NS II
Lab II
Auditory Functions Tests

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Physics of Sound

- The waves travel through air at a speed of approximately 344 m/s at
- **1) Pitch or Frequency:**
- . Number of waves per unit of time
- . It is measured in cycle/sec or Hertz or Hz.
- . Normally the human ear can hear sounds from 20-20.0000Hz
- . The maximal sensitivity of the ear is between 1000-3000 Hz.

Sound intensity

- **Amplitude**
- . The amplitude of a sound wave is a measure of intensity or
- energy of pressure fluctuations.
- . Amplitude can be measured as the absolute energy passing through an area of one cm2 (dyne /cm2).
- In audiology is measured as bells units .
- Intensity of given sound in bells = Log (Intensity of sound /Intensity of standard sound)
- . The standard sound equals 0.000204 × dyne/cm2. Thus. a value of 0 decibels does not mean the absence of sound but a sound level of an intensity equal to that of the standard.
- . A decibel (dB) is 0.1 bel.

Hearing loss

- Conductive (involves outer or middle ear)
- Sensorineural (involves inner ear)
- Mixed (combination of the two)

Causes of sensory neuronal deafness

- **Aging. Degeneration of inner ear structures occurs over time. (presbycusis)**
- **Loud noise. Exposure to loud sounds can damage the cells of your inner ear.**
- **Heredity.**
- **Occupational noises. ...**
- **Meningitis**
- **Head trauma.**
- **Virus or disease.**
- **Malformation of the inner ear.**
- **Ménière's disease**
- **Tumors of Brain e.g. acoustic neuroma**
- **Neurological disorders e.g. meningitis, and stroke**
- **Antibiotics: streptomycin, and neomycin.**
- **Labyrinthitis**

- **Presbycusis,** the gradual hearing loss associated with aging, affects more than one-third of those over age 75 and is probably due to gradual cumulative loss of hair cells and neurons.

Common causes of conduction deafness

- **1.Otitis media and externa**
- **2. Earwax**
- **3.Tympanic membrane perforation**
- **4.Otosclerosis of bony ossicles**

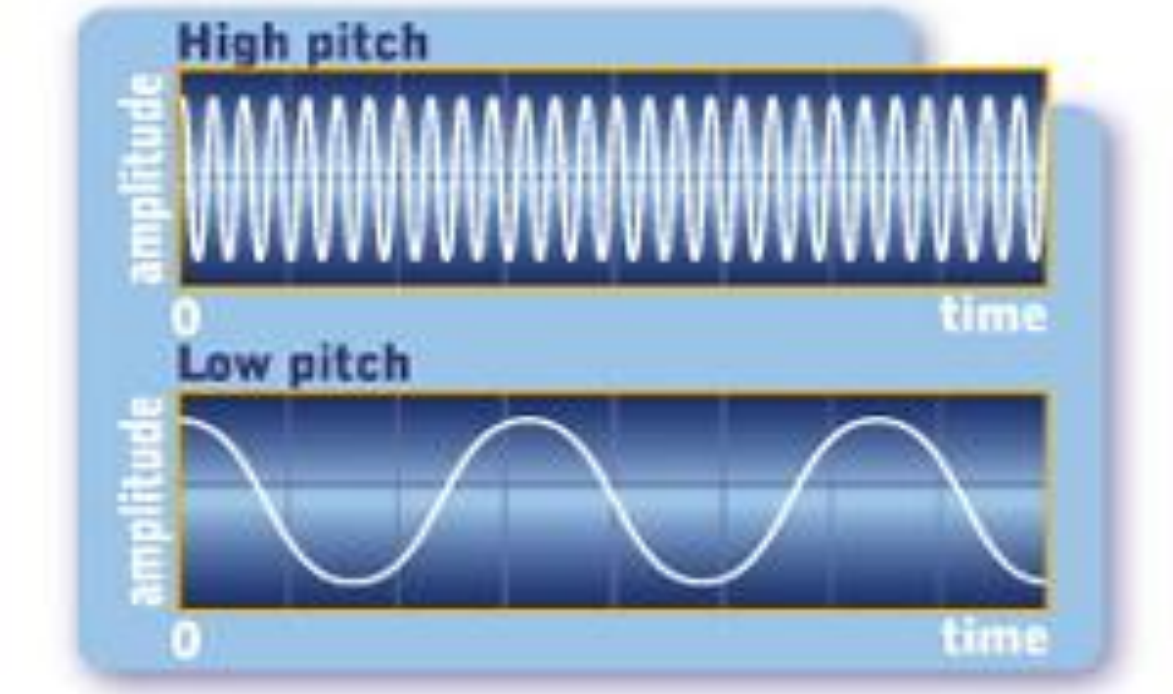
Hearing Tests

- Tuning fork test
  - Weber
  - Rinne
- Pure tune audiometry

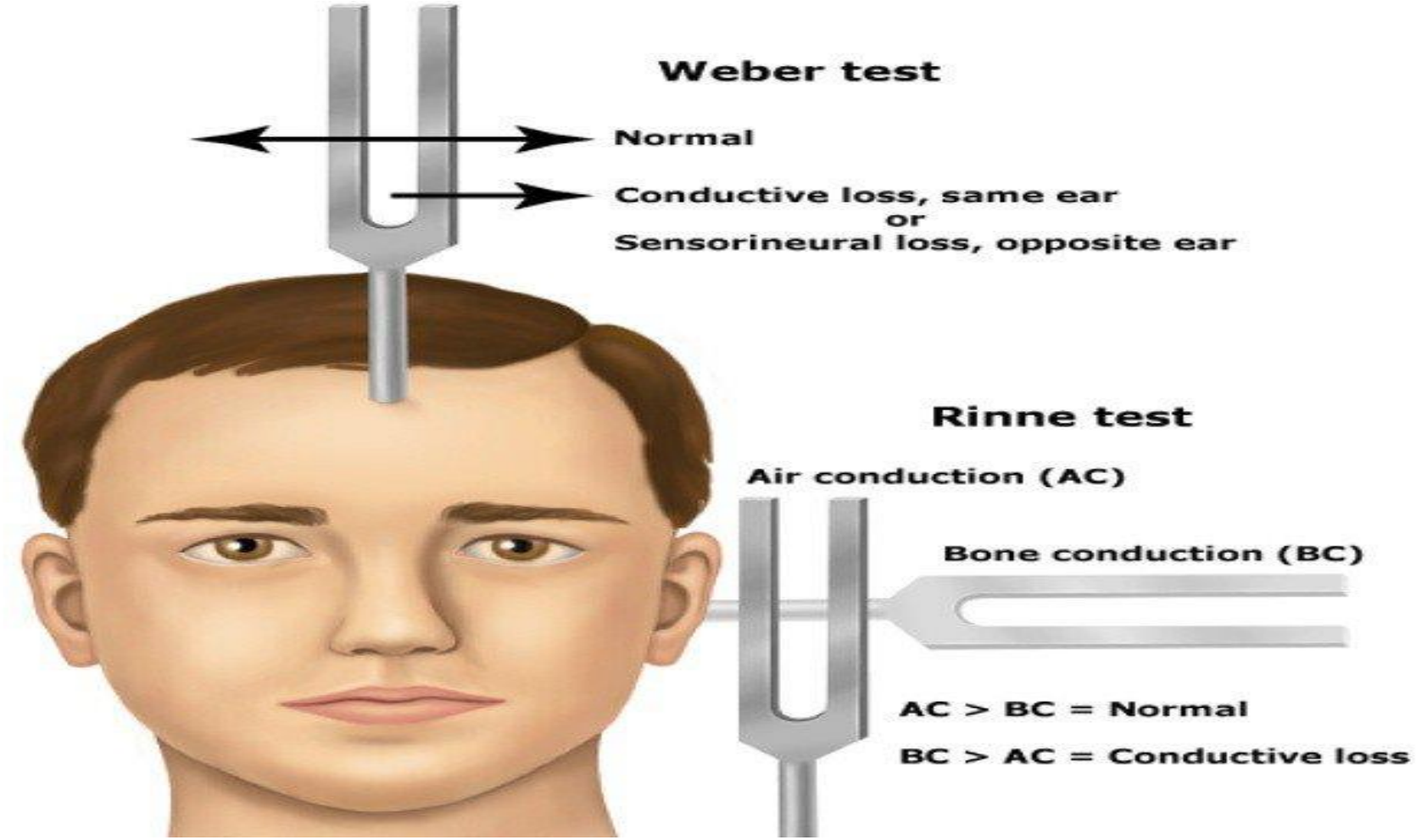
Auditory testing

- Air conduction testing
- This test assesses sensitivity when the signal is transmitted through the outer, middle, and inner ear and then through the brain to the cortex. Testing may be performed using headphones, insert earphones.
- Bone conduction testing
- This technique assesses sensitivity when the signal is transmitted through the bones of the skull to the cochlea and then through the auditory pathways of the brain. This type of testing bypasses the outer and middle ear
- Masking presents a constant noise to the non-test ear to prevent crossover from the test ear. The purpose of masking is to prevent the non-test ear from detecting the signal (line busy), so only the test ear can respond. asking

- A **pure tone** is a single frequency tone with no harmonic content (no overtones). corresponds to a sine wave



Tuning fork tests



Rinne’s Test

Technique

- **Principle:** test bone and air conduction on the same ear
- **Equipment:** Tunning Fork 512 Hz
- **Procedure :** Strike the fork against hard object and place it on mastoid process (bone conduction) until subject no longer hears it, then held in air next to ear (air conduction
    - First: Bone Conduction
        - Vibrating Tuning Fork held on Mastoid
        - Patient covers opposite ear with hand
        - Patient signals when sound ceases
        - Move the vibrating tuning fork over the ear canal . Near, but not touching the ear

Rinne’s Test

Next: Air Conduction :

Patient indicates when the sound ceases

Normal: Air Conduction is better than Bone Conduction

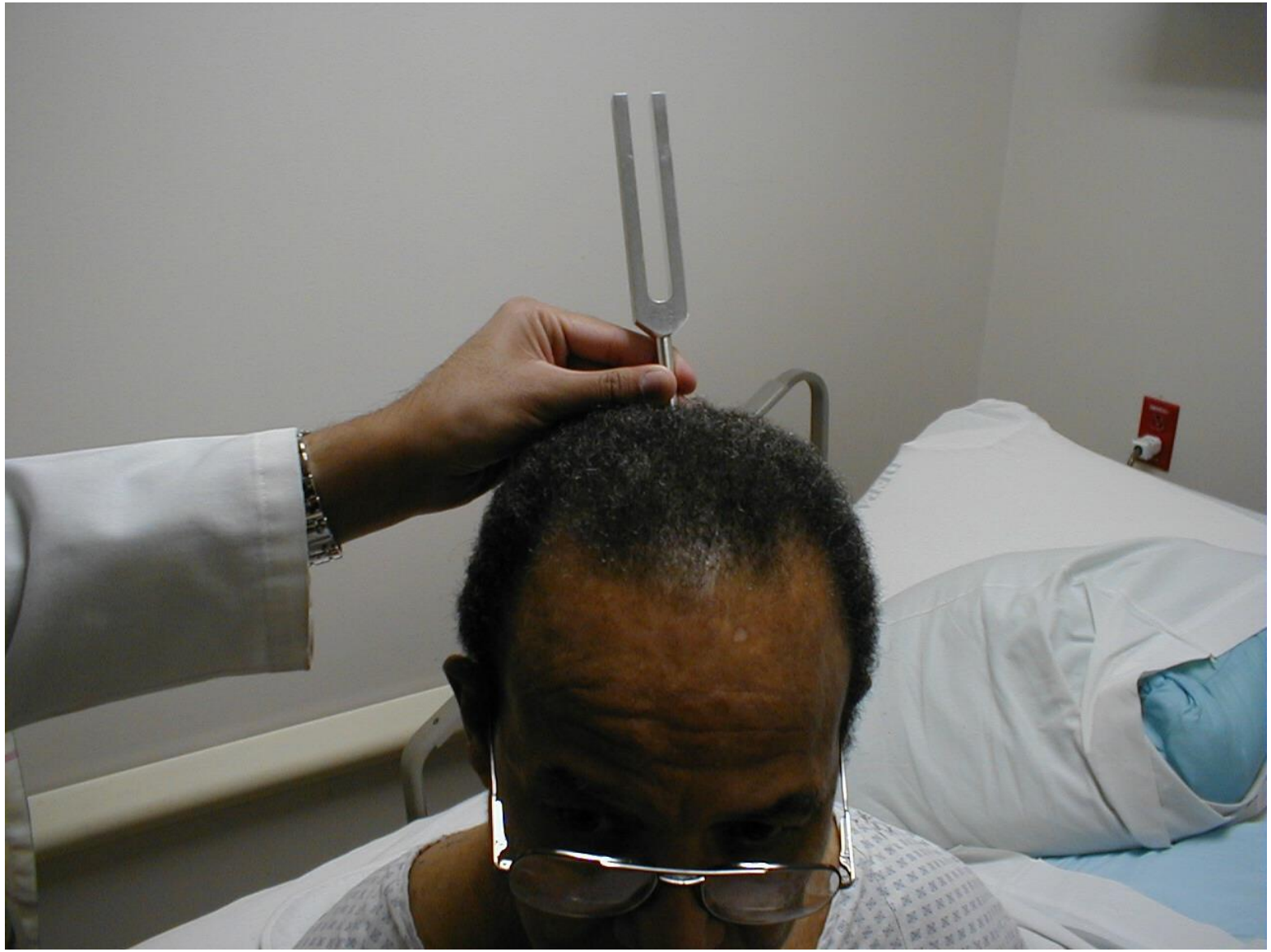
- Air conduction usually persists twice as long as bone
- Referred to as "positive test"

- Abnormal: Bone conduction better than air conduction
  - Suggests Conductive Hearing Loss.
  - Referred to as "negative test"

Weber Test

- **Principle:** test bone conduction on both ears at same time
- **Equipment:** Tunning Fork 512 Hz
- **Procedure :** Strike the fork against hard object and place it on the middle of forehead
- **Results:**
- **a. Normal person →** hears equally on both sides.
- Lateralization in deafness
- **b. Conduction deafness (one ear)** → Sound louder in diseased ear because masking effect of environmental noise is absent on diseased side

  c. Nerve deafness (one ear) →Sound louder in normal ear



Pure tone Audiometry

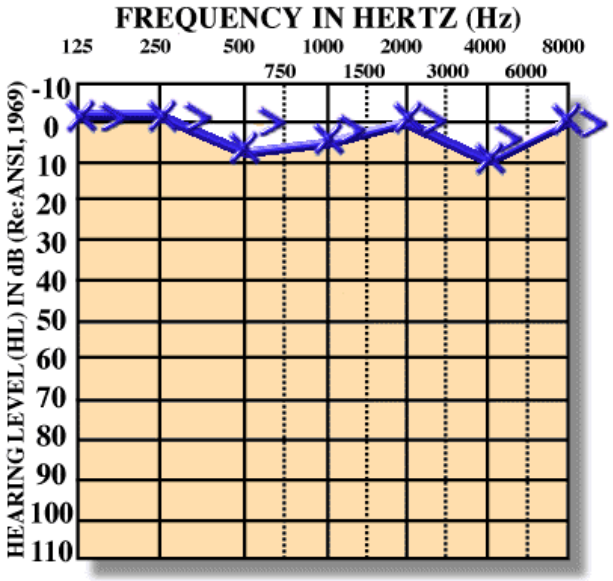
- In a sound proof room person is seated comfortably.
- Ear phones are applied which are color coded. (Red for right ear, Blue for left ear.)
- Masking sound is delivered to the non-test ear.
- Start with a frequency of 125Hz. & 0 dB.
- Gradually increase the dB. till person hears the sound & respond.
- Mark the threshold intensity on the audiogram paper.

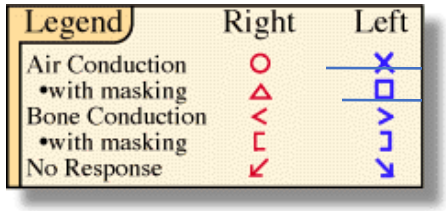
Pure Tone Audiogram (PTA)

- **. Auditory acuity is commonly measured with an audiometer.**
- **. This device presents the subject with pure tones of various frequencies through earphones.**
- **. At each frequency, the threshold intensity is determined and plotted on a graph as a percentage of normal hearing.**
- **.This provides an objective measurement of the magnitude of hearing loss at different frequencies**


650A
AMBCO
TONE

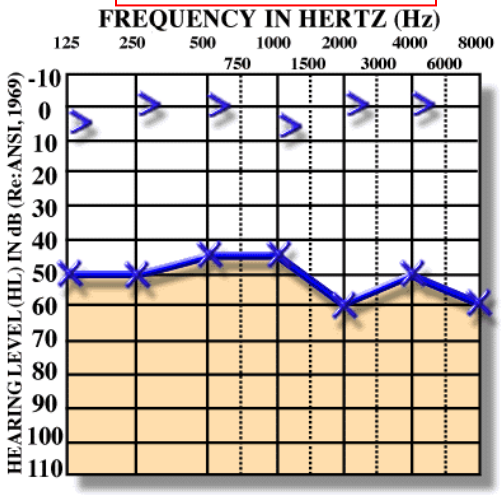
Plotting Results on an Audiogram

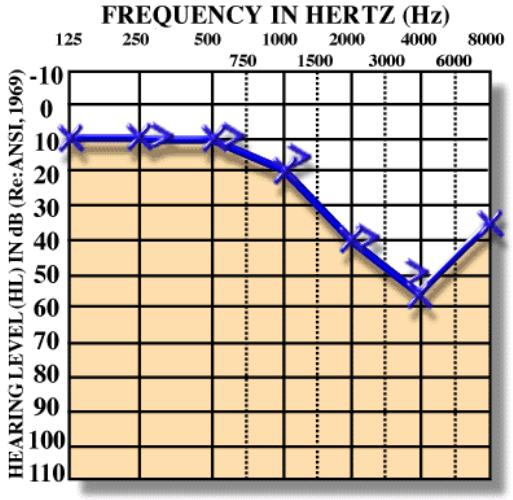




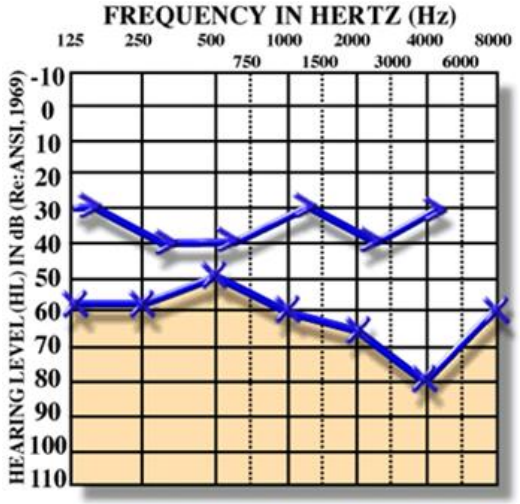
White area is inaudible
Tan area is audible

Conductive



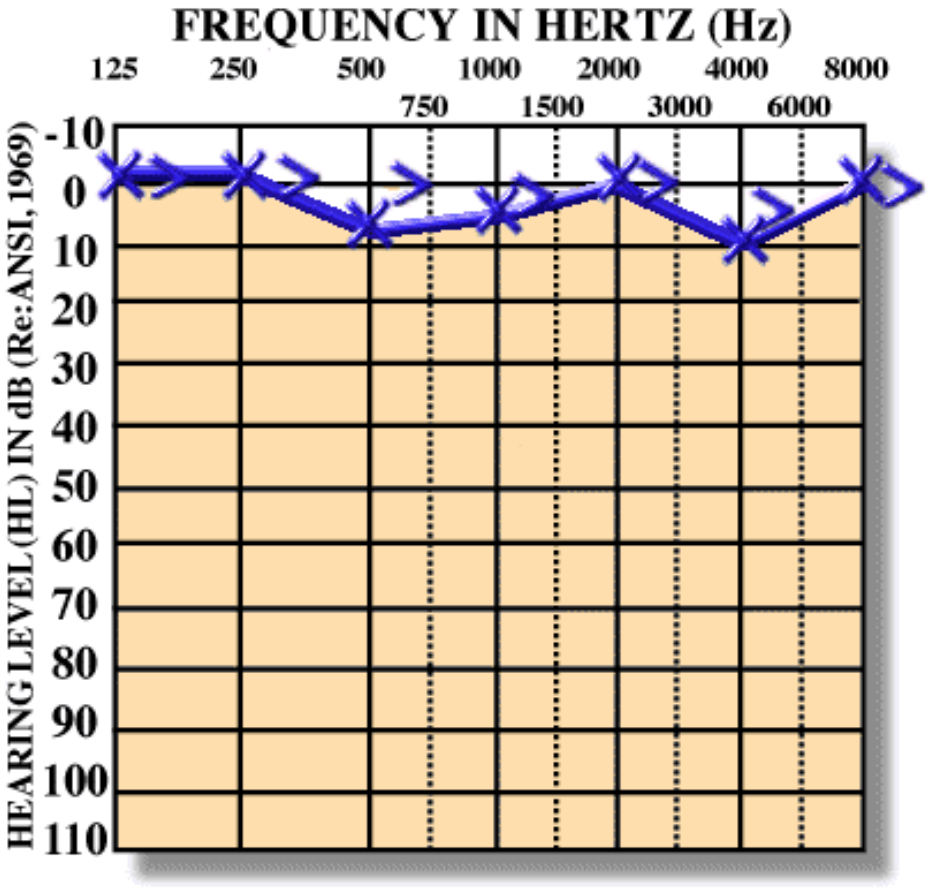


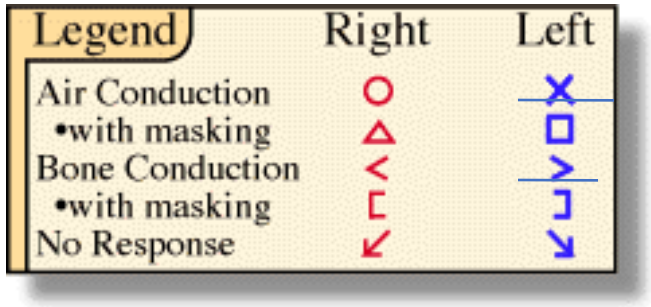
Sensory neural



Mixed

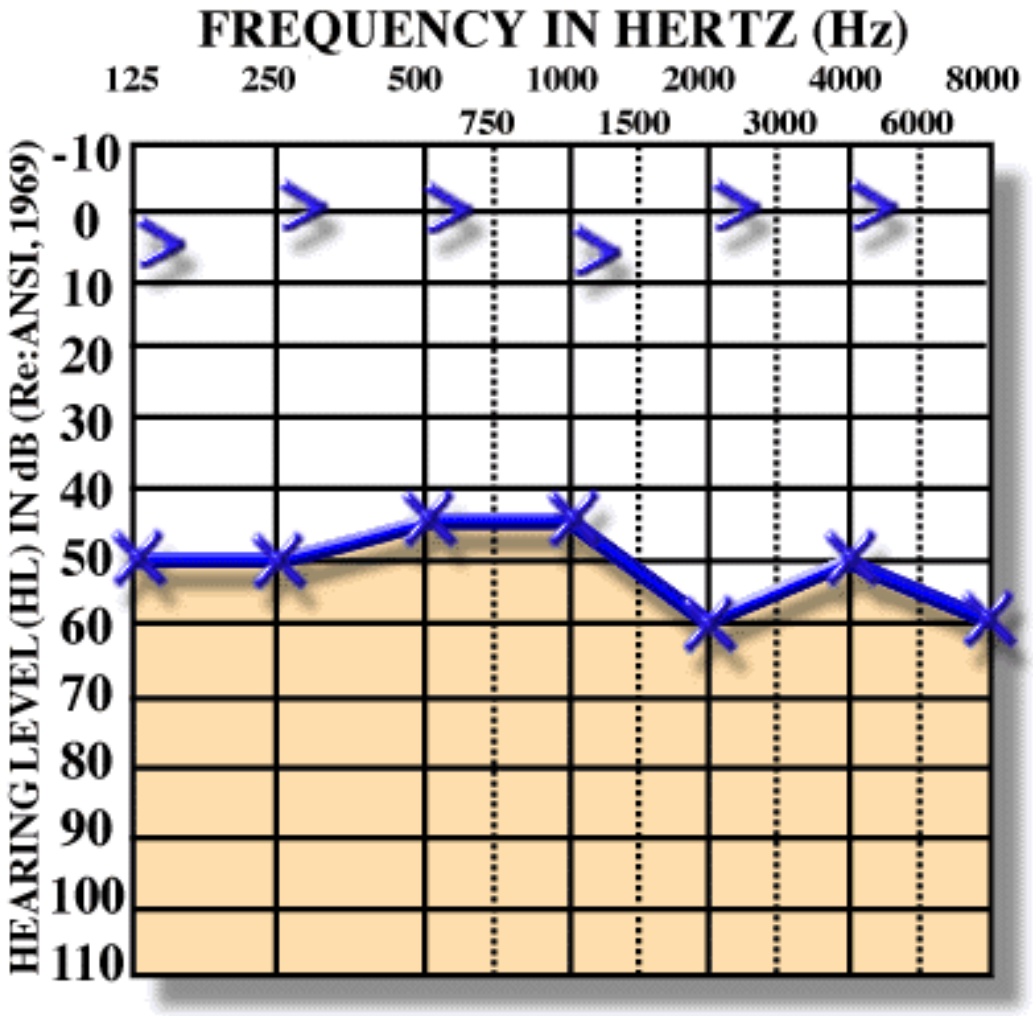
Plotting Results on an Audiogram

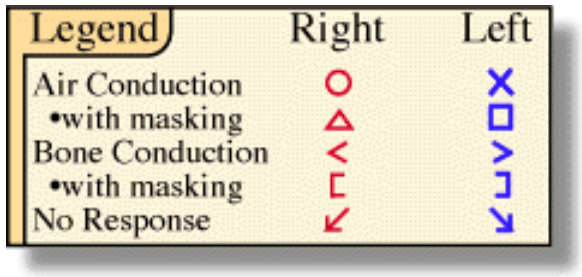




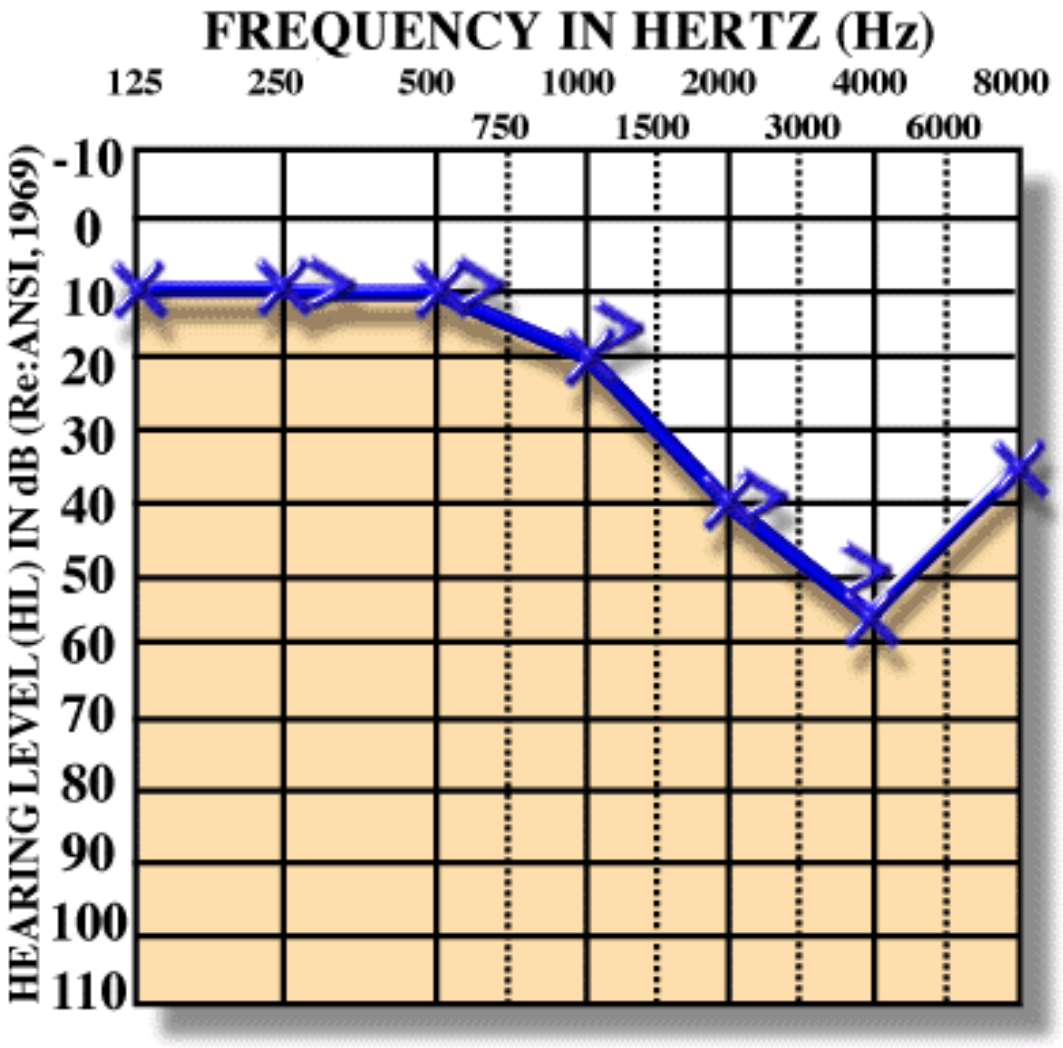
White area is inaudible
Tan area is audible

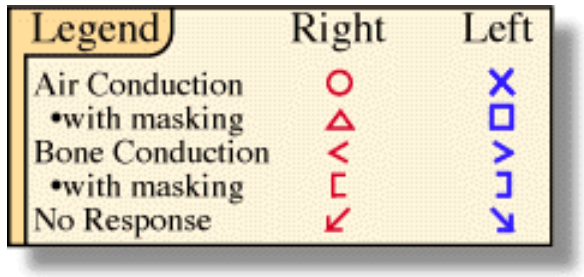
Conductive Hearing Loss



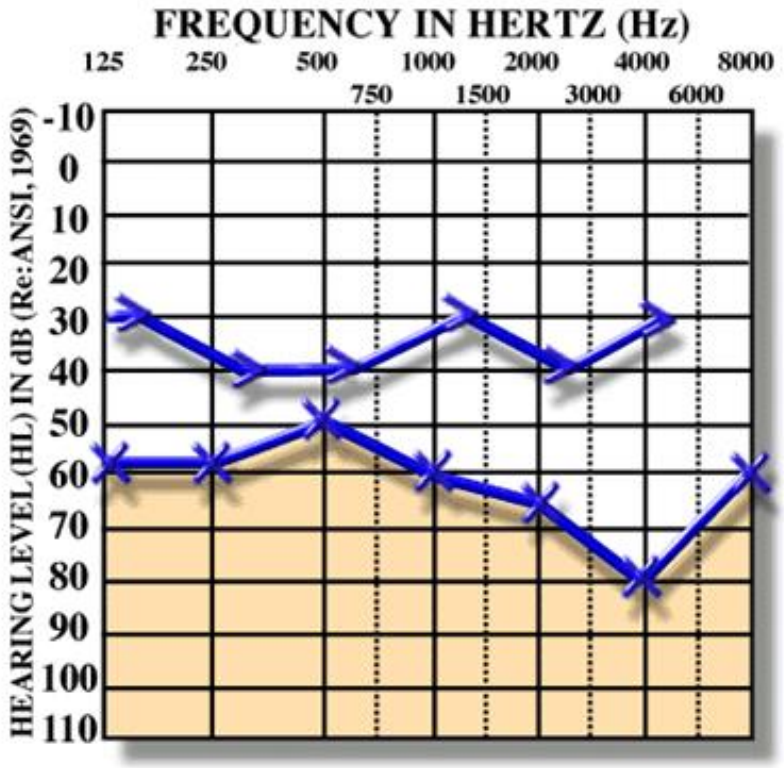


Sensorineural Hearing Loss

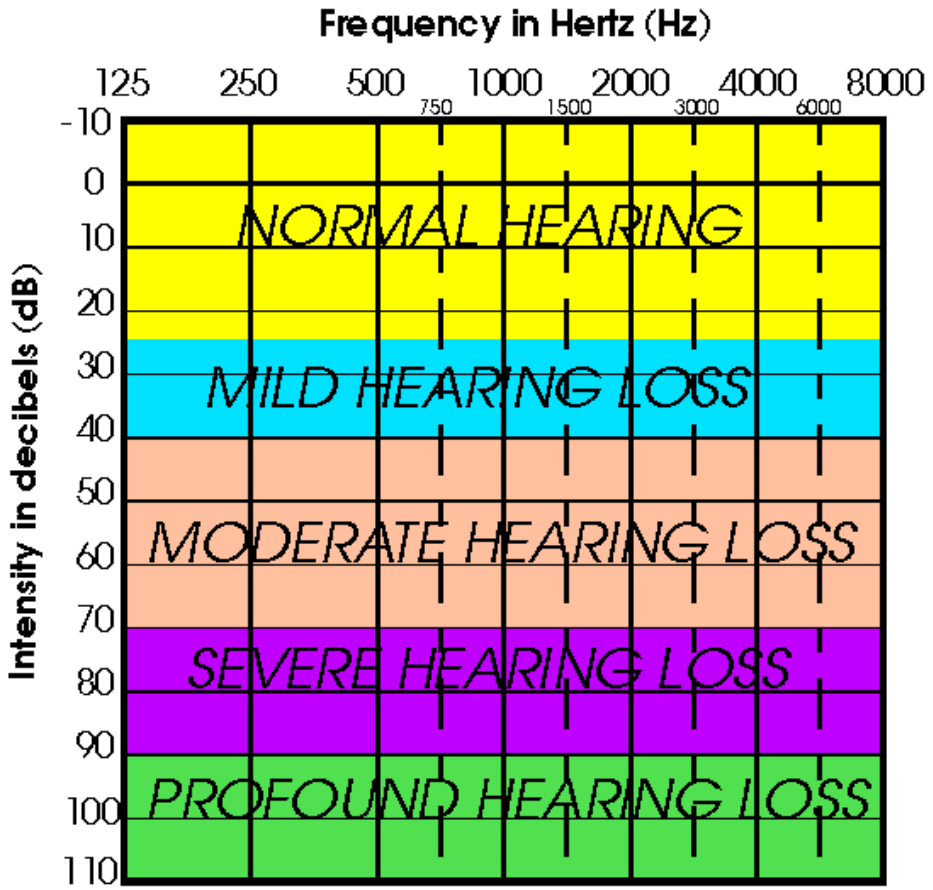




Mixed deafness



Degree of Hearing Loss



16 to 25 dB = Minimal hearing loss

26 to 40 dB = Mild hearing loss

41 to 60 dB = Moderate hearing loss

65 to 85 dB = Severe hearing loss

> 90 dB = Profound hearing loss

More auditory testing
Not required for the exam

- Otoacoustic Emission
- **Brainstem auditory evoked potentials (BAEPs)**
- **ElectroCochleoGraphy (ECoG) tests**