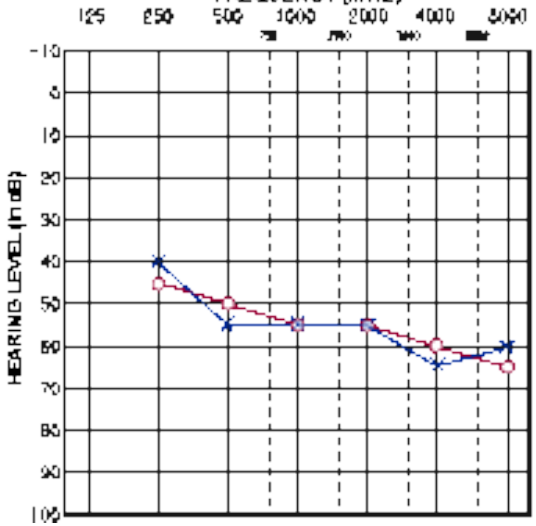
## NORMAL HEARING



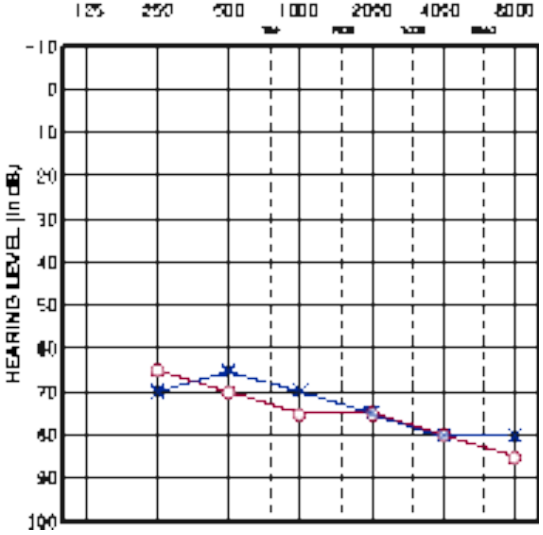

## MILD HEARING LOSS




## MODERATE HEARING LOSS




## SEVERE HEARING LOSS



# Type of impairment

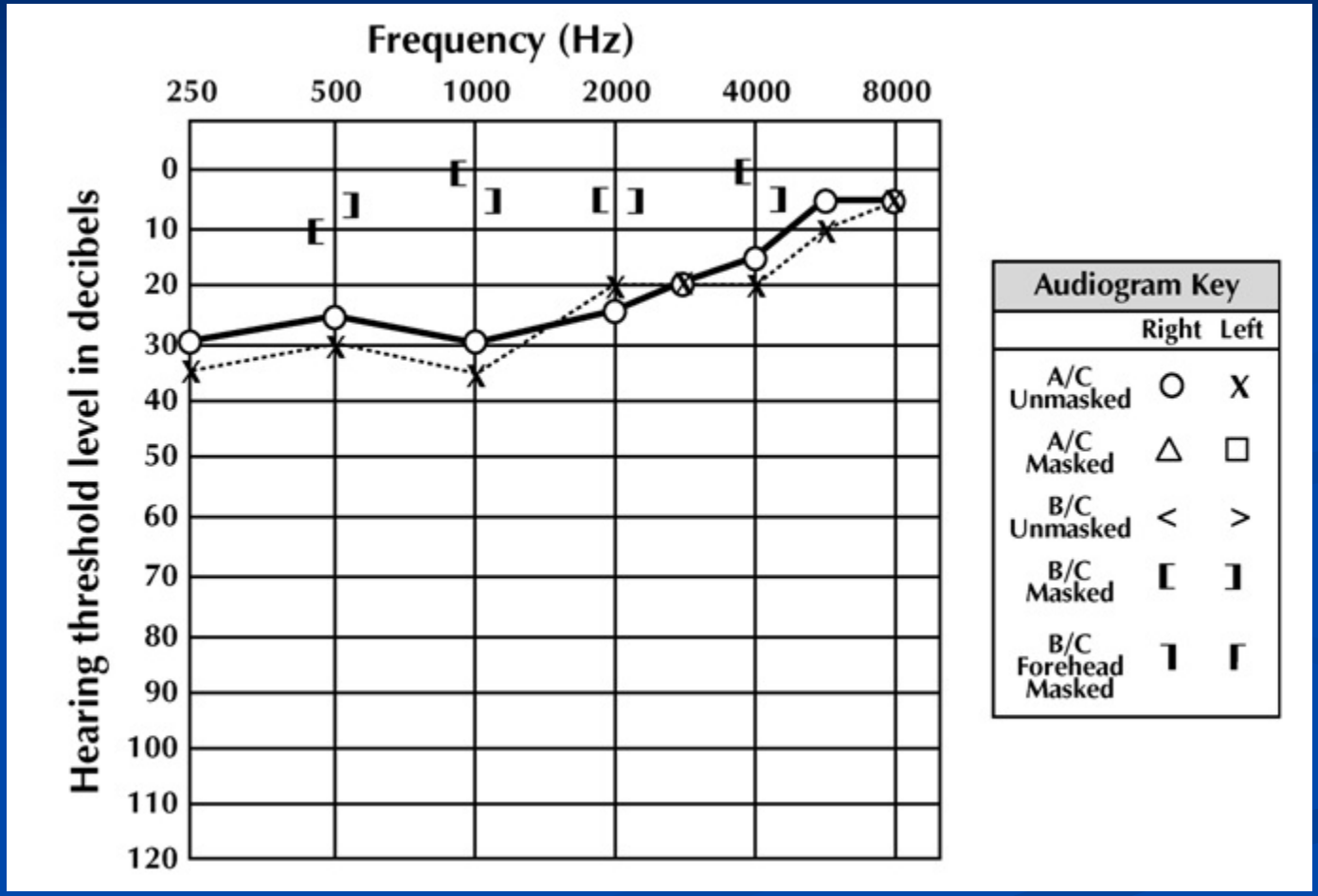
- **Conductive hearing loss**
  - AC: Decrease in hearing sensitivity and
  - BC: Nl sensitivity
  - Or if Air-bone gap ≥10dB

**Causes: Obstruction or blockage of the outer or middle ear.**

Eg:

- Otitis media
- Congenital atresia
- Cerumen
- Perforation of tympanic mb
- Otosclerosis

# Conductive deafness



# Sensorineural hearing loss

- **AC and BC thresholds are both decreased in sensivity & are approximately the same (±10dB) at all frequencies.**

**Causes:** Damage to cochlea, auditory nerve, auditory cortex

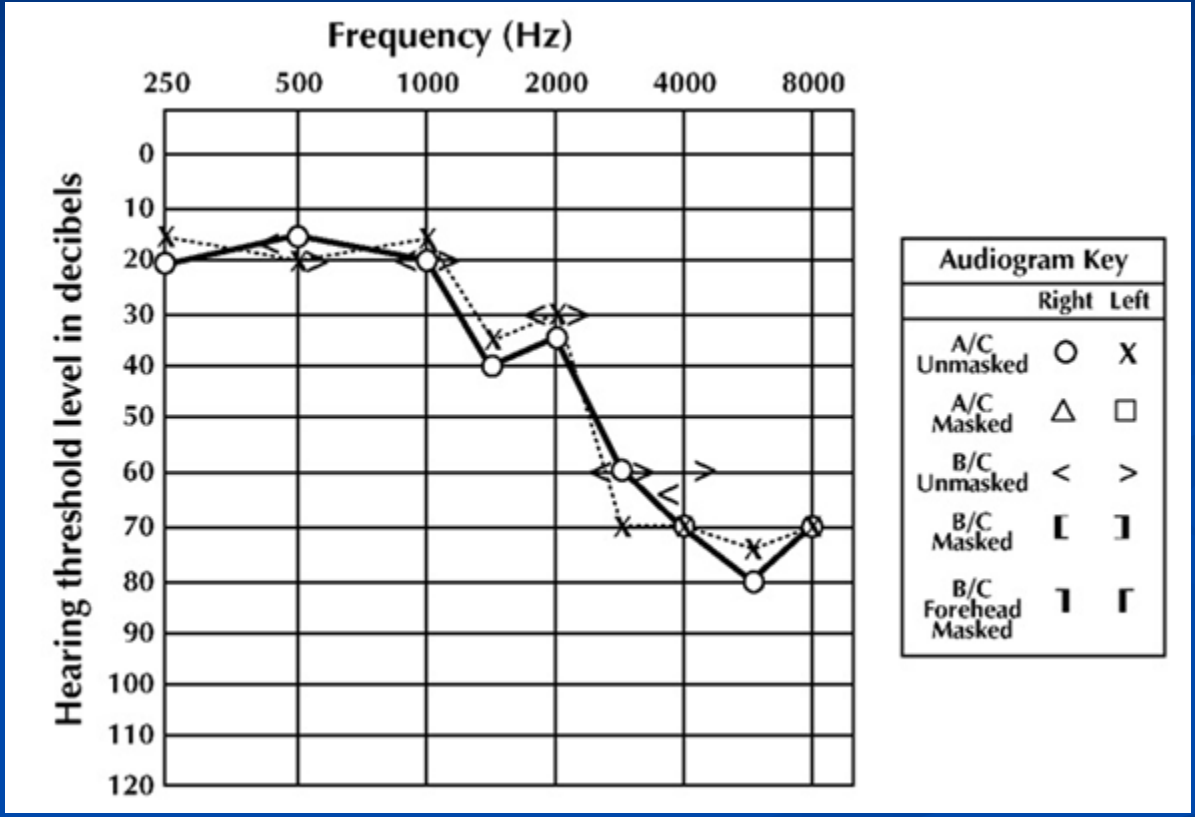
Eg:**Congenital**:

- Heredity
- Complication of maternal infection
- Birth trauma

## Acquired:

- **Noise**:Low frequency sounds
- **Aging**: For high frequency sounds (sloping audiogram): presbyacousis
- **Ototoxic drugs**: For all frequencies
- **Inflammatory disease**: measles, mumps.

# Sensorineural deafness



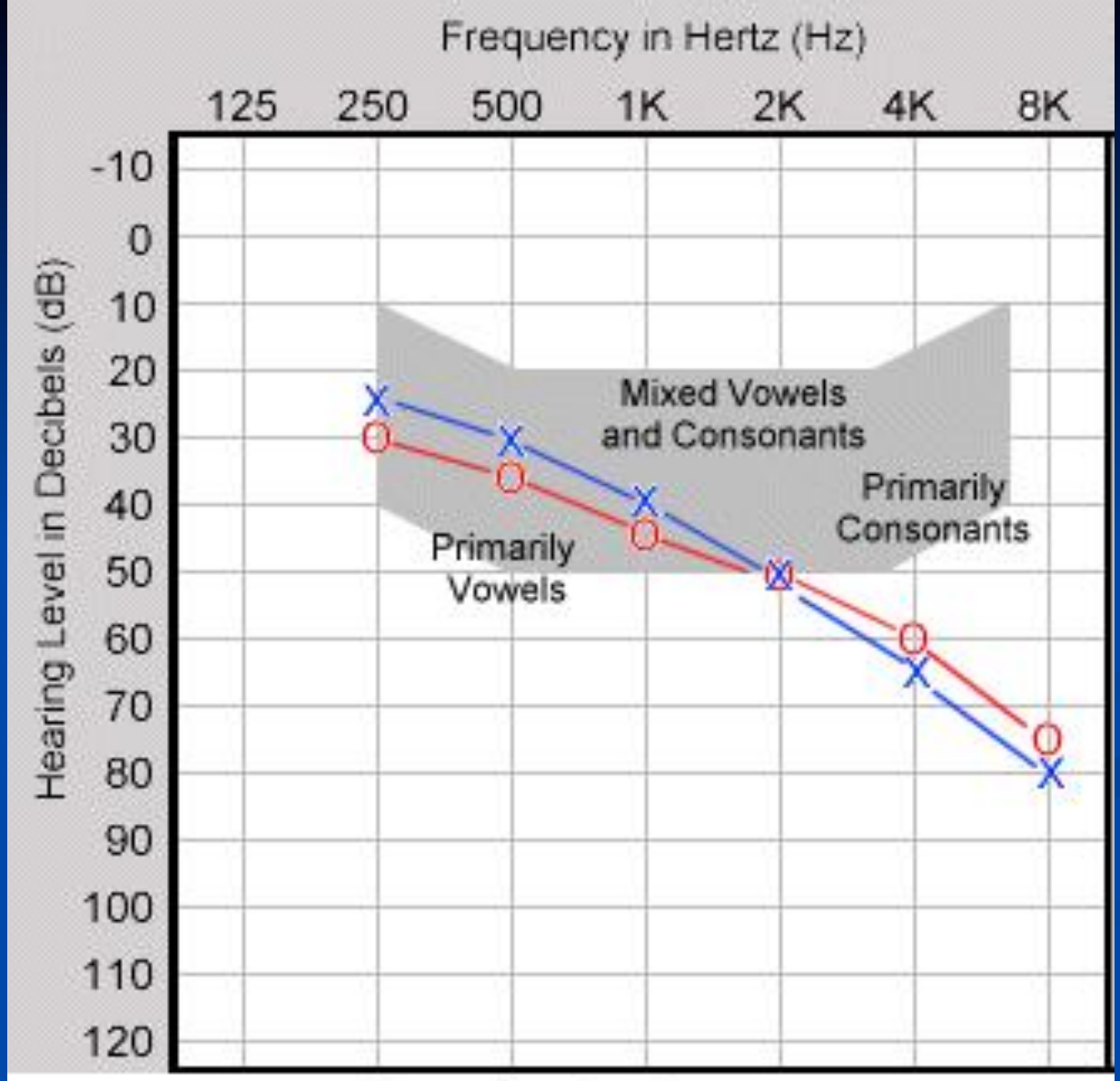



Figure One Audiogram
The "Speech Banana"

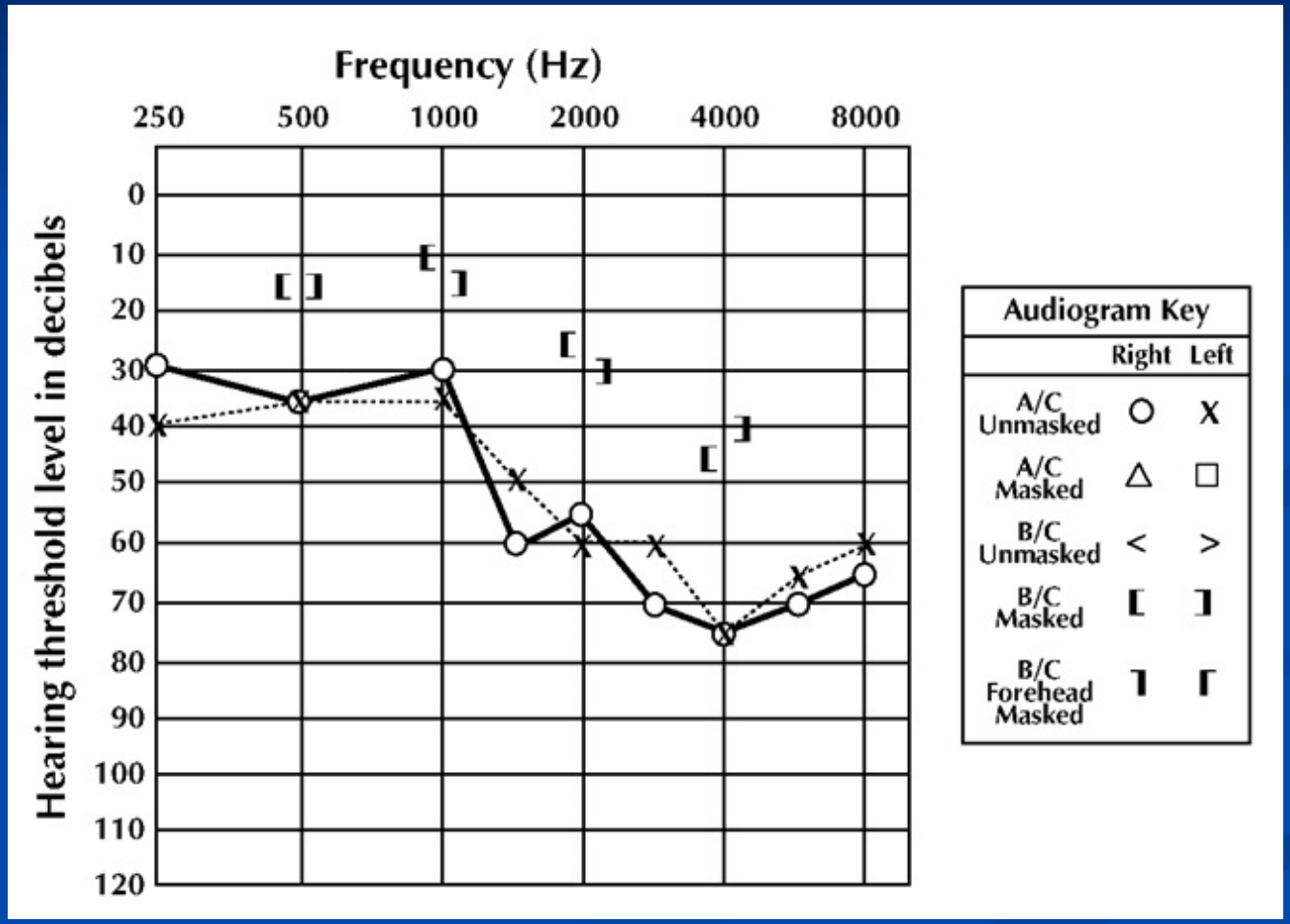
A fairly typical audiometric pattern for older people

# Mixed hearing loss

- Both AC thresholds and BC thresholds are reduced in sensitivity, but BC yields better results than AC

- The patient's HL is partially conductive, partially sensorineural

# Mixed hearing loss



| | | |
|---|---|---|
| Conductive HL | BC Nl | AC ↓ |
| Sensorineural HL | BC ↓ | AC ↓ but no AB gap |
| Mixed HL | BC ↓ | AC ↓ but BC> AC |

# WEBER TEST

- **Distinguishes between conductive and sensorineural hearing.**
- **Checks for lateralization in unilateral hearing loss.**

1) Strike a 512 Hz tuning fork softly
2) Place the vibrating fork on the middle of the client's head
3) Ask client if the sound is heard better in one ear or the same in both ears

A) If hearing is normal, the sound is symmetrical with no lateralization.

B) Sound localizes toward the poor ear with a conductive loss

C) Sound localizes toward the good ear with a sensorineural hearing loss.

# RINNE TEST

**Compares air and bone conduction hearing for the same ear.**

1) Strike a 512 Hz tuning fork softly.
2) Place the vibrating tuning fork on the base of the mastoid bone.
3) Ask client to tell you when the sound is no longer heard.
4) Note the time interval and immediatly move the tuning fork to the auditory meatus.
5) Ask the client to tell you when the sound is no longer heard..



A. Normal hearing clients will note air conduction twice as long as bone conduction (AC>BC)

C. With conductive hearing loss, bone conduction sound is heard longer than or equally as long as air conduction (BC>AC)

E. With sensorineural hearing loss, air conduction is heard longer than bone conduction in affected ear, but less than 2:1 ratio (AC>BC)

# THANK YOU