# Pure Tone Audiometery

## What is pure tone audiometry?

- Standard behavioral procedure for describing auditory sensitivity.
- Measures the function of the total hearing system, including the external, middle, and inner ear.
- Help answer these questions:
  - Is a hearing loss present?
  - If so, what type of hearing loss is present?
  - If so, what degree of hearing loss is present?

# Threshold/hearing sensitivity

- Threshold level: the lowest signal intensity at which multiple presentations are detected 50% of the time.
- Examples of variables that affect threshold (hearing sensitivity):
  - Patient related: Motivation, intelligence, attention, familiarity with the listening task, and understanding of the test instructions.
  - Equipment calibration.

# Pure-Tone Audiometer

- An electronic device use to determine hearing thresholds for pure tones.
- Typical test frequencies: 125, 250, 500, 750, 1000, 1500, 2000, 3000, 4000, 6000, 8000 Hz.
- Typical intensity range: -10 to 110 dB HL.
- Air conduction (headphones) and bone conduction (bone-conduction vibrator) test capability.

# Type of transducer

# Quiet Test Environment

- Sound isolated chambers.
  - Sound proof booths.
- Double walls and glass.
- Ventilation
- Lighting

# Is a Hearing Loss Present?

- Perform pure-tone audiometry:
  - Hearing screening
  - Diagnostic audiological evaluation
- Compare patient's thresholds to average normal hearing

# Patient's Position During Test

- Patient must not see what the audiologist is doing during testing.
- Audiologist must see what the patient is doing during testing.

# Instructions

- Must be appropriate for the age of the patient.
- Must inform patient of what will be heard.
- Must inform patient how to respond.
- Good idea to tell patient what ear will be tested first.
- Good idea to tell patient to respond even if they heard a very low\ far sound.

# Place Earphones on Patient

- Remove eyeglasses (some ear rings).
- Check for collapse of outer ear canal.
- Headband over top of head.
- Position so diaphragms are aimed at ear canals.
- Ask patient if the earphones feel comfortable.

## Procedure for Diagnostic Air-Conduction Audiometry

- Select ear to start (always test better ear 1st).
- Select starting frequency (usually 1000 Hz).
- Select starting level (usually 30 dB HL).
- Present tone, maintain for 1-2 seconds.
- If patient responds lower level by 10 dB and continue to lower by 10 until no response.
- Then raise level by 5 until 50% 3/6 presentations heard.

## Procedure for Diagnostic Air-Conduction Audiometry

- If patient does not respond increase level to 50 dB, if no response raise level by 10 until response obtained.
- When threshold is found record results on audiogram.

## Procedure for Diagnostic Air-Conduction Audiometry

- Frequency sequencing:

- Begin at 1000 Hz – easily heard by most and high test-retest reliability
- ORDER of FREQS: 1000, 2000, 4000, 8000, recheck 1000 (only the 1st ear), then go to 500, then 250
- Test at the octave points and the mid-octaves (750, 1500, 3000, 6000 Hz) if there is a difference of 20 dB or more between adjacent octaves

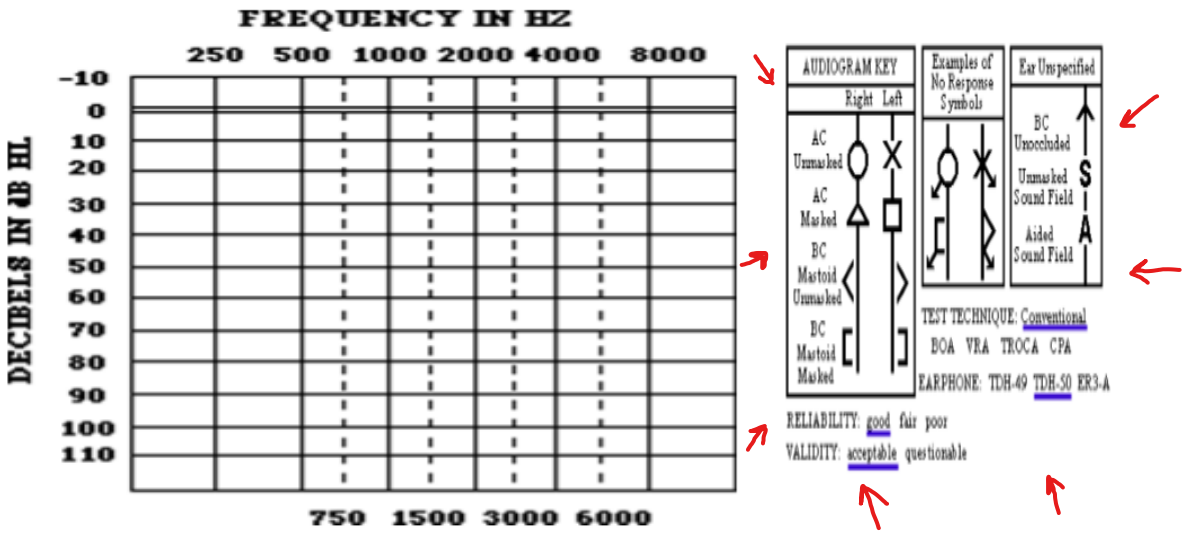
## Procedure for Hearing Screening

- Select ear to start.
- Select starting frequency (usually 1000).
- Set level to 20 dB HL (don't find threshold).
- If patient responds to first tone at 20 ascend and descend in frequency (usually test 500, 1000, 2000, and 4000 Hz).
- Indicate Pass or Fail

## Procedure for Bone-Conduction Audiometry

- Can use mastoid process or forehead .
- Both cochleas are stimulated simultaneously since they are encased in the petrous portion of the temporal bones of the skull
- Select stimulation site (mastoid process or forehead).
- Follow frequency and level testing of AC.
- Test (1000, 2000, 4000 and 500 Hz) Frequencies only.
- Record results on audiogram form.

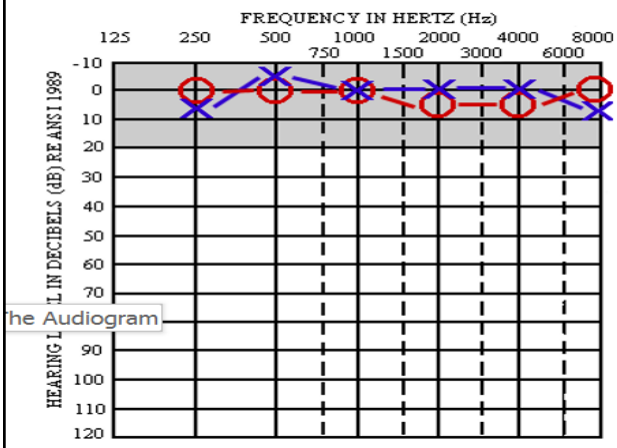
# The Audiogram



# The Audiogram

- Record air conduction test results (red, right and blue, left).
- Place appropriate symbol on the frequency line at the level that corresponds to the level dial setting at patient's threshold

# Normal Hearing Sensitivity




- All the symbols are at 25 dB or less at all frequencies tested.
- The Zero line indicates average normal hearing.

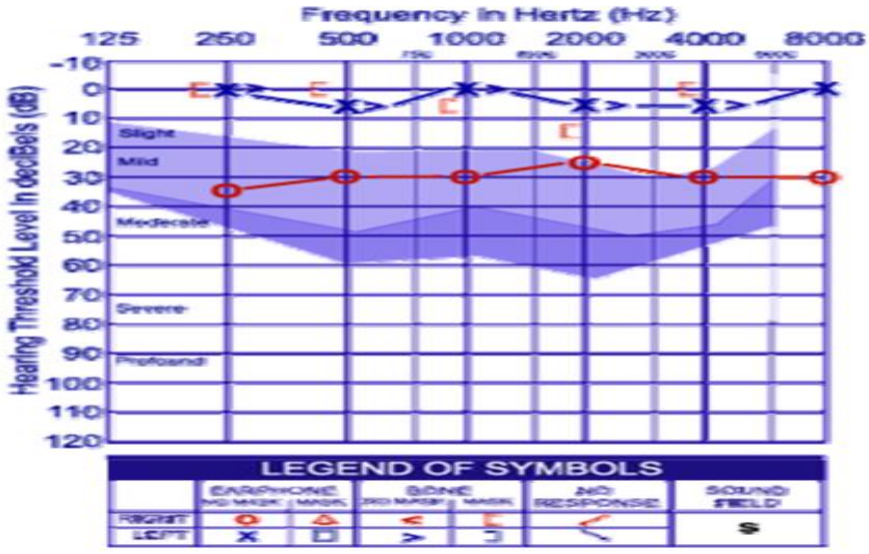
## What type of hearing loss is present?

- Differences between thresholds obtained through air and bone conduction are used to determine the type of hearing loss (normal hearing vs conductive loss vs sensorineural hearing loss [SNHL]).

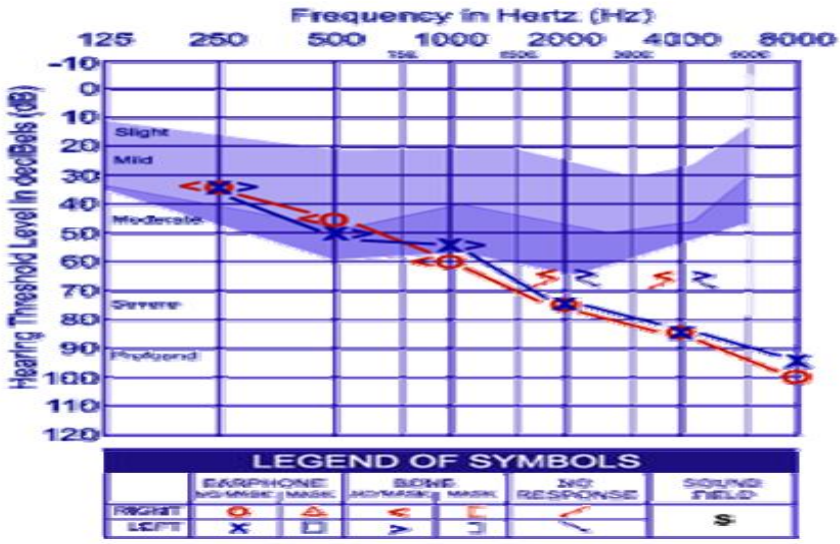
## Conductive hearing loss

- When air-conduction thresholds are elevated relative to normal bone-conduction thresholds (air-bone gap)
- Occurs from a dysfunction of the outer or middle ear
- Can usually be treated with medicine or surgery
- A deficit of loudness only.
- Characteristics: - Maintain soft speaking voice - Excellent speech discrimination when speech is loud enough - Typically either low frequency or flat hearing loss (equal at all frequencies)

# Conductive hearing loss



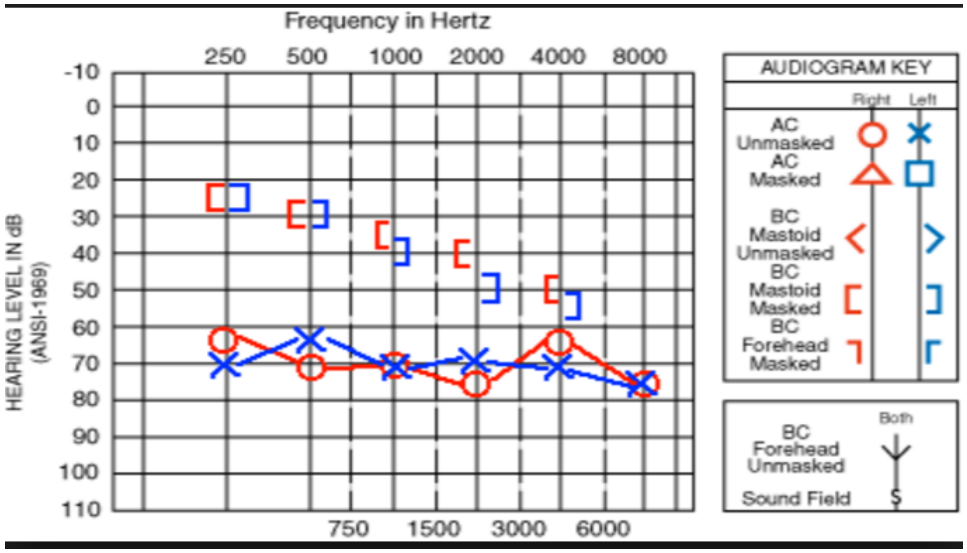

# Sensorineural Hearing loss



# Sensorineural Hearing loss

- Sensorineural - when air-conduction and bone-conduction thresholds indicate the same amount of hearing loss.
- Dysfunction of the inner ear or auditory nerve, usually permanent and untreatable
- Characteristics: - Inappropriately loud voice - Tinnitus - High frequency loss common, but any configuration possible -Speech sounds distorted - Background noise makes listening more difficult - Hearing aids may help

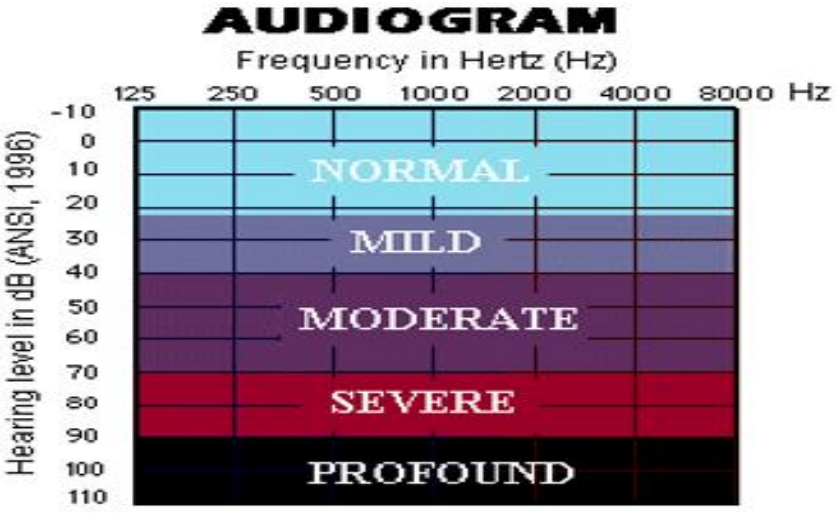
# Mixed hearing loss



# Mixed hearing loss

- Mixed - when air-conduction thresholds are elevated relative to abnormal bone-conduction thresholds.
- Combination of conductive (outer or middle ear) disorder and sensori-neural hearing loss.
- Treatment may be available for the conductive portion; however, the sensori-neural portion will remain.

# What is the degree of severity?



## What is the degree of severity?

- Severity of loss is often determined by pure-tone average (PTA) at 500, 1000, & 2000 Hz.
- Patients, however often have normal hearing at some frequencies and hearing loss at other frequencies.

## Types of pure tone audiometry

- Standard audiometry
- Visual reinforcement audiometry (VRA)
- Conditioned play audiometry (CPA)

# Visual reinforcement audiometry (VRA)

- Developing infants normally make head turns toward sound sources during the first few months of life.

  This response provides an opportunity for auditory behavior evaluation.
- When VRA is used, a head turn response following an auditory stimulus is rewarded with an interesting visual event or reinforcer, such as an animated toy.
- This test appears to be well suited for normally developing infants and toddlers. Used for children ages 6 months – 2 year

# Conditioned play audiometry (CPA)

- Assesses hearing acuity using conditioned responses to sound by engaging in play-oriented activities.
- Appropriate for testing children from 30 months through 5 years of age.
- Purpose is to make the test an enjoyable game for the young child
- The child is taught to wait and listen for a stimulus.
- The child is then to respond by performing a motor task in response to the stimulus.

  - e.g. the child is taught to put an object in a specific place, (e.g., a marble in a box or a cow in the barnyard) when a specific sound is heard.

# Conditioned play audiometry (CPA)