Praxis Review

Hearing Science (Part 1)

Auditory Rehabilitation (Part 2)

Facilitated by

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Audiologist & Speech-Language Pathologist

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Part One – Hearing Science (and Basic Audiometry)

- Assessment of Anatomy/Physiology (Pre-Tests)
- Etiology of Hearing loss
- Epidemiology and characteristics of Hearing loss
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- Hearing Assessment (diagnostic) procedures
- Auditory Development and Performance across the lifespan
- Testing infants and young children

Part Two – Aural Rehabilitation (Treatment Procedures)

- Hearing Wellness and Prevention of Hearing loss
- Hearing aids and implants
- Aural Rehabilitation procedures
- Case Studies

Pre-Test

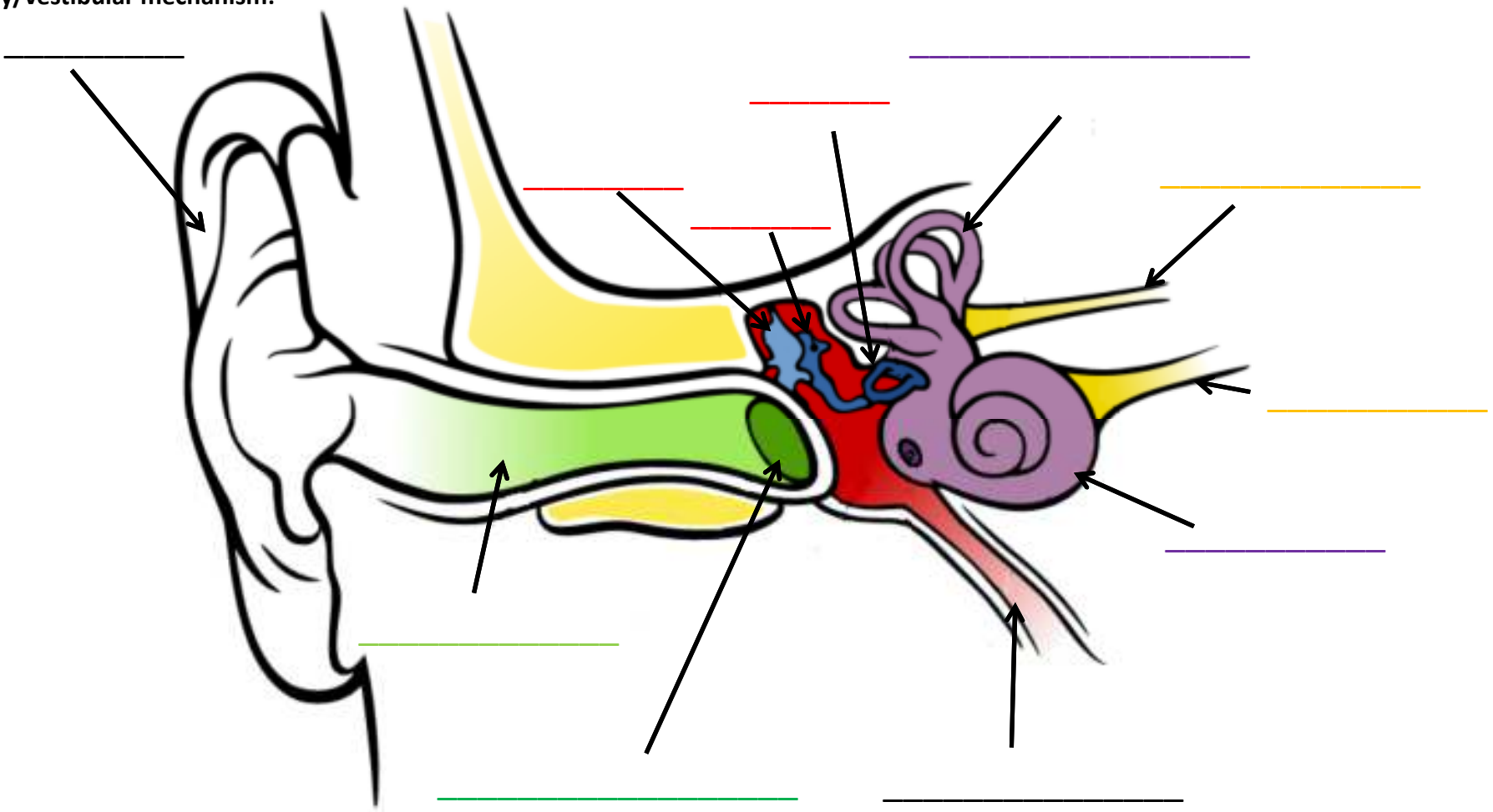
Complete the following test pages prior to the start of this instructional module.

Fill in the requested information:

Label the four divisions of the ear:

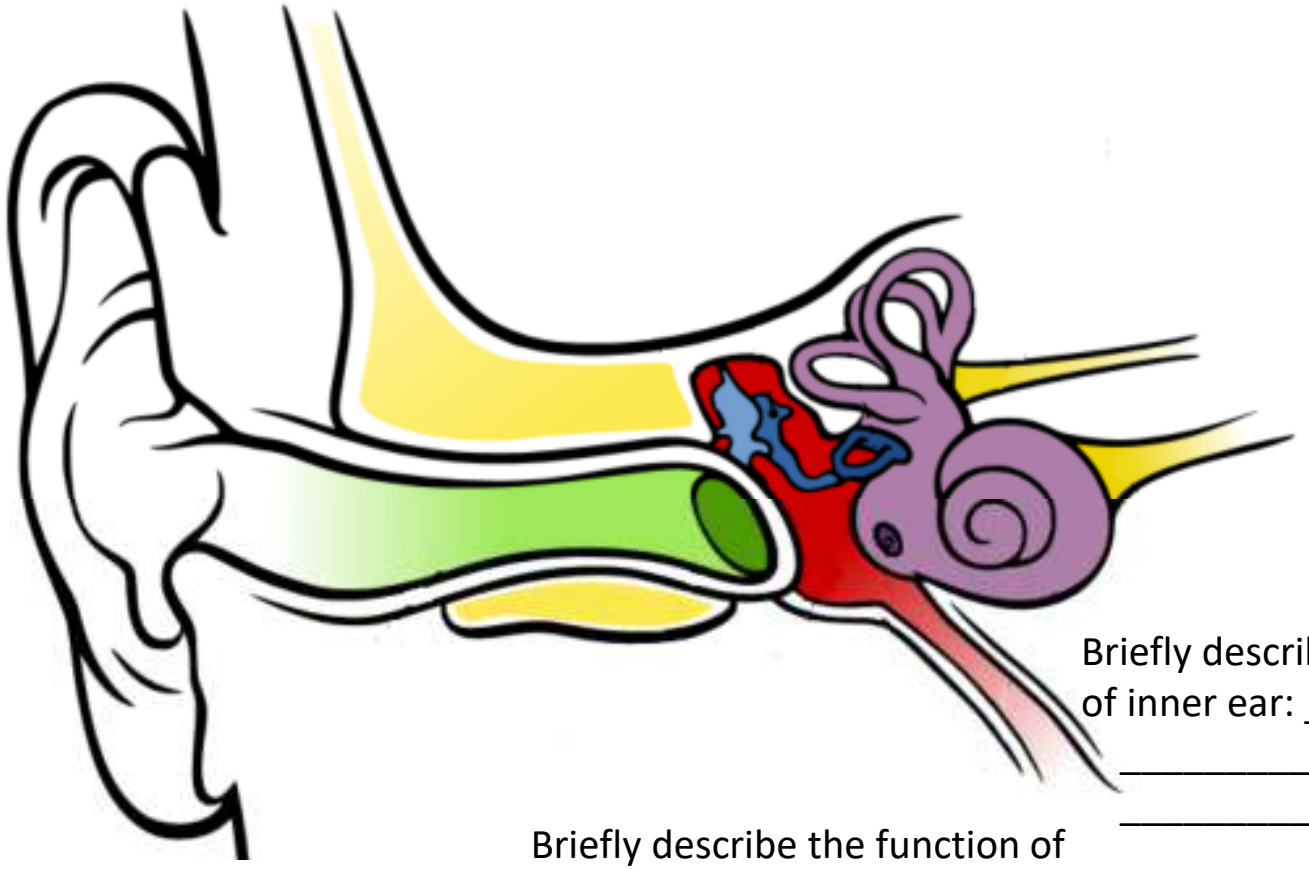
_____ _____ _____ _____

Label the components of the auditory/vestibular mechanism:



Complete this schematic before the presentation.

Ear Physiology Pre-Test



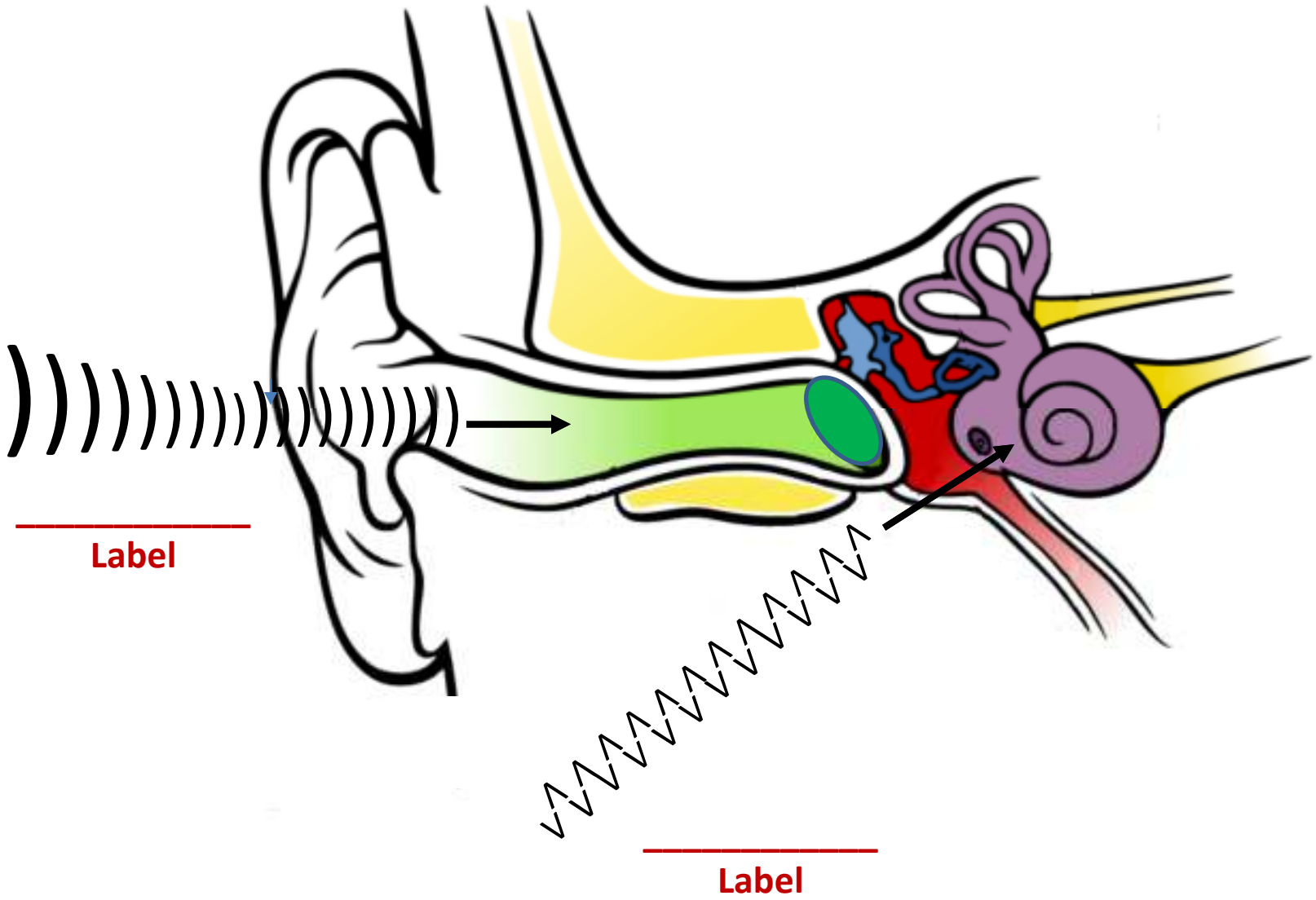
Briefly describe the function of outer ear: _____
_____
_____

Briefly describe the function of middle ear: _____
_____
_____
_____

Briefly describe the function of inner ear: _____
_____
_____
_____

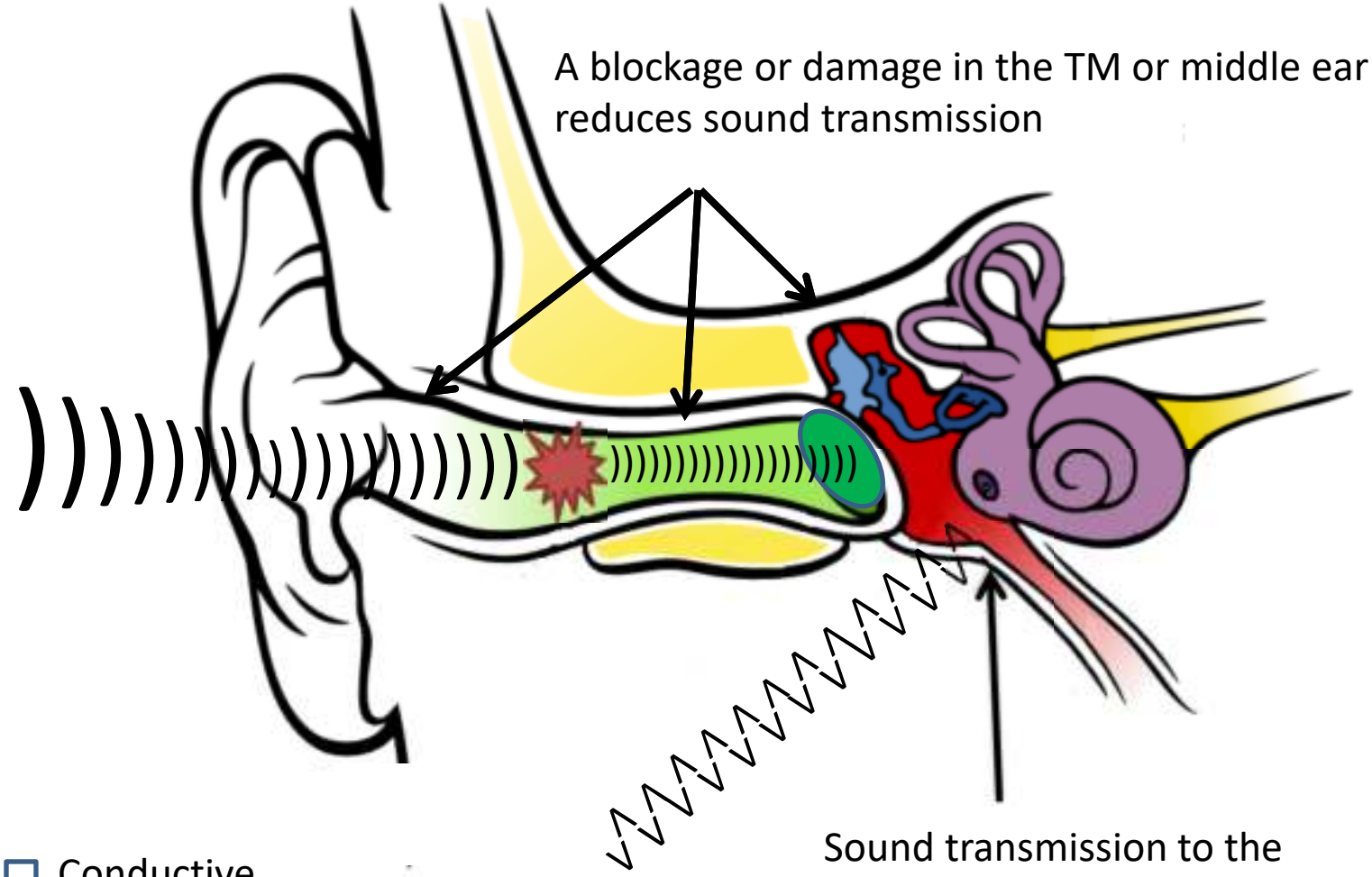
Complete this schematic before the presentation.

What are the two modes of hearing?



Complete this schematic before the presentation.

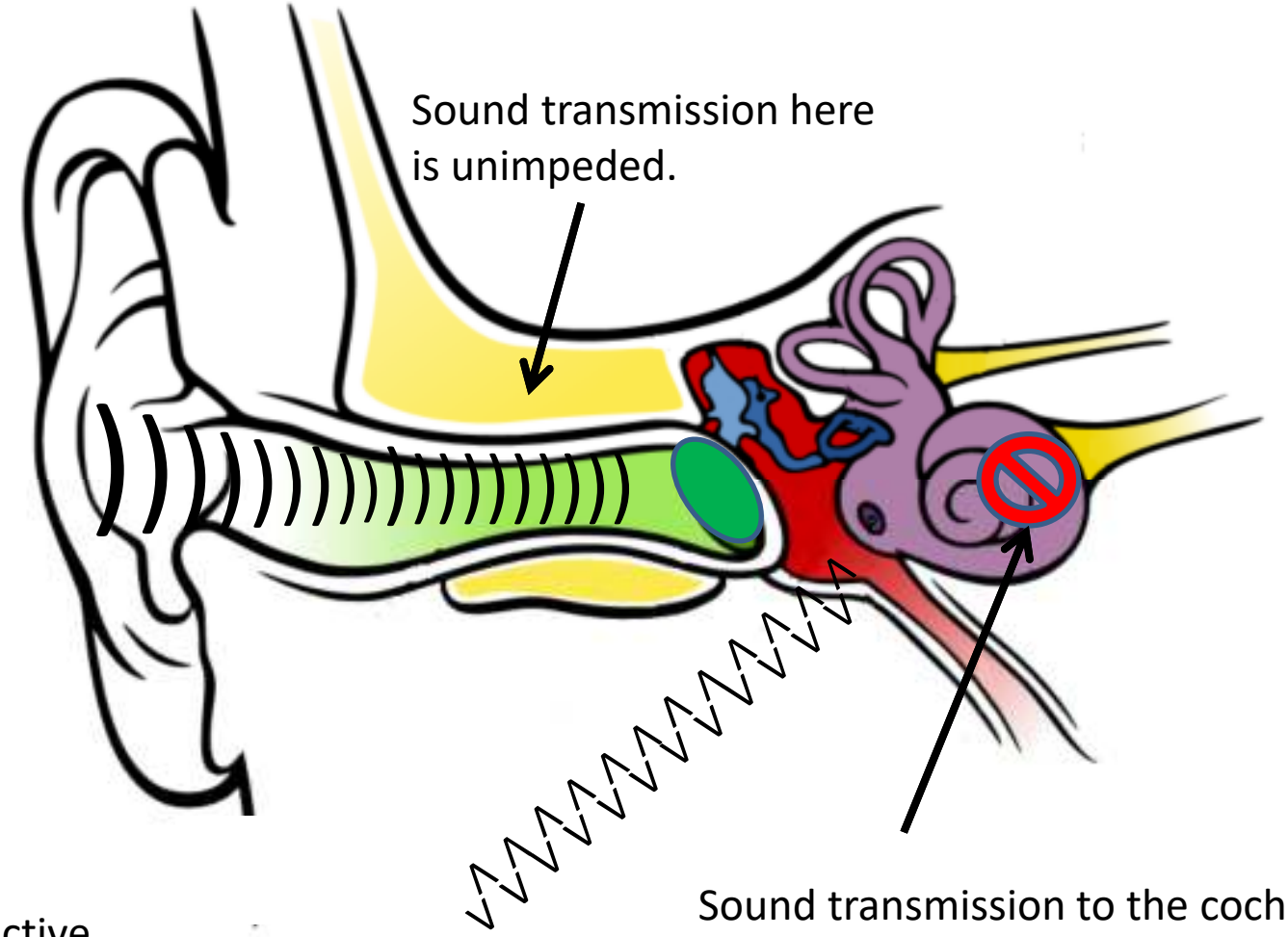
What type of hearing loss is this?



- ☐ Conductive
- ☐ Sensorineural
- ☐ Mixed

Complete this schematic before the presentation.

What type of hearing loss is this?



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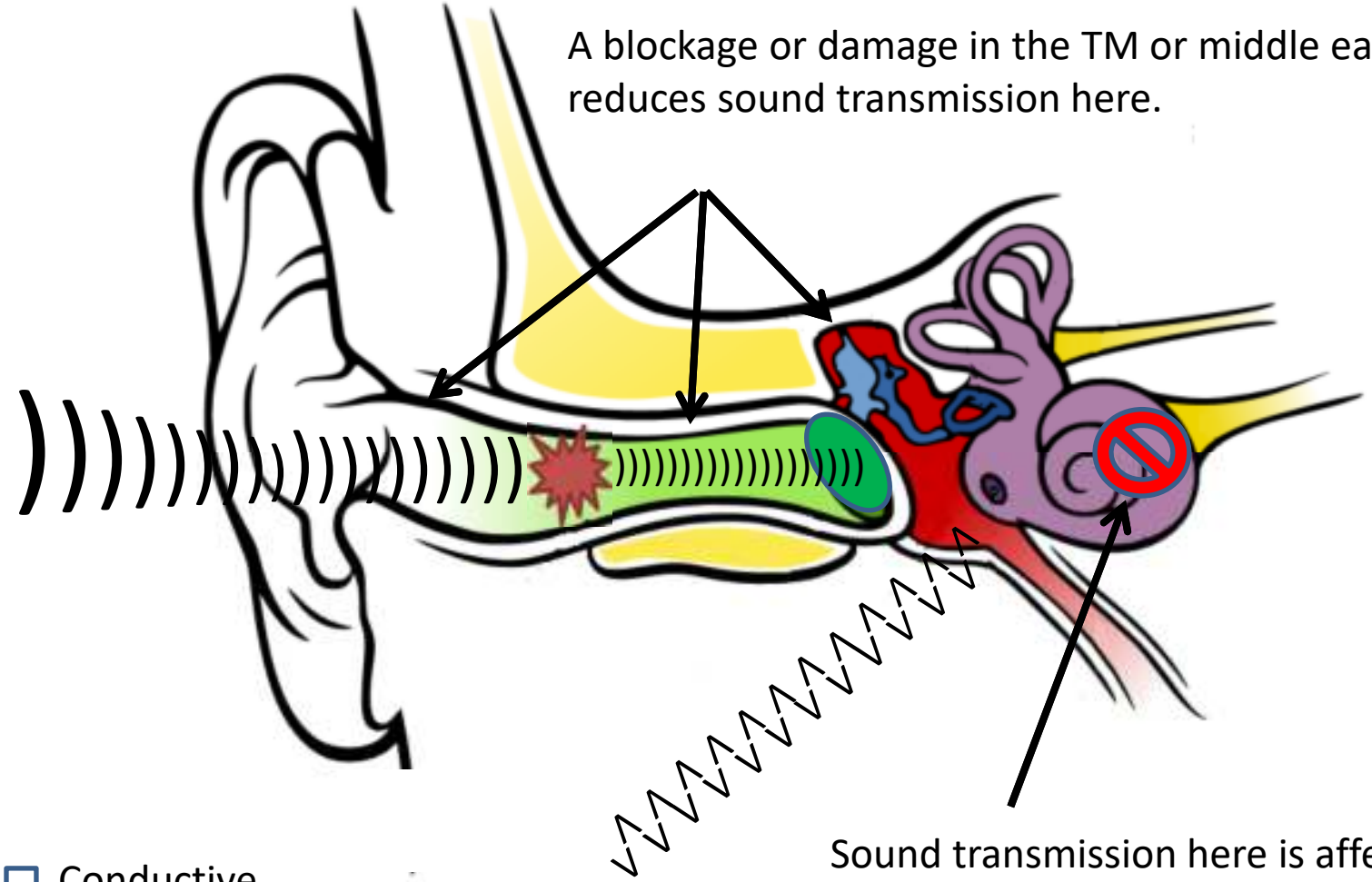
Complete this schematic before the presentation.

What type of hearing loss is this?



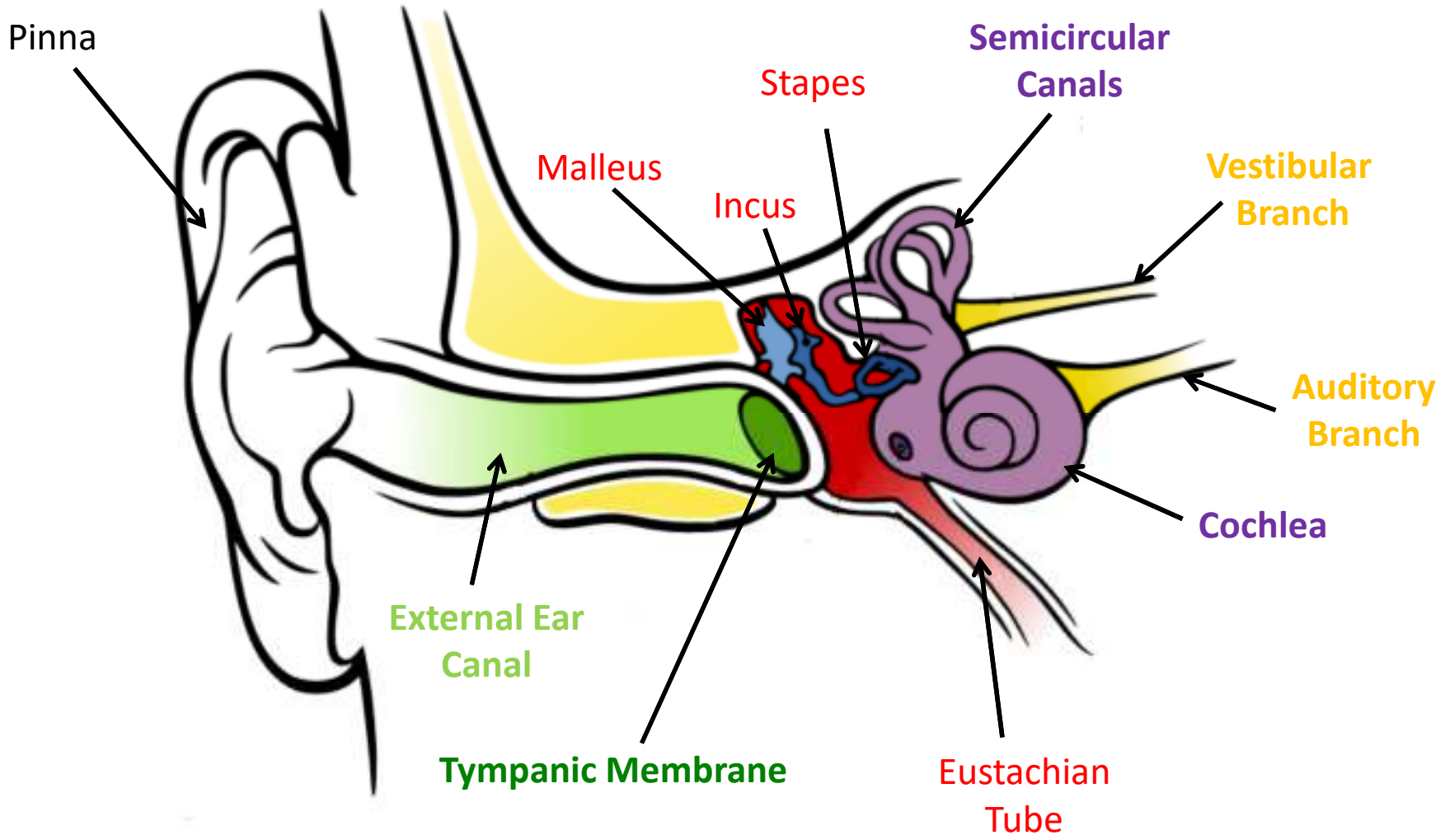
- ☐ Conductive
- ☐ Sensorineural
- ☐ Mixed

Complete this schematic before the presentation.

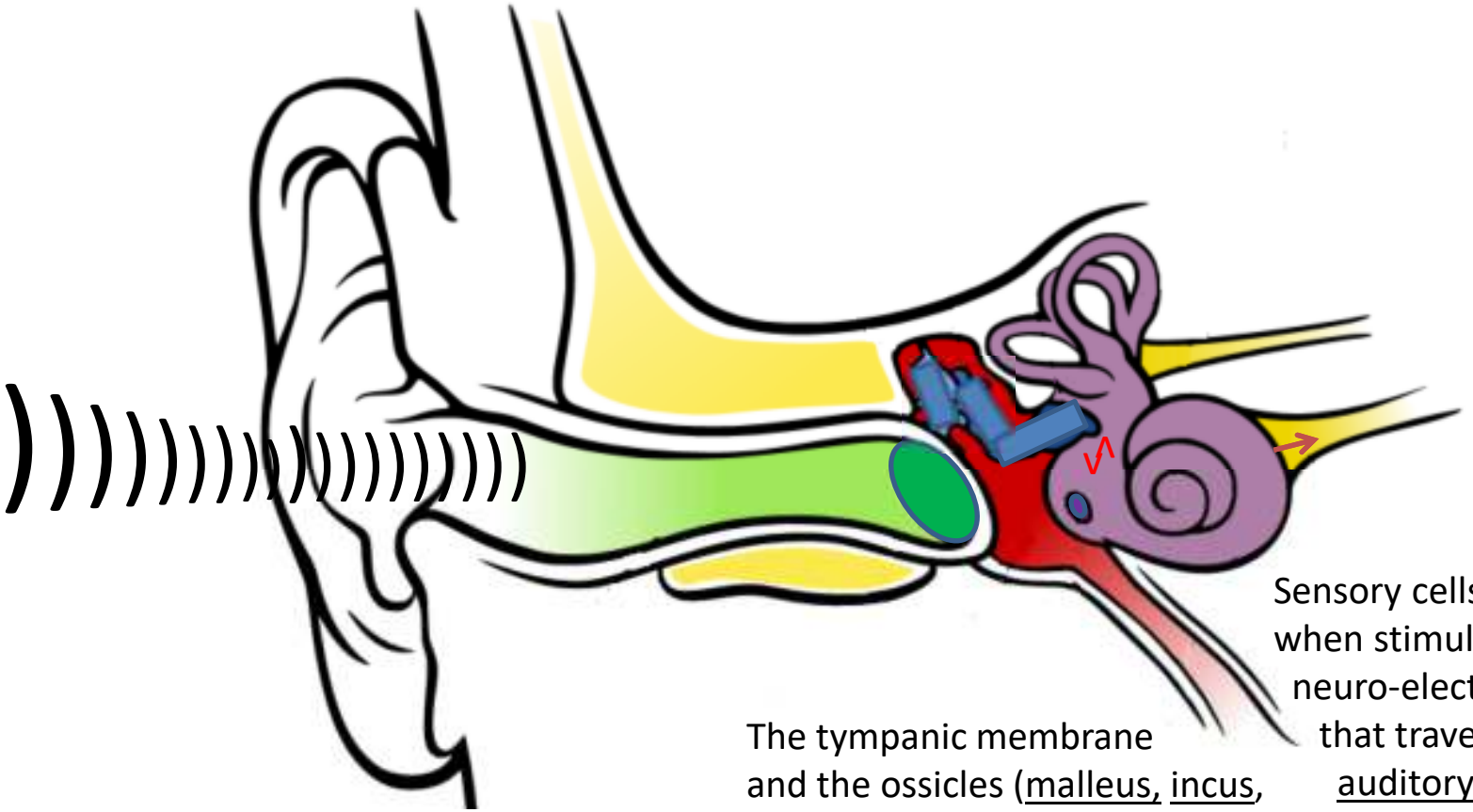
Answers

Anatomy

Outer Ear Middle Ear Inner Ear Auditory Nerve



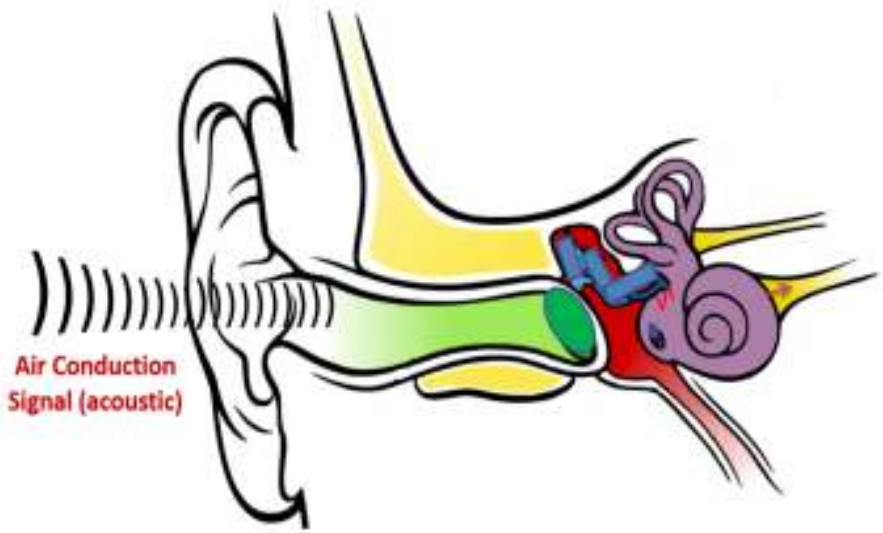
Physiology

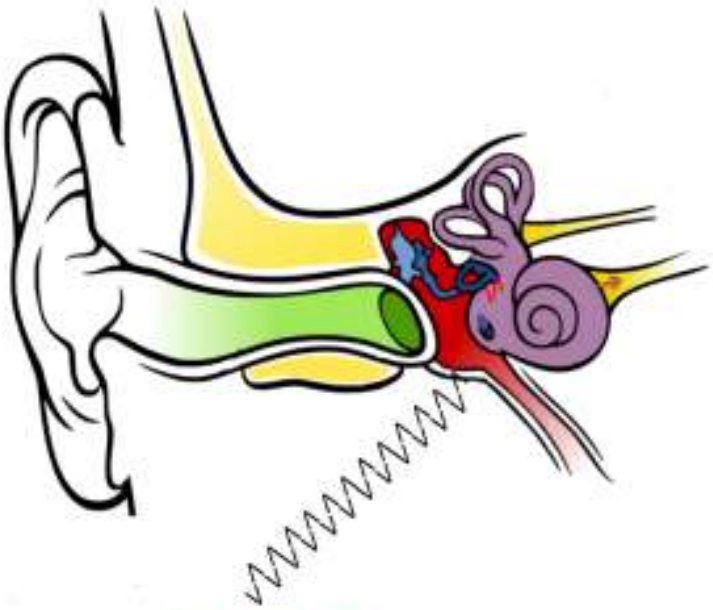


Sound waves enter the ear canal and strike the tympanic membrane

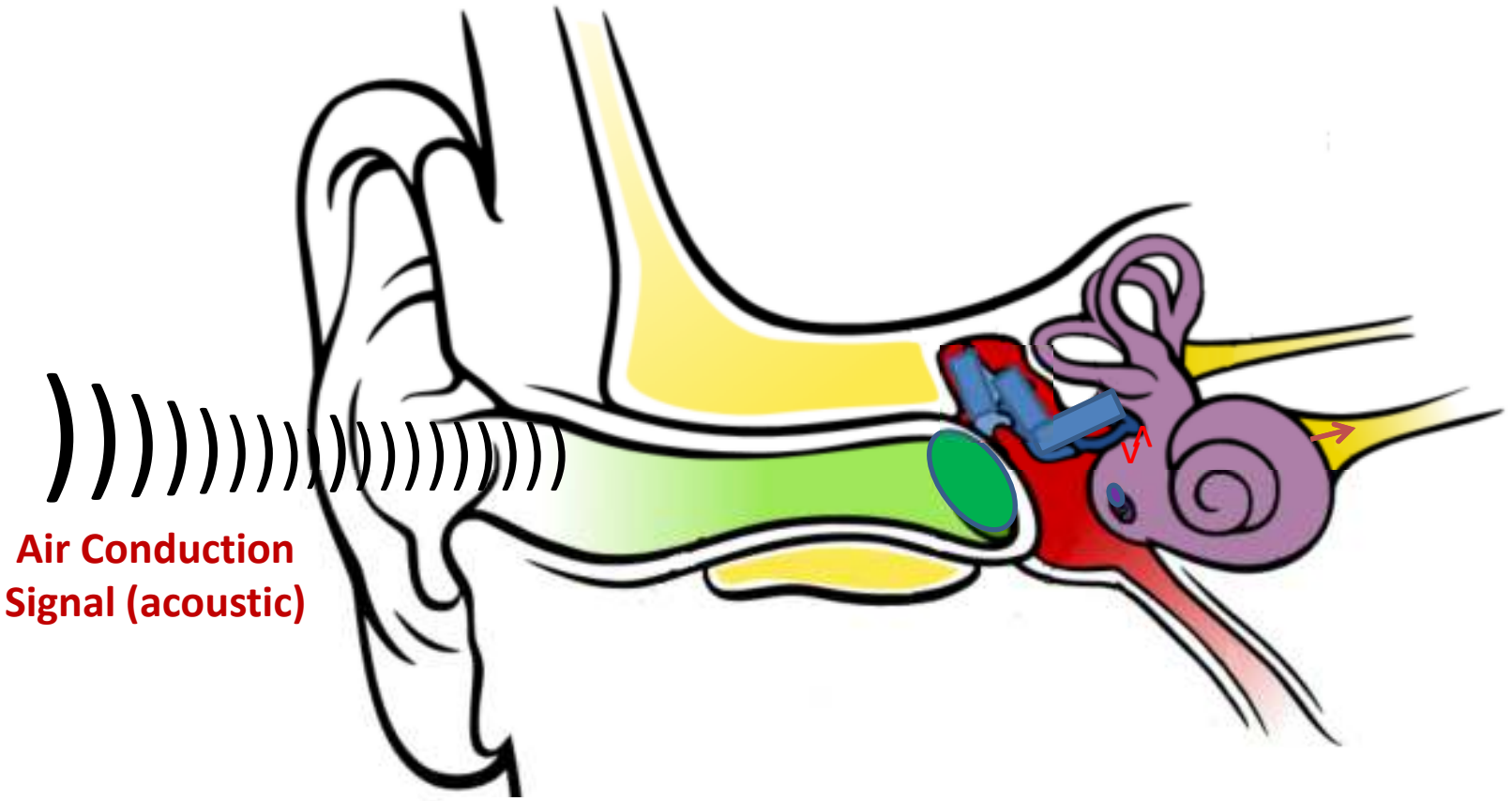
The tympanic membrane and the ossicles (malleus, incus, stapes) are set into vibration. This vibration mechanically amplifies the sound energy. The middle ear system acts as an ***impedance matcher.***

Sensory cells in the cochlea when stimulated generate neuro-electrical impulses that travel through the auditory nerve to be interpreted in the temporal lobes of the brain.

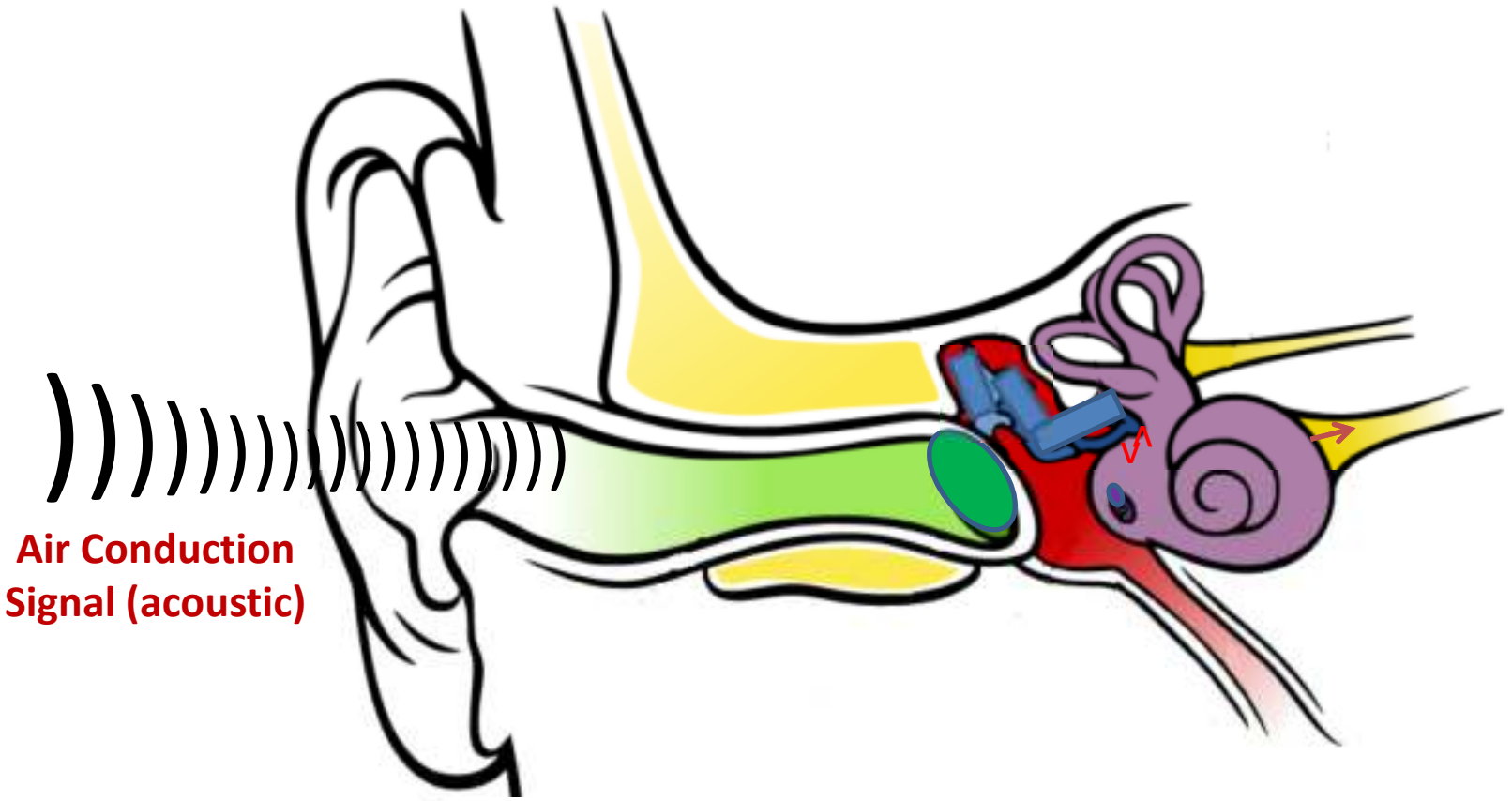

Air Conduction
Signal (acoustic)


Bone Conduction
Signal (vibratory)

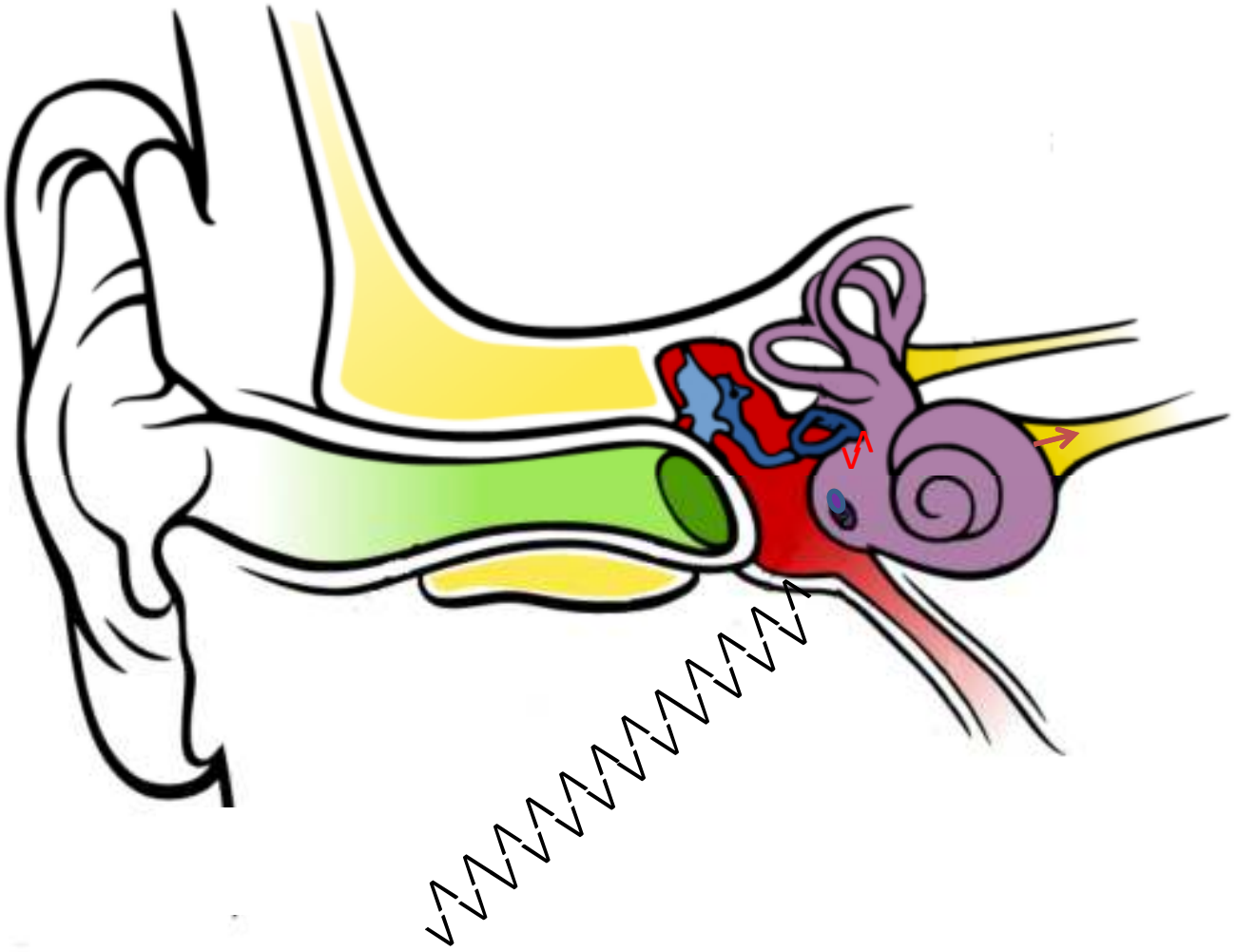
Air Conduction Hearing



Air Conduction Hearing

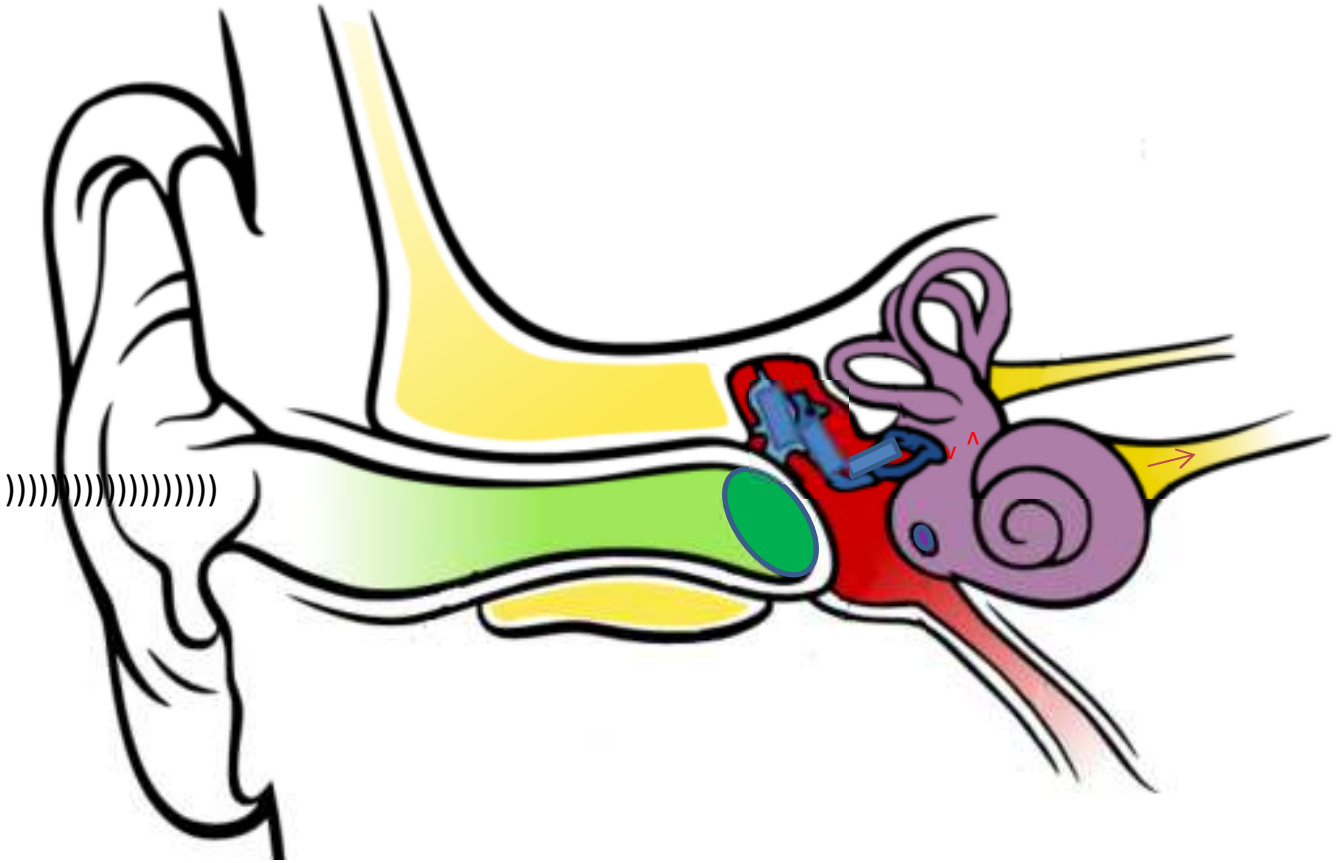


Bone Conduction Hearing

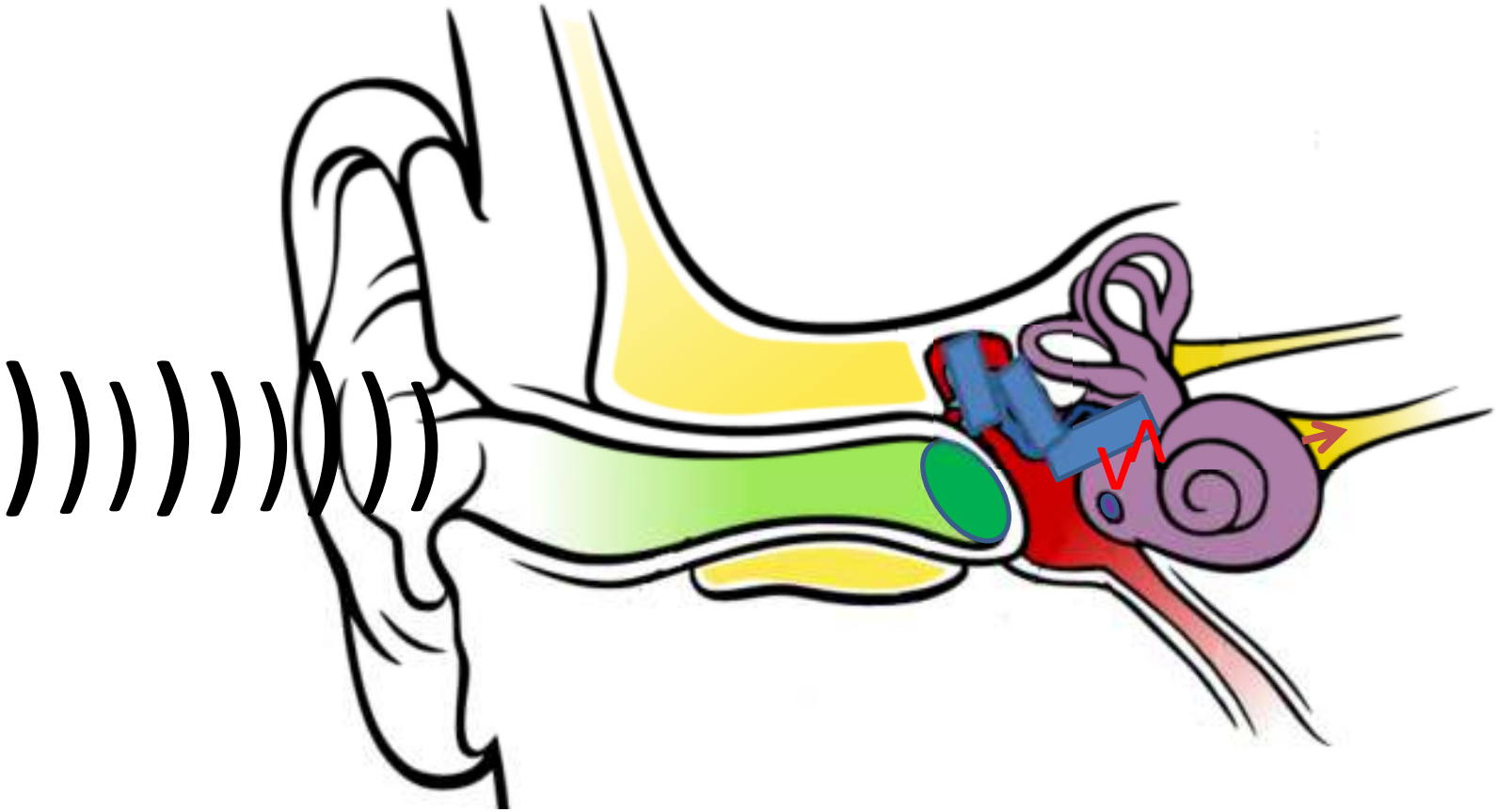


Bone Conduction Signal (vibratory)

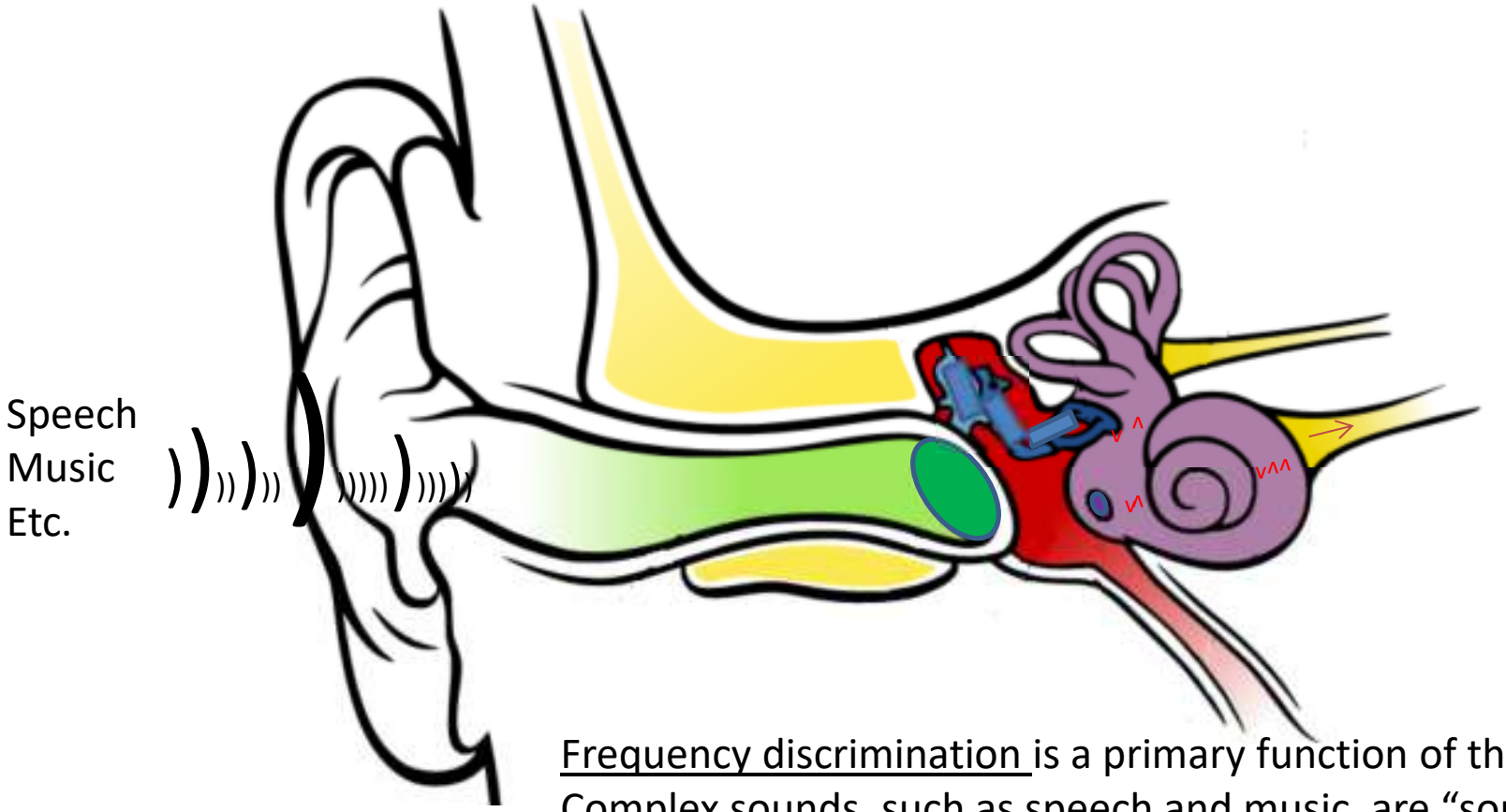
Physiology: Soft sounds



Physiology: Louder sounds



Physiology: Frequency Discrimination

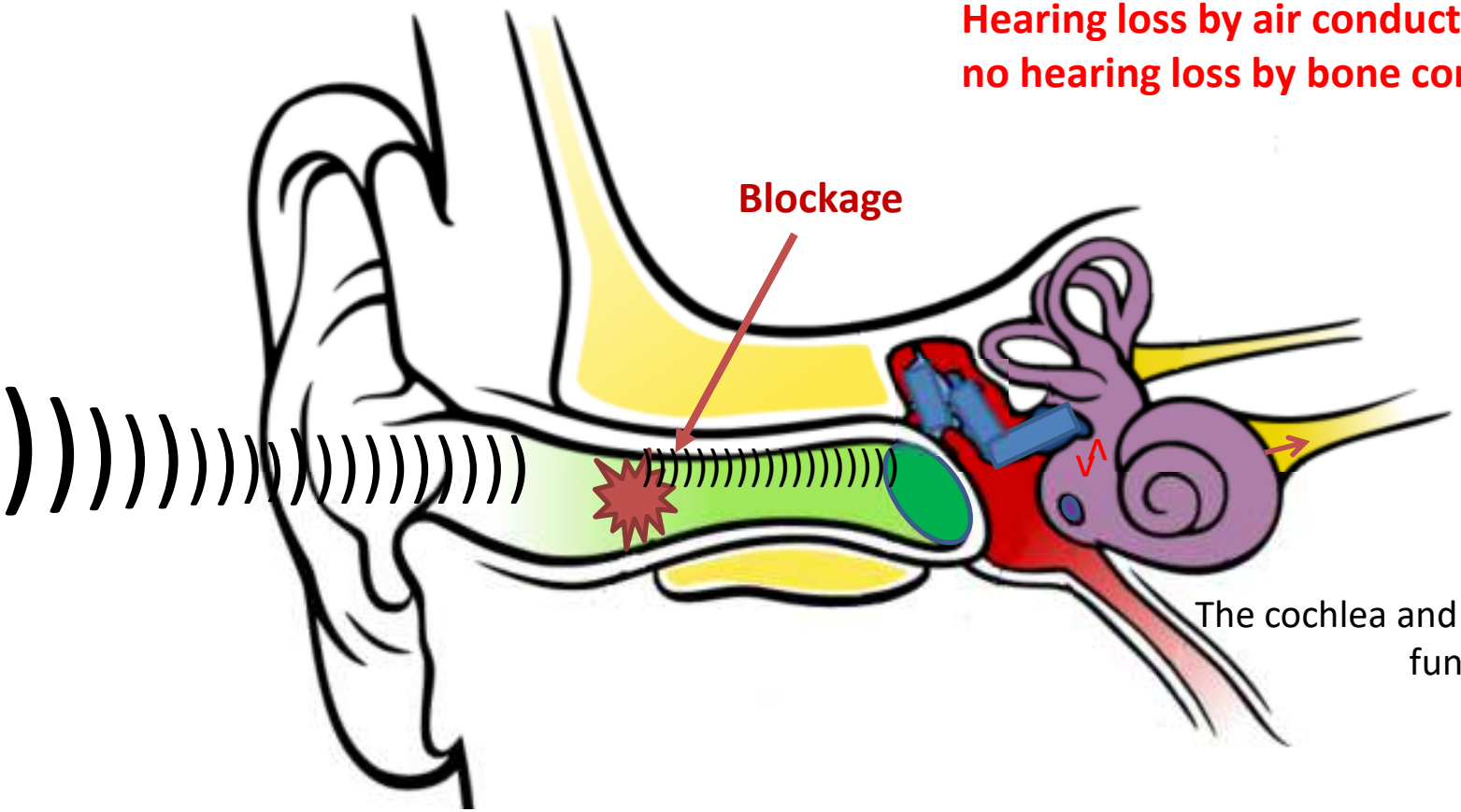


Frequency discrimination is a primary function of the cochlea. Complex sounds, such as speech and music, are "sorted" based on the location in the cochlea where the hair cells detect specific frequencies. For example, lower frequencies are detected at the top of the cochlea; higher frequencies at the bottom, and mid frequencies are detected in the middle of the cochlea.

Hearing Loss

Conductive Hearing Loss

Hearing loss by air conduction but no hearing loss by bone conduction.

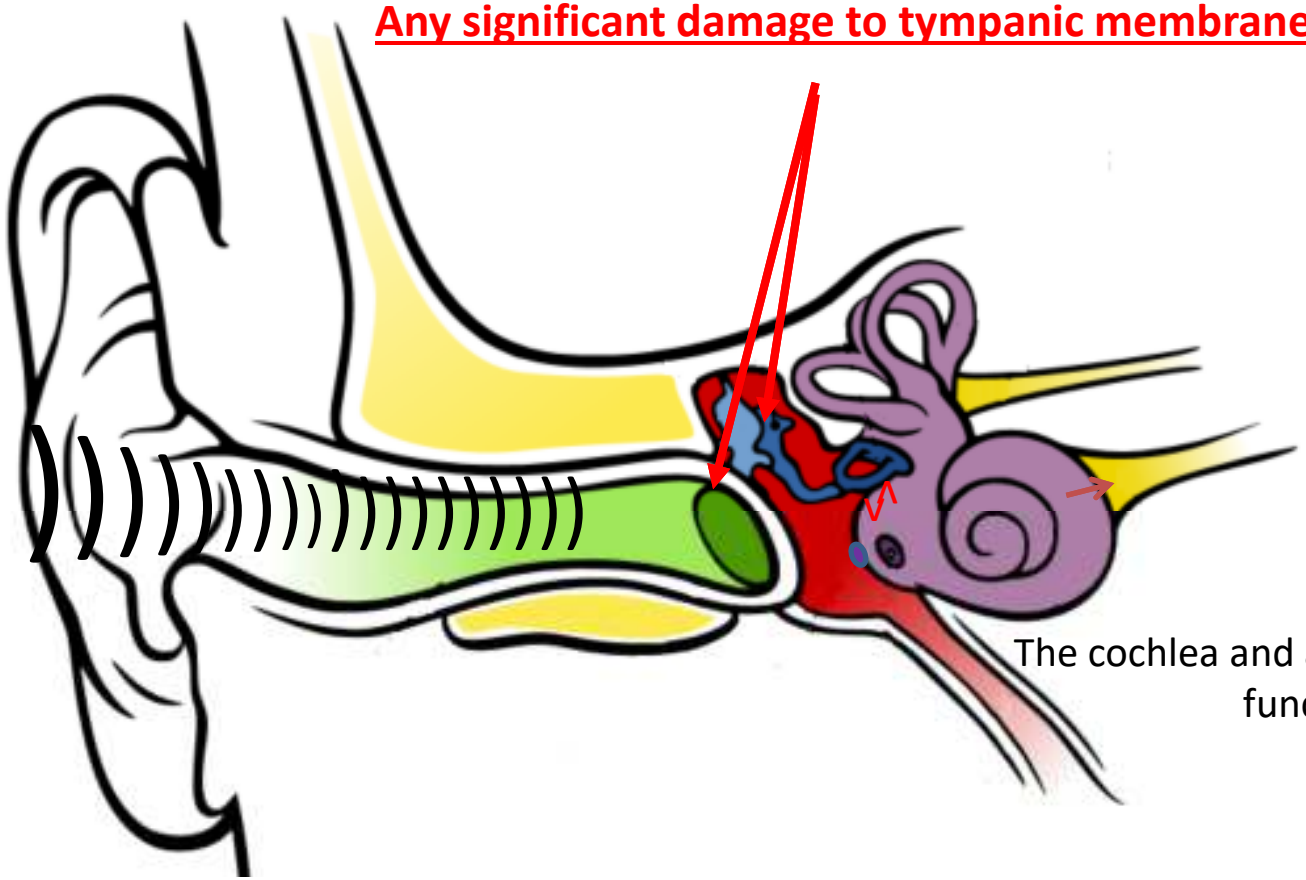


The cochlea and auditory nerve function normally.

If there is an obstruction of the ear canal (i.e., impacted earwax, debris, etc.), or if there is a problem with the tympanic membrane (i.e., perforation, scarring, etc.), **a conductive hearing loss** can result. Note that the sound's intensity is reduced.

Conductive Hearing Loss (cont'd)

Any significant damage to tympanic membrane or ossicles

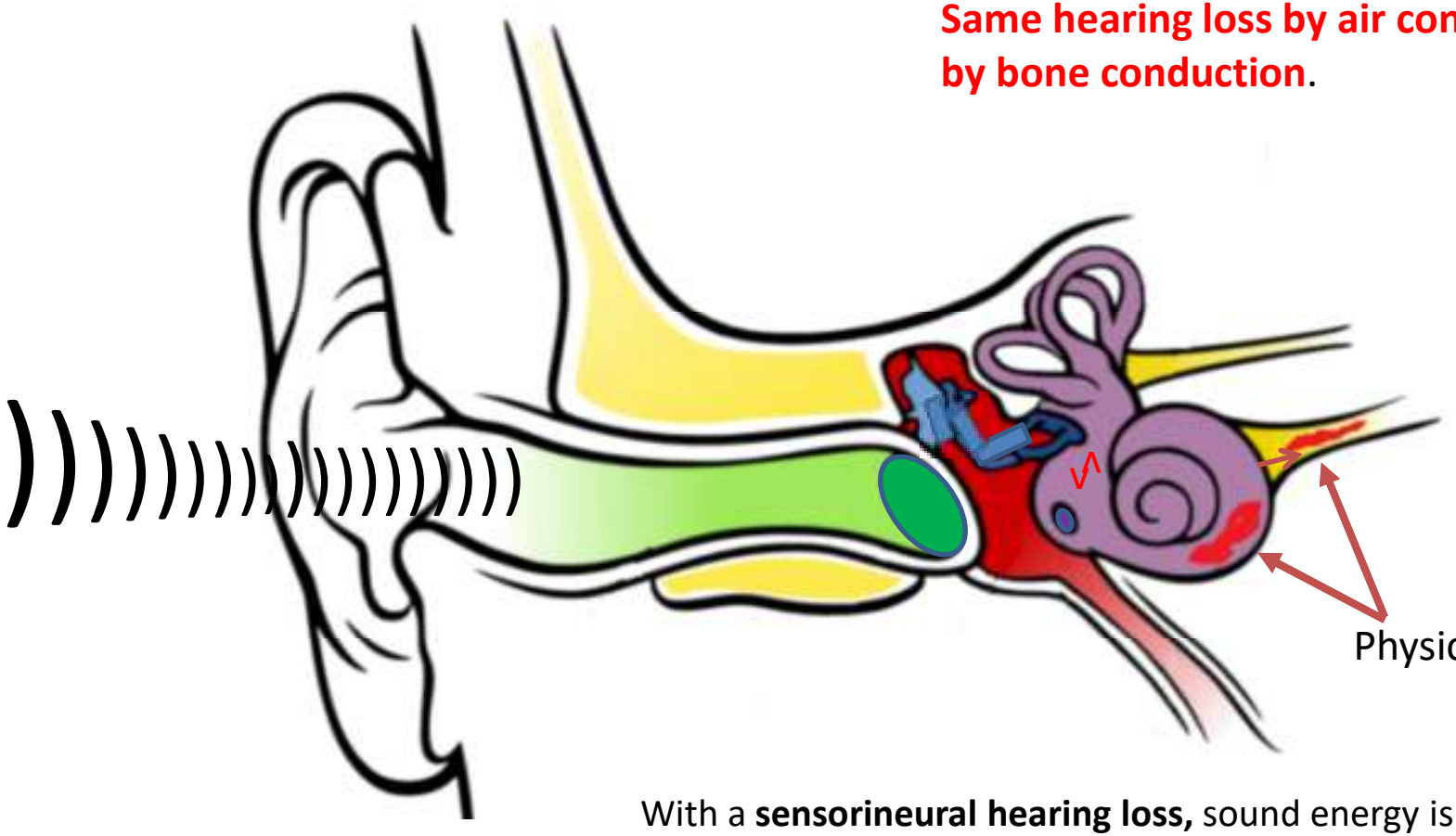


The cochlea and auditory nerve function normally.

If the problem is with the tympanic membrane (i.e., perforation, scarring, etc.), or if there is a problem with the ossicles (i.e., fracture, deformity, otosclerosis), again **a conductive hearing loss** can result.

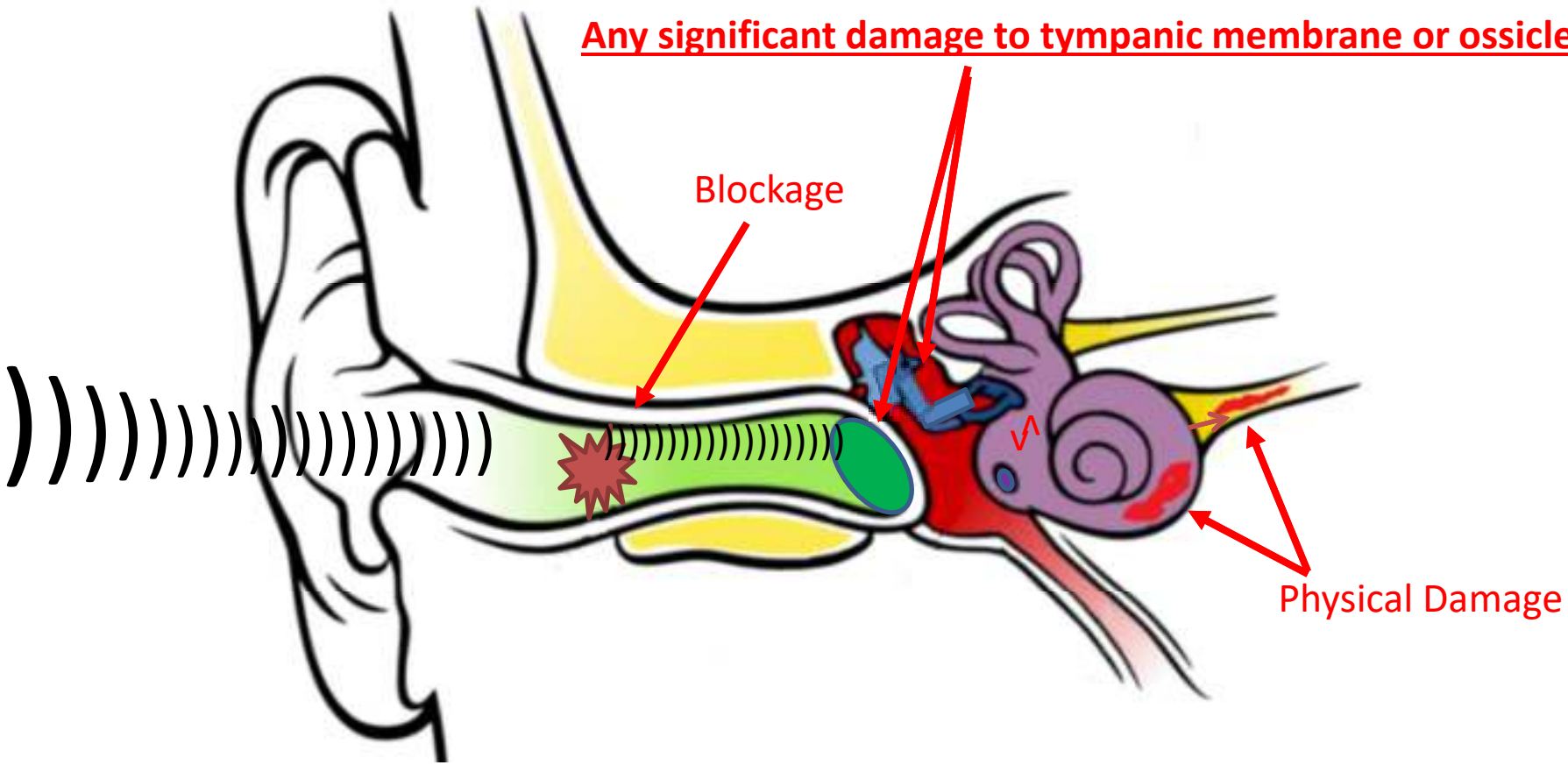
Sensorineural Hearing Loss

Same hearing loss by air conduction as by bone conduction.



With a **sensorineural hearing loss,** sound energy is reduced or distorted by the presence of a cochlear and/or auditory nerve problem (i.e., missing or damaged hair cells, faulty or damaged nerve fibers, etc.). Sensorineural hearing losses affect the reception and perception of sound patterns (e.g., speech, music, etc.)

Mixed Hearing Loss



With a **mixed hearing loss** sound energy is reduced by the presence of an outer ear or middle ear problem **and** an inner ear and/or an auditory nerve problem. There is a hearing loss by bone conduction and more by air conduction (the conductive loss adds to the sensorineural loss).

Part One

Hearing Science and Basic Audiometry

Etiology of Hearing Loss

Congenital/Genetic
Developmental
Disease processes
Auditory problems
Structural and functional
Neurological
Psychogenic

Congenital Causes

- The term ***congenital hearing loss*** implies that the hearing loss is present at birth. It can include hereditary hearing loss or hearing loss due to other factors present either in utero (prenatal) or at the time of birth.

- **Genetic factors** are thought to cause more than 50% of all incidents of congenital hearing loss in children (4). Genetic hearing loss may be autosomal dominant, autosomal recessive, or X-linked (related to the sex chromosome).

- In ***autosomal dominant hearing loss***, one parent who carries the dominant gene for hearing loss and typically has a hearing loss passes it on to the child. In this case there is at least a 50% probability that the child will also have a hearing loss. The probability is higher if both parents have the dominant gene (and typically both have a hearing loss) or if both grandparents on one side of the family have hearing loss due to genetic causes. Because at least one parent usually has a hearing loss, there is prior expectation that the child may have a hearing loss.

- In ***autosomal recessive hearing loss***, both parents who typically have normal hearing, carry a recessive gene. In this case the probability of the child having a hearing loss is 25%. Because both parents usually have normal hearing, and because no other family members have hearing loss, there is no prior expectation that the child may have a hearing loss.

http://www.asha.org/public/hearing/disorders/causes.htm

Congenital Causes (cont'd)

- In ***X-linked hearing*** loss, the mother carries the recessive trait for hearing loss on the sex chromosome and passes it on. Males with X-linked nonsyndromic hearing loss tend to develop more severe hearing loss earlier in life than females who inherit a copy of the same gene mutation. A characteristic of X-linked inheritance is that fathers cannot pass X-linked traits to their sons.
- There are some genetic syndromes, in which, hearing loss is one of the known characteristics. Some examples are Down syndrome (abnormality on a gene), Usher syndrome (autosomal recessive), Treacher Collins syndrome (autosomal dominant), Crouzon syndrome (autosomal dominant), and Alport syndrome (X-linked).
- **Other causes of congenital hearing loss** that are not hereditary in nature include prenatal infections, illnesses, toxins consumed by the mother during pregnancy or other conditions occurring at the time of birth or shortly thereafter. These conditions typically cause Sensorineural hearing loss ranging from mild to profound in degree.

- **Examples include:**
  - Intrauterine infections including rubella (German measles), cytomegalovirus, and herpes simplex virus
  - Complications associated with the Rh factor in the blood
  - Prematurity
  - Maternal diabetes
  - Toxemia during pregnancy
  - Lack of oxygen (anoxia)

http://www.asha.org/public/hearing/disorders/causes.htm https://ghr.nlm.nih.gov/condition/nonsyndromic-hearing-loss#inheritance

Acquired Causes

- **Acquired hearing loss** is a hearing loss which appears after birth, and at any time in one's life, perhaps as a result of a disease, a medical condition, or an injury. The following are examples of conditions that can cause acquired hearing loss (type of hearing loss is also noted):
- **Examples include:**
  - Ear infections (otitis media) Conductive hearing loss
  - Ototoxic (damaging to the auditory system) drugs – Sensorineural hearing loss
  - Meningitis – Sensorineural hearing loss
  - Measles – Sensorineural hearing loss
  - Encephalitis – Sensorineural hearing loss
  - Chicken pox – Sensorineural hearing loss
  - Influenza – Sensorineural hearing loss
  - Mumps – Sensorineural hearing loss
  - Head injury – Conductive or Sensorineural hearing loss
  - Otosclerosis (possibly genetic) - Conductive Hearing loss
  - Noise exposure – Sensorineural hearing loss
  - Aging (presbycusis) - Sensorineural hearing loss
  - Neurologic (central auditory disorder) – Specific auditory performance deficiencies
  - Psychogenic (no organic etiology, malingering(?)) – General auditory dysfunction

http://www.asha.org/public/hearing/disorders/causes.htm

Epidemiology and Statistical Characteristics of Hearing Loss

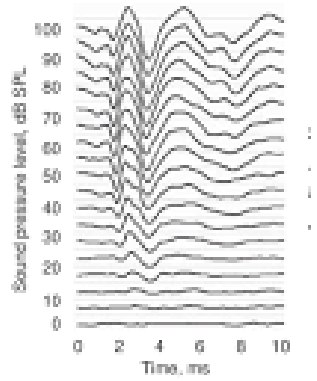
- About 2 to 3 out of every 1,000 children in the United States are born with a detectable level of hearing loss in one or both ears.(1)
- More than 90 percent of deaf children are born to hearing parents.(2)
- Approximately 15% of American adults (37.5 million) aged 18 and over report some trouble hearing.(3)
- Men are more likely than women to report having hearing loss.(3)
- One in eight people in the United States (13 percent, or 30 million) aged 12 years or older has hearing loss in both ears, based on standard hearing examinations.(4)
- About 2 percent of adults aged 45 to 54 have disabling hearing loss. The rate increases to 8.5 percent for adults aged 55 to 64. Nearly 25 percent of those aged 65 to 74 and 50 percent of those who are 75 and older have disabling hearing loss.(5)
- The NIDCD estimates that approximately 15 percent of Americans (26 million people) between the ages of 20 and 69 have high frequency hearing loss due to exposure to noise at work or during leisure activities.(6)
- Roughly 10 percent of the U.S. adult population, or about 25 million Americans, has experienced tinnitus lasting at least five minutes in the past year.(7)
- Among adults aged 70 and older with hearing loss who could benefit from hearing aids, fewer than one in three (30 percent) has ever used them. Even fewer adults aged 20 to 69 (approximately 16 percent) who could benefit from wearing hearing aids have ever used them.(8)
- As of December 2012, approximately 324,200 cochlear implants have been implanted worldwide. In the United States, roughly 58,000 devices have been implanted in adults and 38,000 in children.(9)
- Five out of 6 children experience ear infection (otitis media) by the time they are 3 years old.(10)

Compiled by the National Institute on Deafness and Other Communication Disorders (NIDCD, 2015).

Audiometry

Identifying Hearing Loss Through the First Year

- Parents' reports (case history)
- Informal observation by specialists
- Formal testing:
  - ✓Behavioral Observation Audiometry
  - ✓Visual Reinforcement Audiometry
  - ✓Middle Ear Immittance Testing
  - ✓Auditory Brainstem Response Audiometry
  - ✓Otoacoustic Emissions

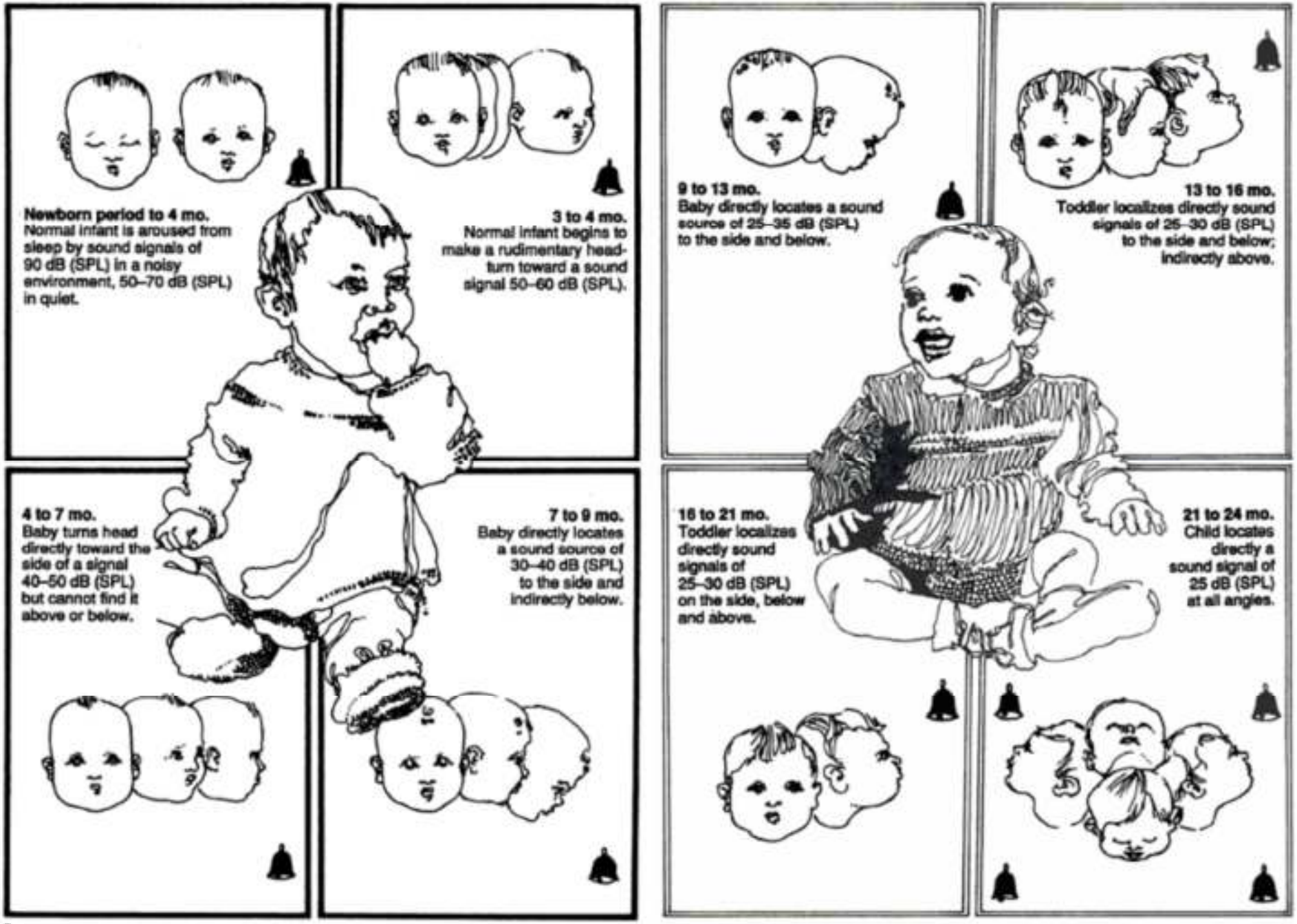


Typical Response Levels to Sounds from birth-2 years

Age Range	Types of Behavioral Responses	Warble tones (in dB HL)	Speech[b] (in dB HL)	Noisemakers (in dB SPL, approximate)
0 to 6 weeks	Eye-blink Eye-widening Startle Arousal/stirring from sleep	78	40–60	50–70
6 weeks to 4 months	Eye-blink Eye-widening Eye shift Quieting Rudimentary head turn starts by 4 months	70	47	50–60
4 to 7 months	Head turn laterally toward sound Listening attitude	51	21	40–50
7 to 9 months	Directly localizes to side Indirectly localizes below ear level	45	15	30–40
9 to 13 months	Directly localizes to side & below ear level Indirectly localizes above ear level	38	8	25–35
13 to 16 months	Directly localizes to side/below/above ear level	32	5	25–30
16 to 21 months	Directly localizes to side/below/above ear level	25	5	25
21 to 24 months	Directly localizes to side/below/above ear level	26	3	25

[a] Adapted from J.L. Northern and M.P. Downs, 1991. *Hearing in Children*, 4th ed. Baltimore, MD: Williams and Wilkins, with permission.

[b] A startle response to speech is typically expected at 65dB HL for all of the age groups shown.

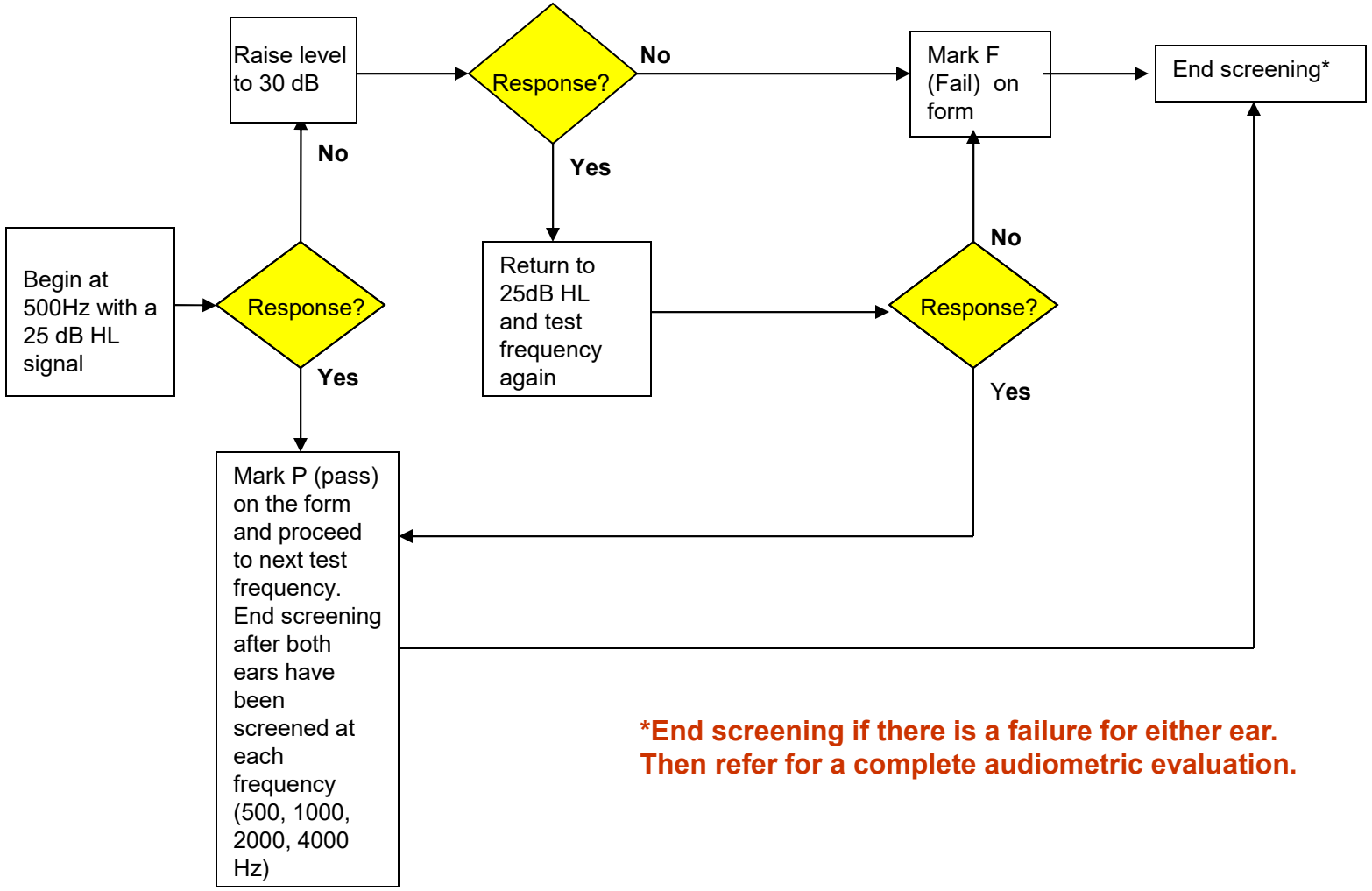


Northern and Downs (1991). Hearing in Children, 4th ed, Baltimore: Williams and Wilkins (with permission)

Hearing Screening

Hearing Screening

Hearing Screening Procedures Flow Chart



***End screening if there is a failure for either ear. Then refer for a complete audiometric evaluation.**

Guidelines for Audiometric Screenings. ASHA. Retrieved 2020 from https://www.asha.org/PRPSpecificTopic.aspx?folderid=8589942721&section=Key_Issues

Instructions:

In this simulation if the caricature hears the test signal at 25dB HL (as indicated by the raising of its hand ), write a **P** in the appropriate space, to indicate **PASS.** If the caricature does not hear the 25dB HL signal, raise the signal to 30dB HL. This is to get its attention. Then immediately return to 25dB HL. If the caricature does not hear the signal at 25dB HL, at any frequency,  use an **F** to indicate **FAIL** for that frequency. Also, indicate a **FAIL** if you had to raise the signal level to 30 dB twice in the same ear. A person fails the screening as soon as he/she fails to respond to a test frequency at the screening level (25 dB HL).

Simulation #1	500 Hz	1000 Hz	2000 Hz	4000 Hz
Right				
Left				

Start Simulation #1

Passed Screening

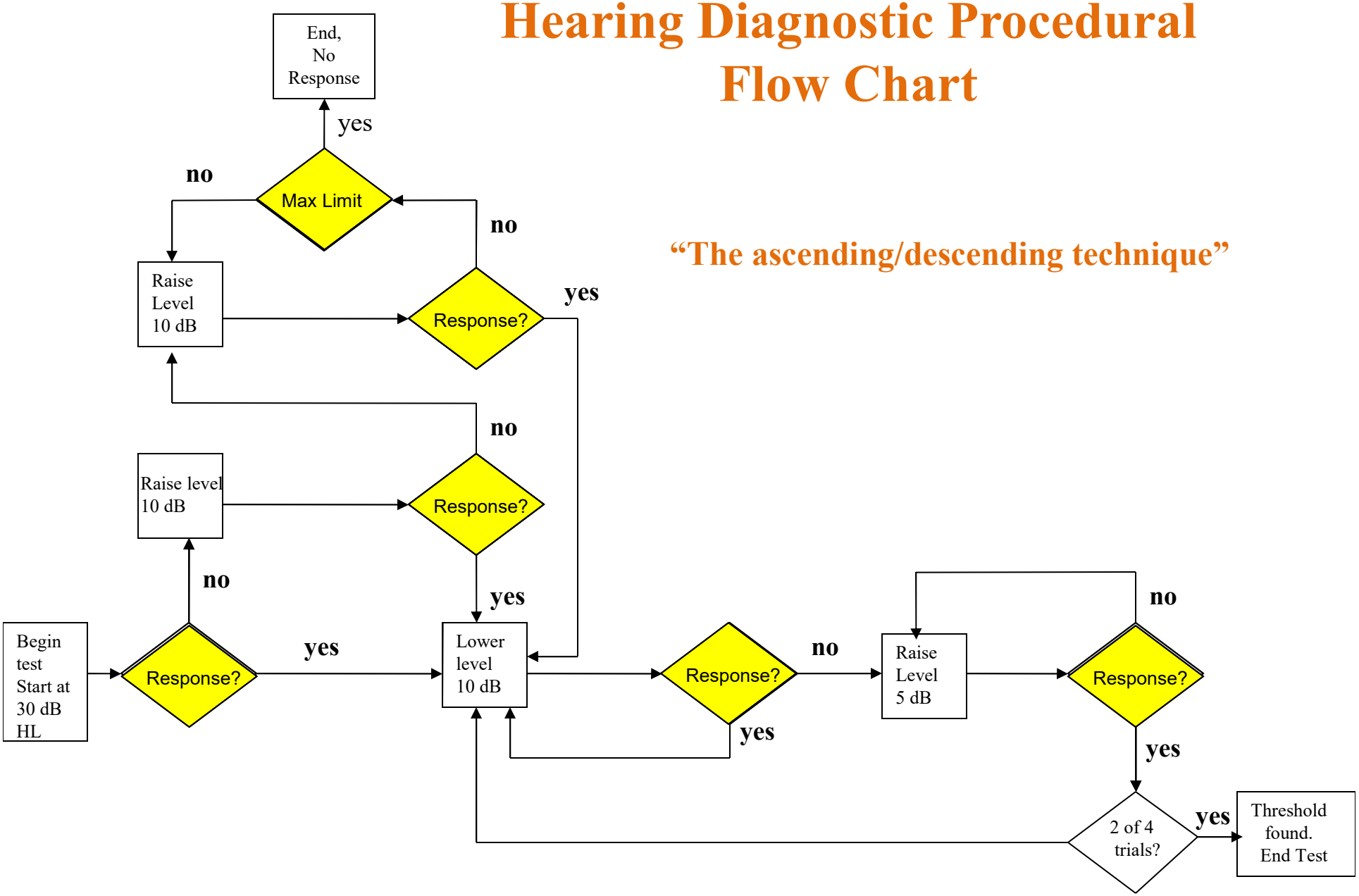
	500 Hz	1000 Hz	2000 Hz	4000 Hz
Right	P	P	P	P
Left	P	P	P	P

Failed Screening

	500 Hz	1000 Hz	2000 Hz	4000 Hz
Right	P	P	F	F
Left	P	P	F	F

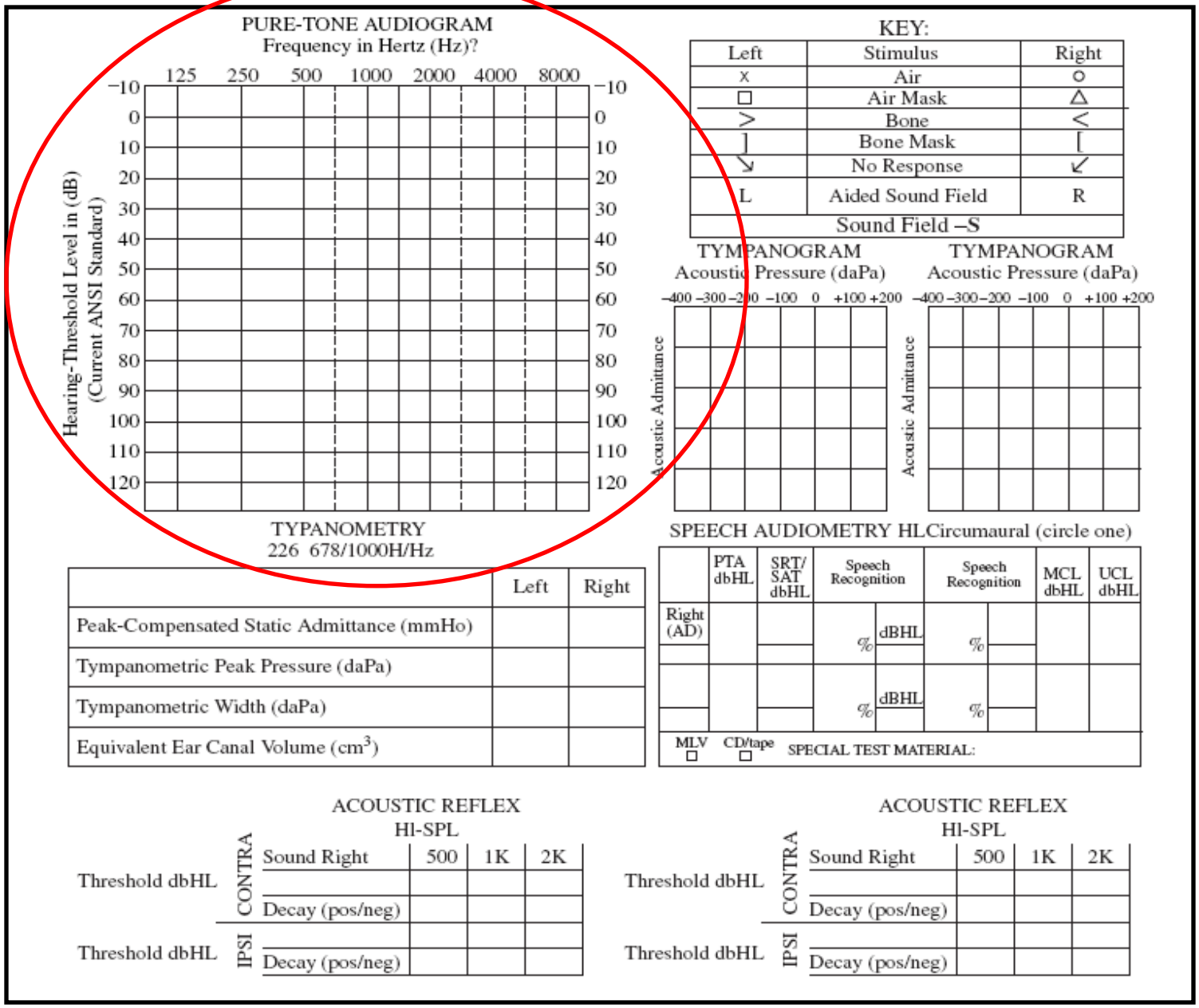
Pure Tone Threshold Audiometry

Hearing Diagnostic Procedural Flow Chart



"The ascending/descending technique"

The Audiogram



FREQUENCY IN HERTZ (Hz)

HEARING LEVEL IN DECIBELS (dB)

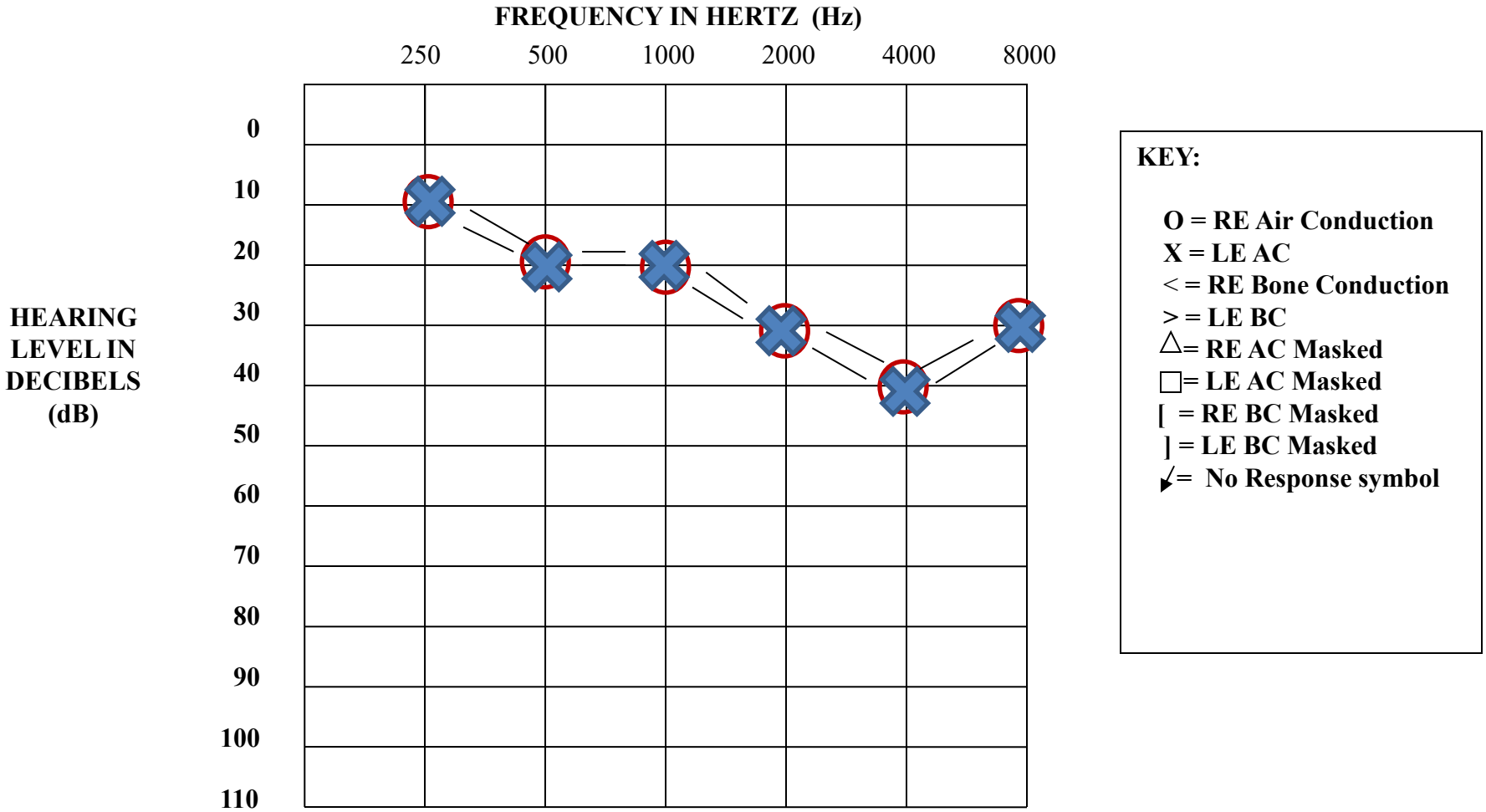
	250	500	1000	2000	4000	8000
0						
10						
20						
30						
40						
50						
60						
70						
80						
90						
100						
110						

KEY:

O = RE Air Conduction
X = LE AC
< = RE Bone Conduction
> = LE BC
△= RE AC Masked
□= LE AC Masked
[= RE BC Masked
] = LE BC Masked
↙= No Response symbol

Start Simulation #2

Simulation Results



TUTORIAL ON INTERPRETING AUDIOGRAMS

To accurately interpret an audiogram, look carefully at the completed audiogram and ask yourself the following questions:

1. **Is there a hearing loss?**
   - Answer: If any of the threshold responses on the audiogram, for either ear, **fall below 15 dB HL**, the answer to this question is yes, there is a hearing loss. Otherwise, no.
2. **Which ear?**
   - Answer: If the hearing loss is in one ear only, the loss is considered a **unilateral hearing loss** (which implies that the other ear is normal). If you say the loss is unilateral, though, you must then say which ear has the loss. If the loss is in both ears, the loss is considered to be a **bilateral hearing loss**.
3. **Is the loss symmetrical or asymmetrical?**
   - Answer: if there is a 15 decibel or greater difference between two or more air conduction thresholds between the two ears, the loss is considered **asymmetrica**l (dissimilar). The hearing loss is considered **symmetrical** (similar) when the thresholds in both ears at each frequency are approximately equal. A unilateral hearing loss is always, by definition, asymmetrical.
4. **What is the degree and configuration of the hearing loss?**
   - Answer: Thresholds for an ear with a hearing loss will fall somewhere between the normal range of hearing (-10 to 20 db HL) down to the profound hearing loss range (90+dB HL). Consequently, the hearing thresholds can be described as being **normal** (0 to 15dBHL), or **slight loss** (16 - 25dB HL), to a mild hearing loss (26 – 40 dBHL); to a **moderate loss** (41 – 55 dBHL); to a **moderately-severe loss** (56-70 dBHL), **severe loss** (71-90 dBHL) and finally to a **profound hearing loss** (91+dBHL).
   - The thresholds also follow specific shapes or patterns. For example, a threshold pattern can **slope gradually** downward from left to right; or it can drop **sharply** or **precipitously**. The patterns can **rise** going from left to right, or it can be **flat**. Rarely do the thresholds show a rising peak and valley (up and down) pattern. The various threshold patterns shown above help to accurately describe the audiogram.
5. **What is the nature of the hearing loss?**
   - Answer: The hearing loss will be the result of either an outer ear, middle ear, inner ear (cochlear), and/or auditory nerve disorder. The loss is considered to be **conductive** if there is outer and/or middle ear involvement only. The loss is **sensorineural** if there is cochlear and/or auditory nerve involvement only. The loss is **mixed** if there is both sensorineural and conductive involvement in the same ear.

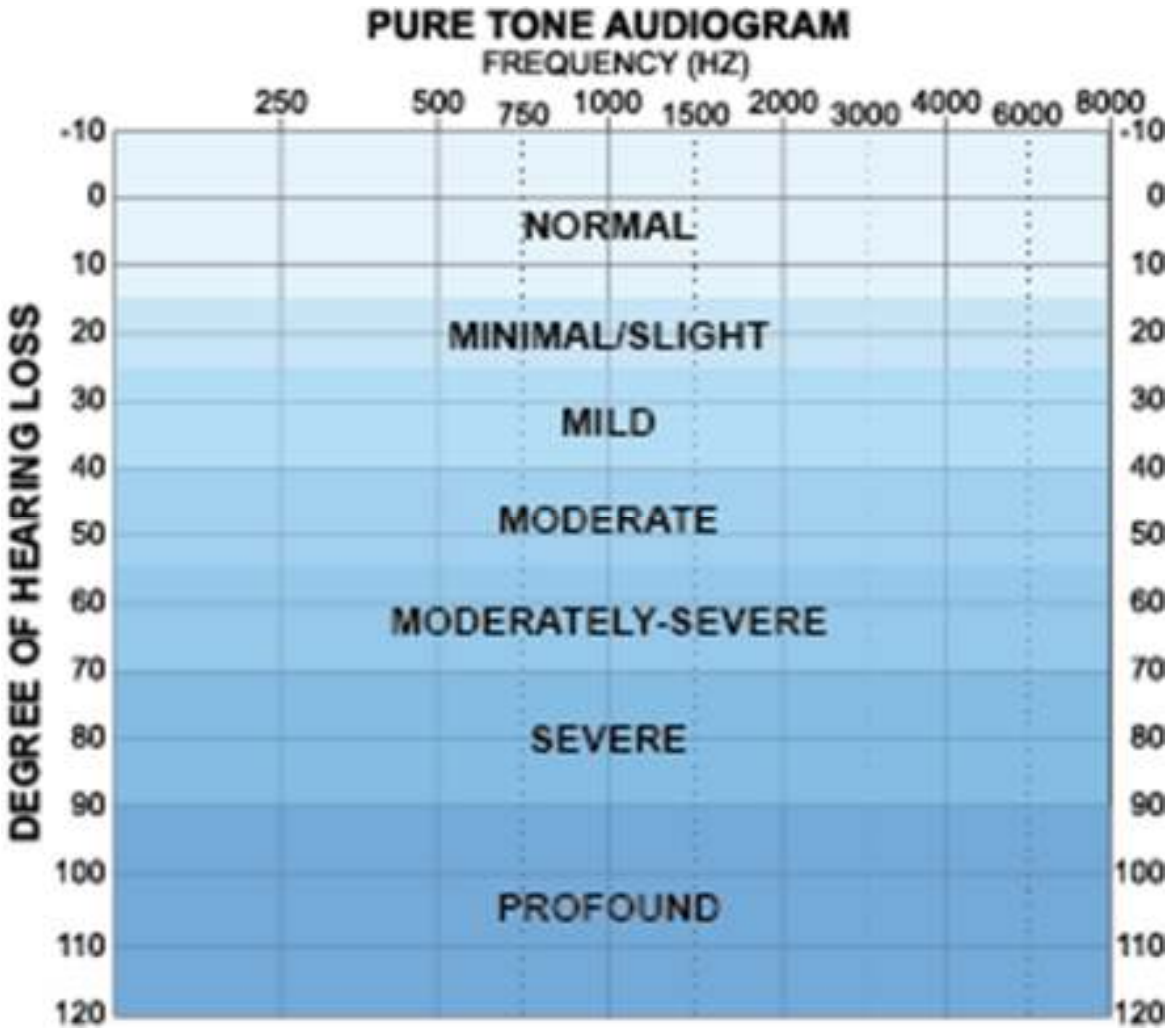
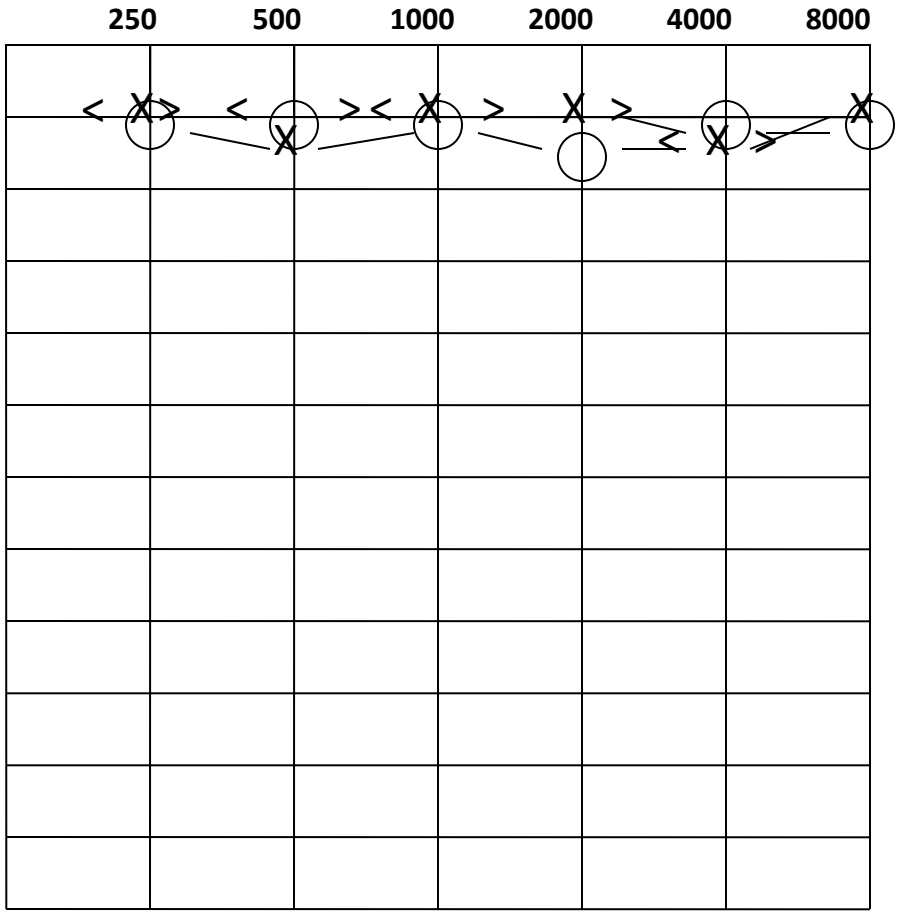


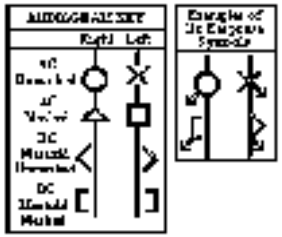
Image source: https://acousticaudiology.ca/about-hearing-loss

#1

FREQUENCY IN HERTZ (Hz)



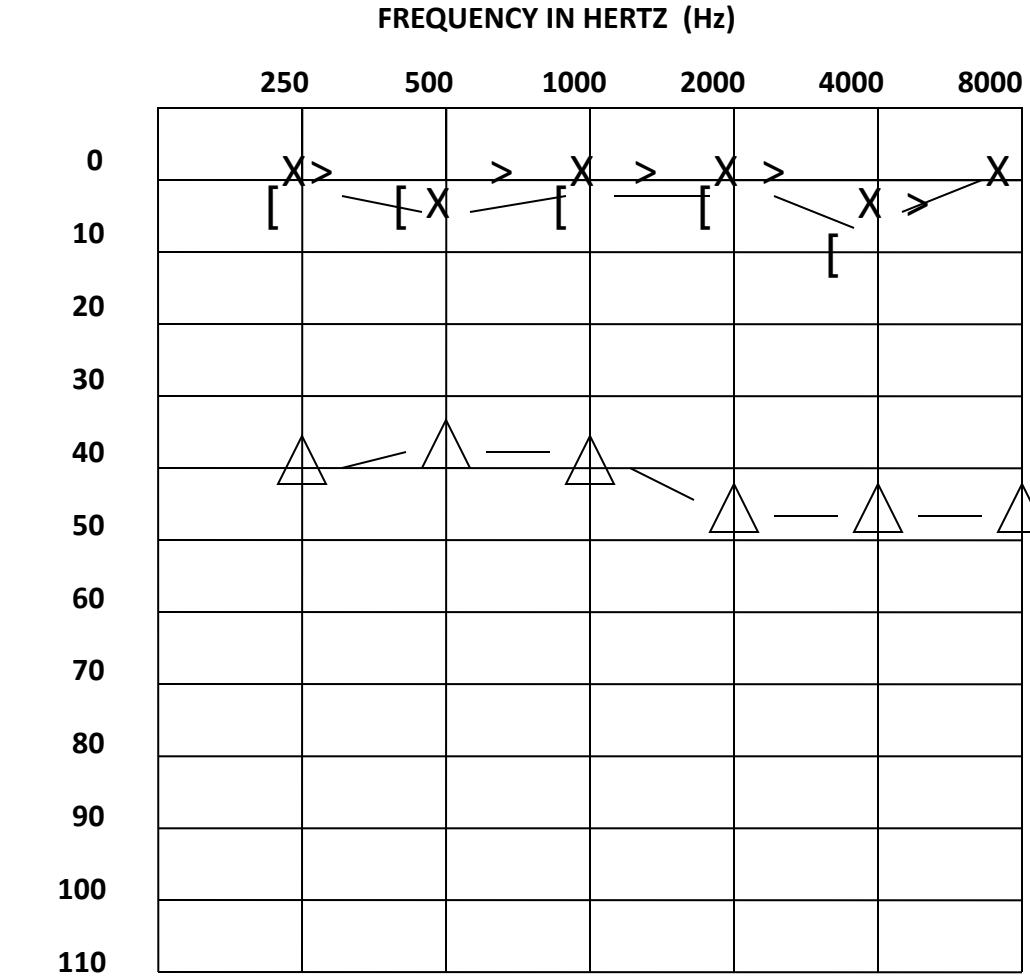
HEARING LEVEL IN DECIBELS (dB)

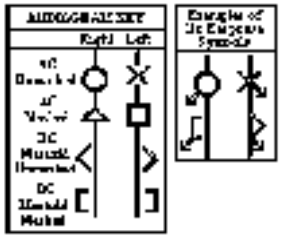


Answer:

Normal hearing sensitivity, bilaterally

#2

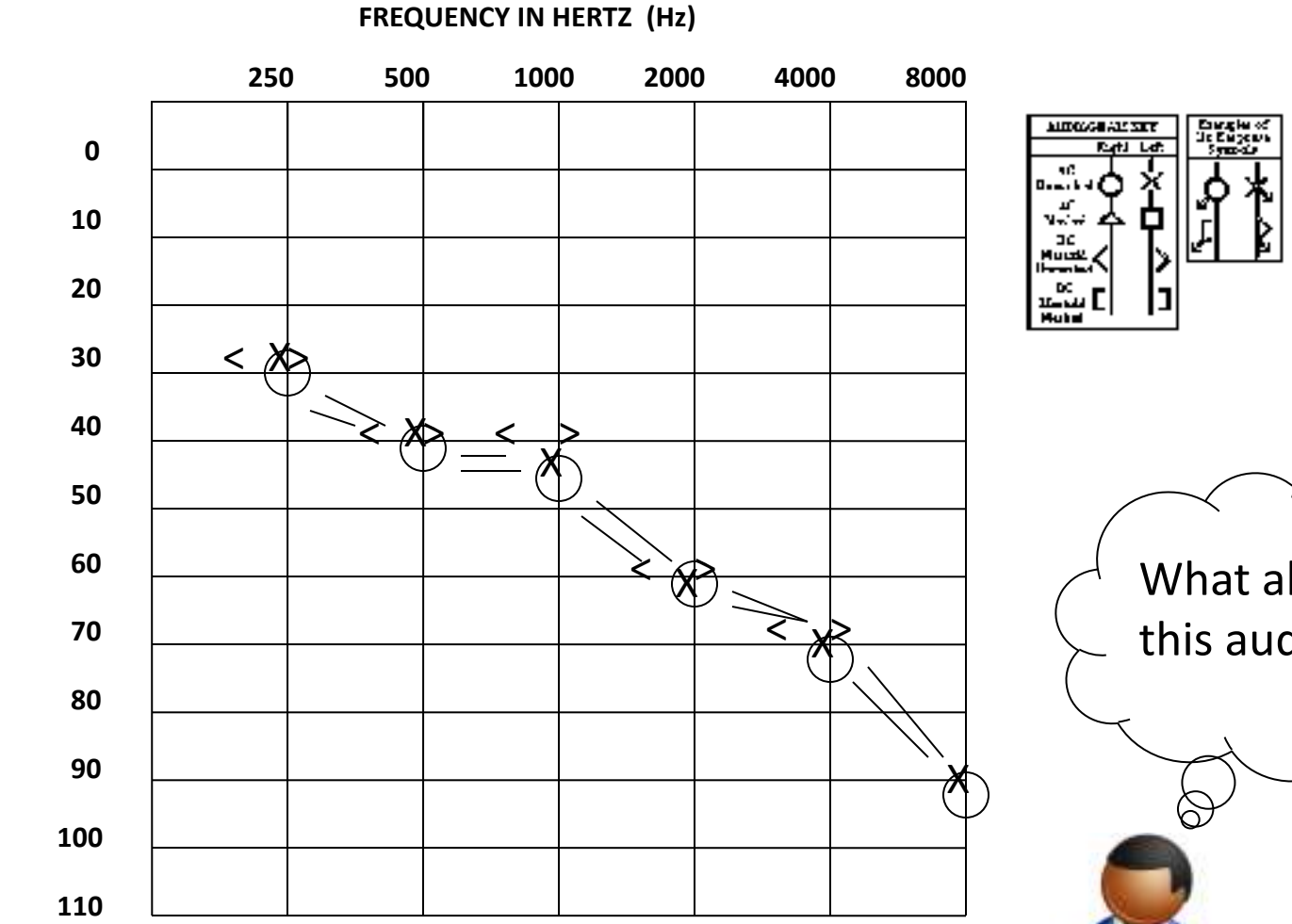




Answer:

Unilateral, flat, mild/moderate conductive hearing loss in the right ear .(Hearing appears normal in the left).

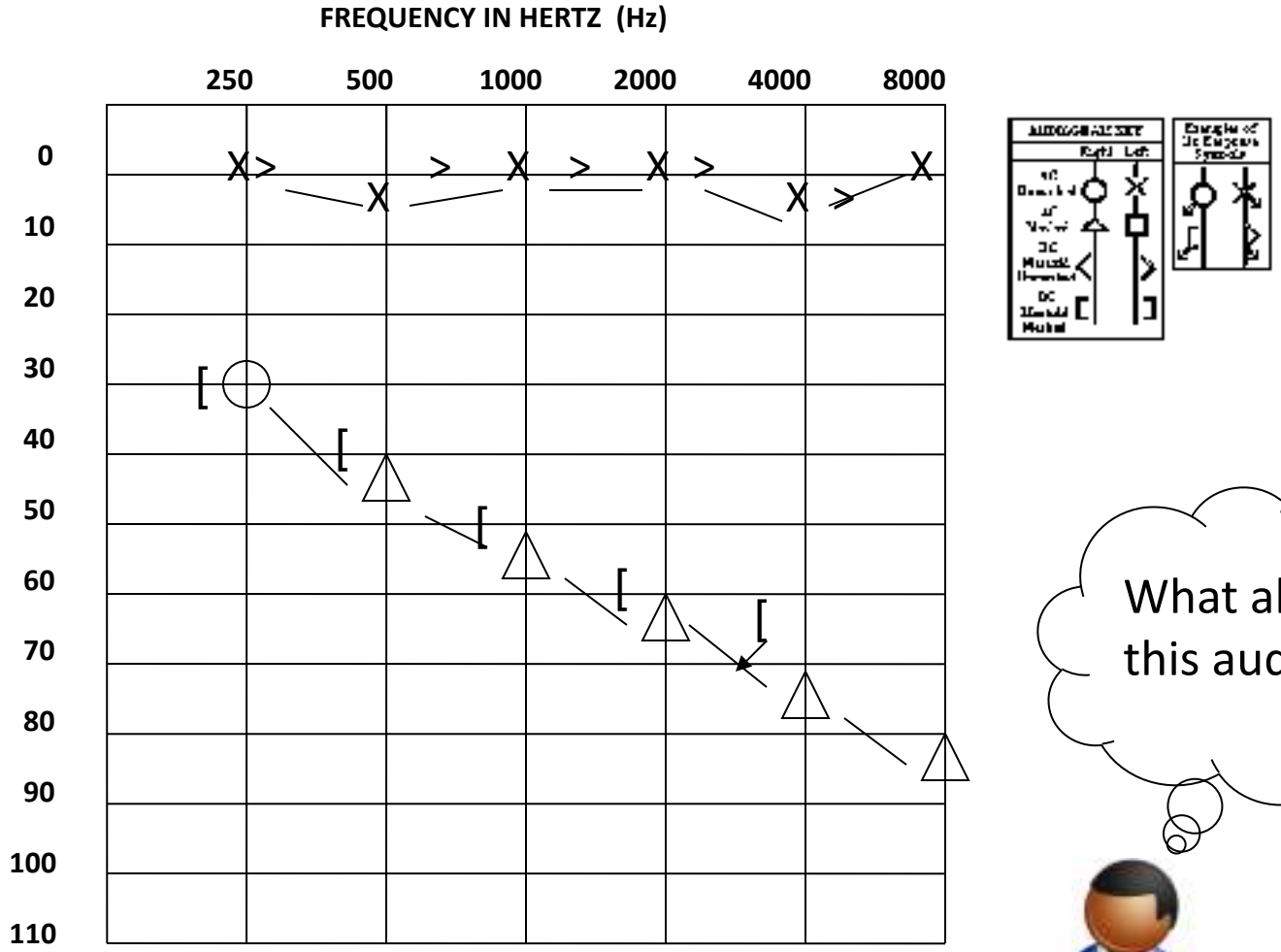
#3



Answer:

Bilateral, symmetrical, sloping, mild to profound sensorineural hearing loss.

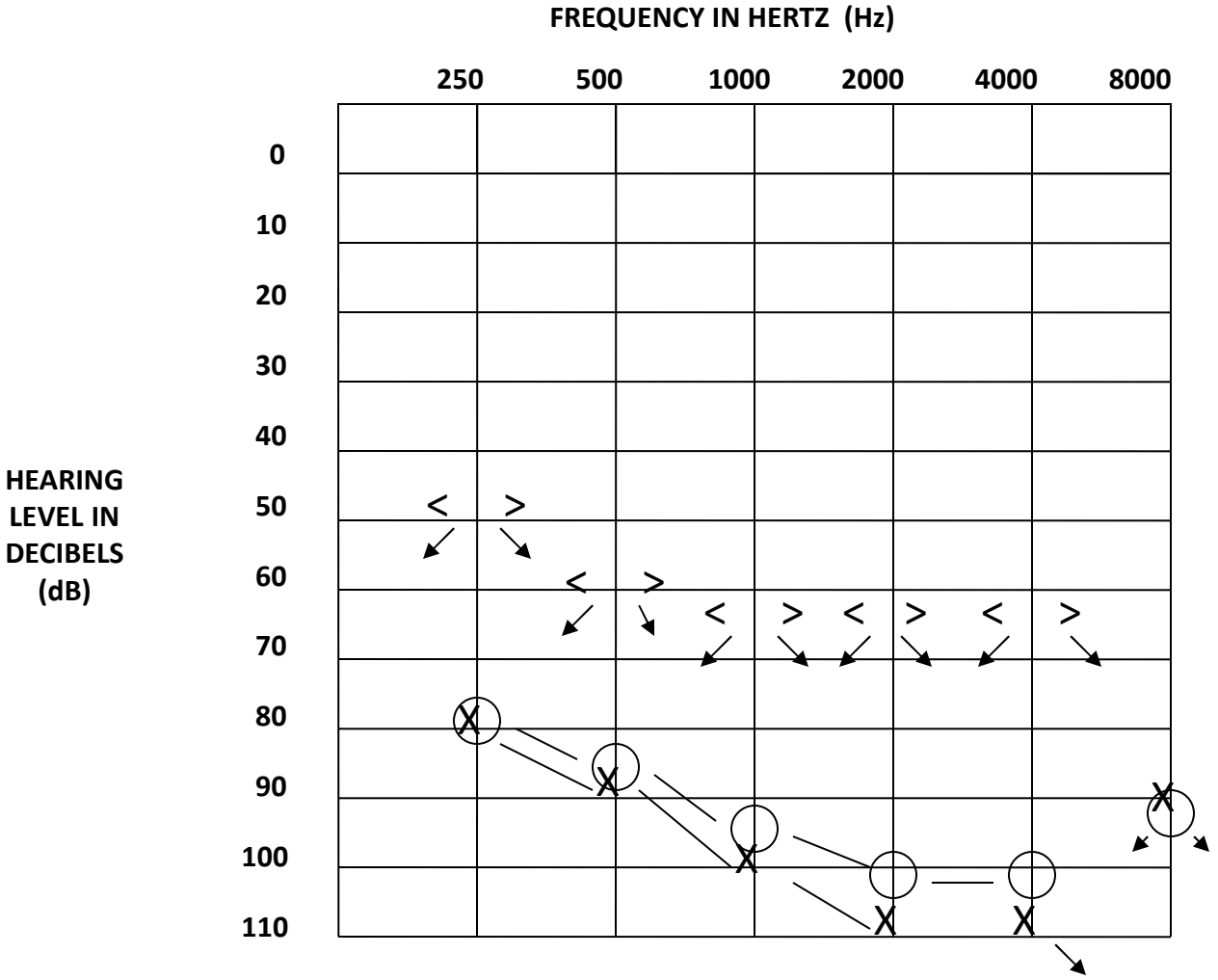
#4

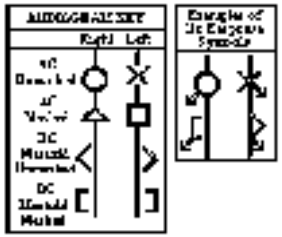


Answer:

Unilateral, sloping, mild to severe sensorineural hearing loss in the right ear. (Hearing appears normal in the left).

#5

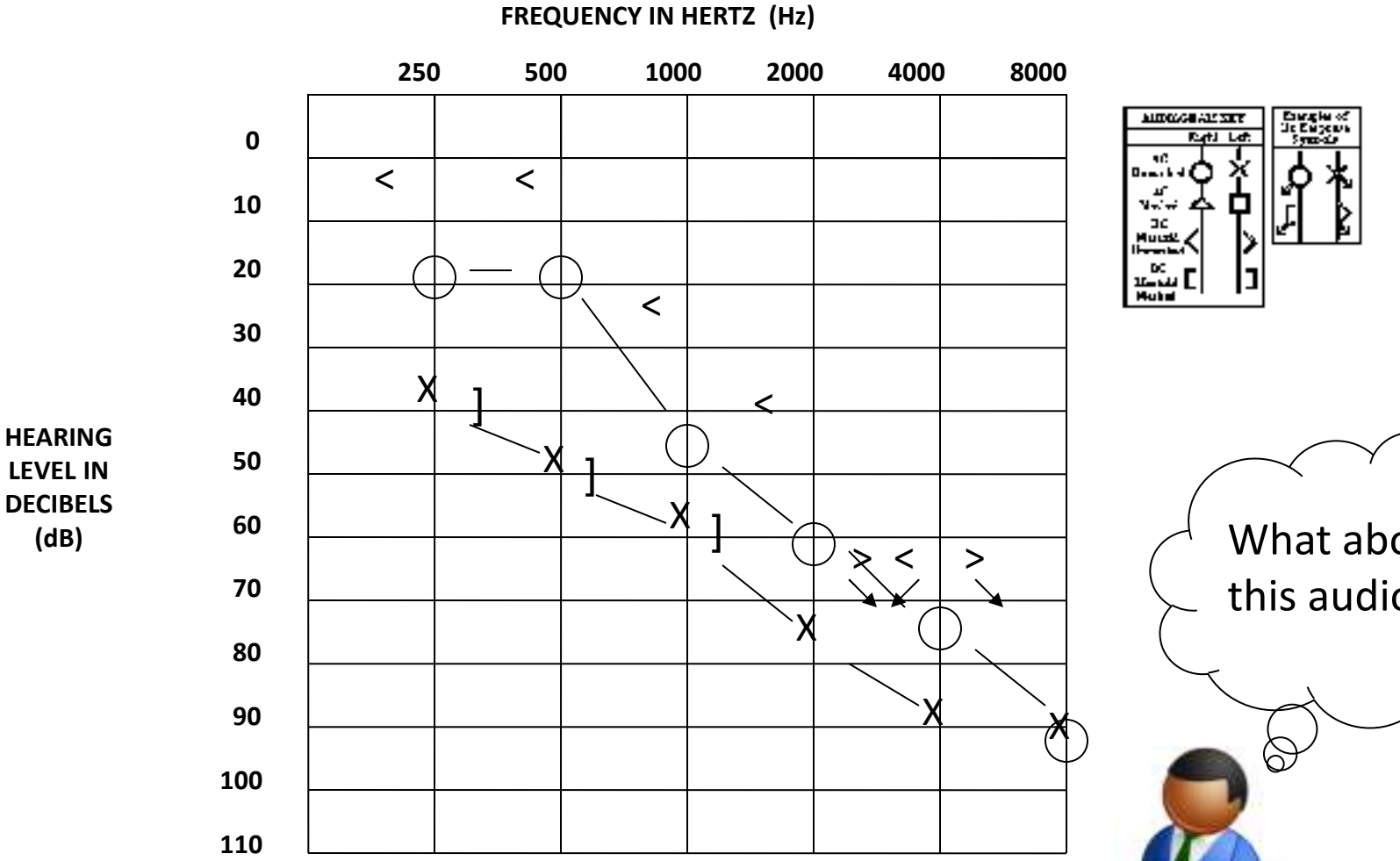




Answer:

Bilateral, symmetrical, sloping, severe to profound sensorineural hearing loss.

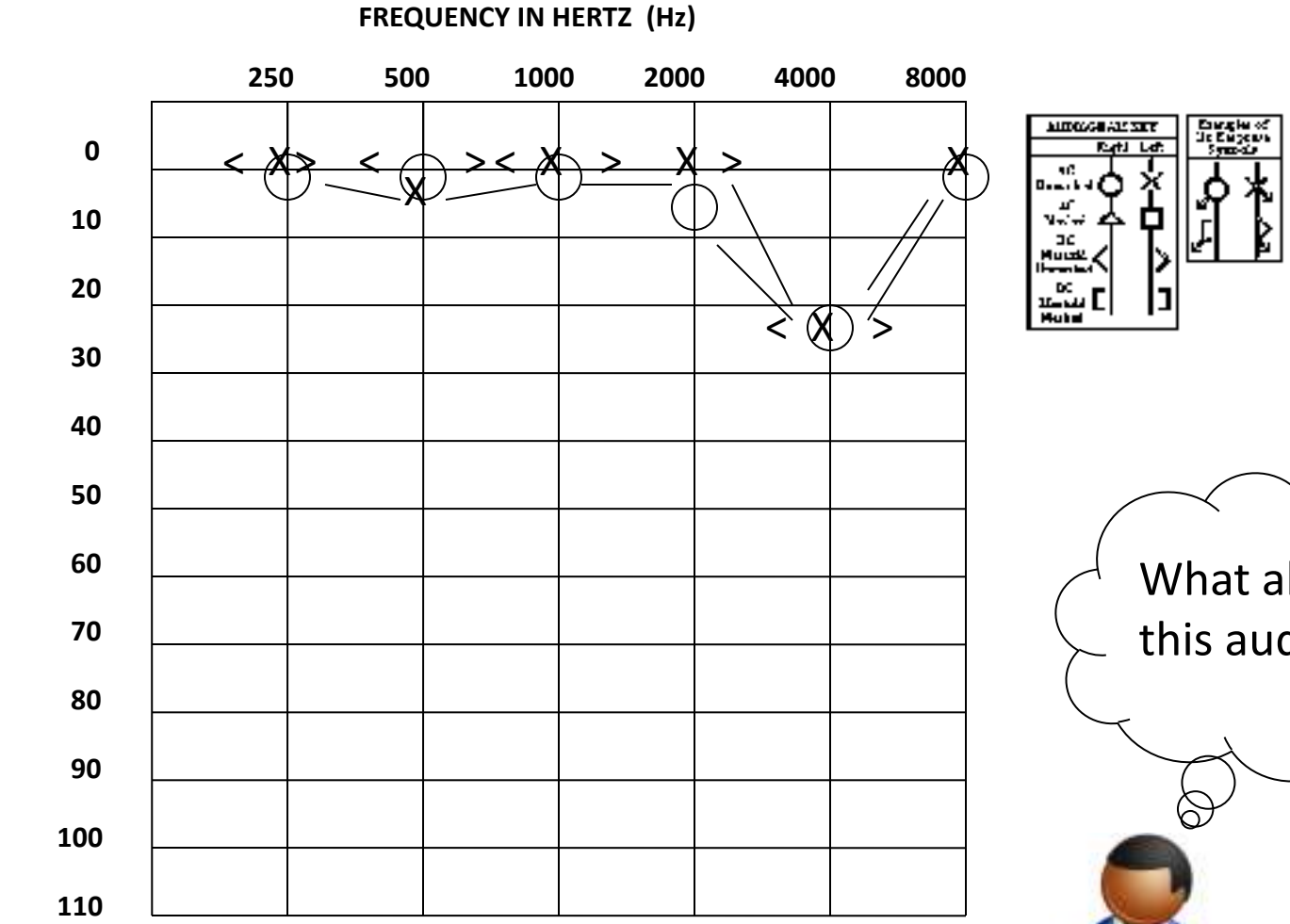
#6



Answer:

Bilateral asymmetrical hearing loss. Right ear thresholds show a sharply sloping, low normal to profound mixed loss. The left ear's thresholds show a sloping, mild to profound sensorineural loss.

#7

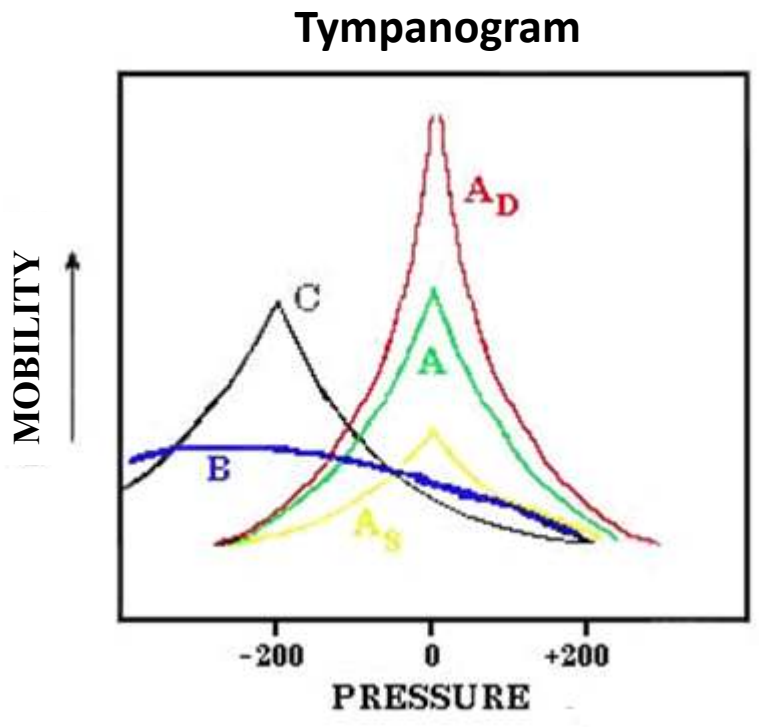


Answer:

Thresholds show normal hearing sensitivity in both ears through to 2000Hz, with a bilateral, symmetrical, mild sensorineural loss at 4000Hz rising back to normal hearing at 8000Hz.

Tympanometry

A tympanogram is a graphic representation of how the tympanic membrane (and the ossicles) move in response to changes in air pressure in the ear canal. During tympanometry, pressure in the external ear canal is made to vary from +200 decapascals (daPa) to -200 daPa. The back and forth movement of the TM and ossicles is graphed and measured.



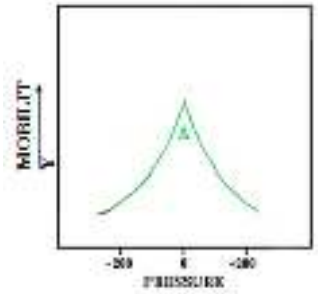
Portable Tympanometer

Tympanometry Probe Placement

Tympanograms are classified according to type, with each indicating a different mobility pattern for the middle ear system.

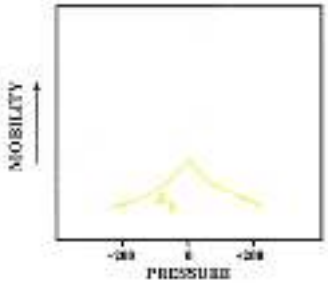
Type A. (Normal)

The peak compliance occurs at or near atmospheric pressure indicating normal pressure in the middle ear, and normal tympanic membrane and ossicles mobility.



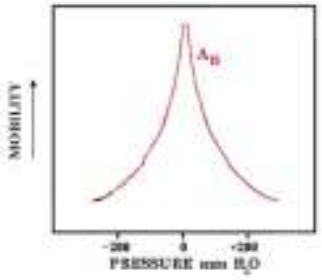
Type AS

A shallow curve compared to the normal Type A. This indicates a stiff system, as in otosclerosis or tympanosclerosis.



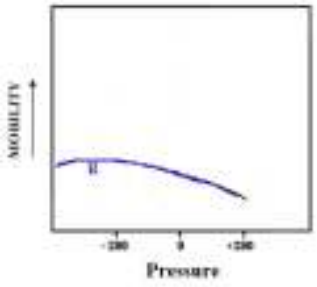
Type AD

A high curve with a tall peak in comparison to a Type A. This indicates an abnormally compliant middle ear system, as seen in ossicular dislocation or ossicular erosion, or loss of elastic fibers in the tympanic membrane.



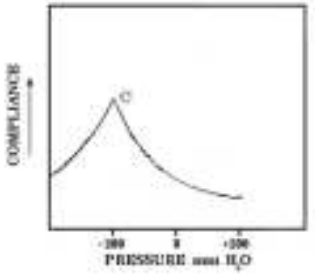
Type B

No sharp peak, with little or no variation in mobility over a wide range of pressure changes. This is usually secondary to fluid buildup in the middle ear (otitis media).

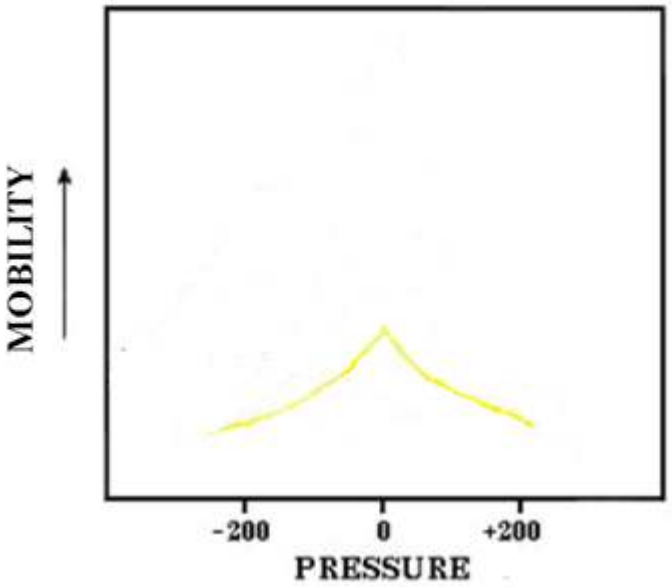


Type C

Peak mobility is significantly negative, indicating there is negative pressure in the middle ear cavity. This finding is often indicative of Eustachian tube dysfunction and the onset of or recovery from otitis media.

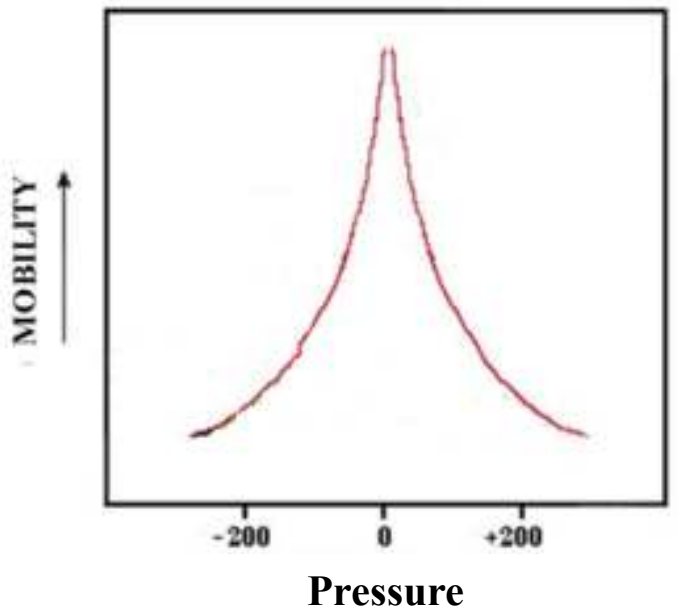


What type of tympanogram is this?



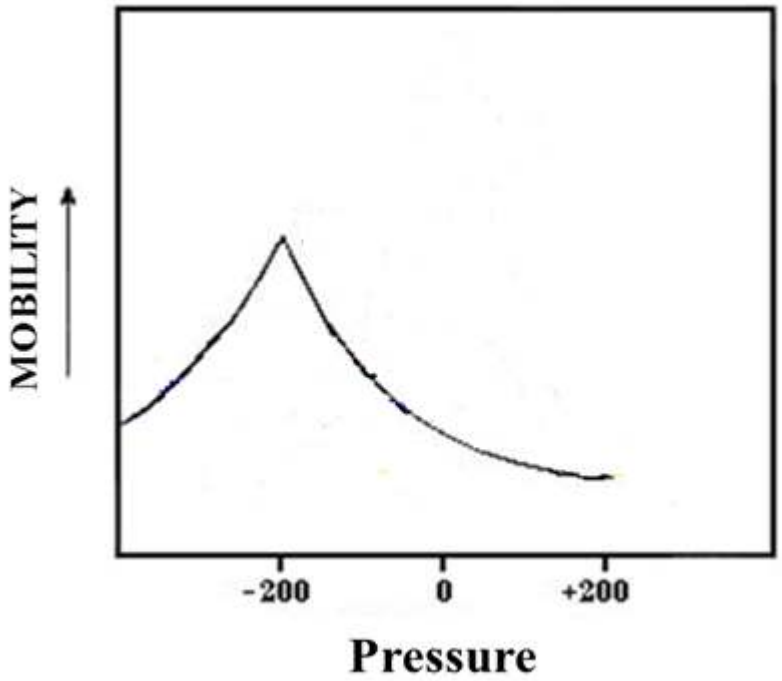
Answer: ?

What type of tympanogram is this?



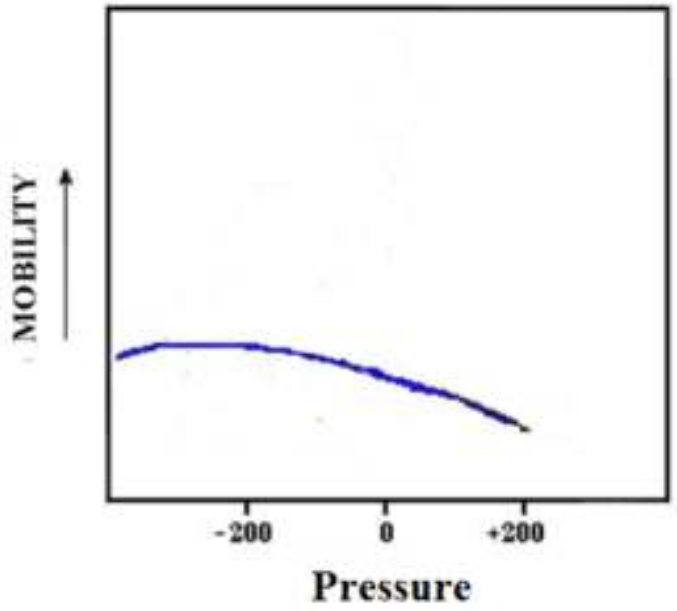
Answer: ?

What type of tympanogram is this?



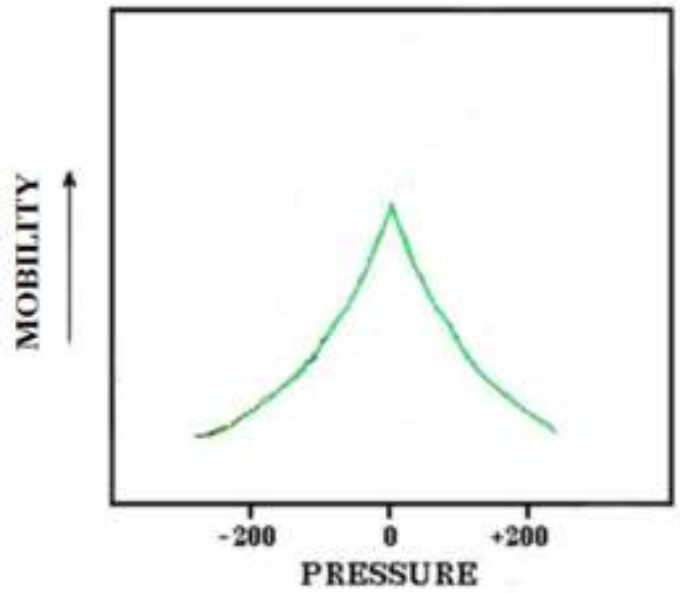
Answer: ?

What type of tympanogram is this?



Answer: ?

What type of tympanogram is this?

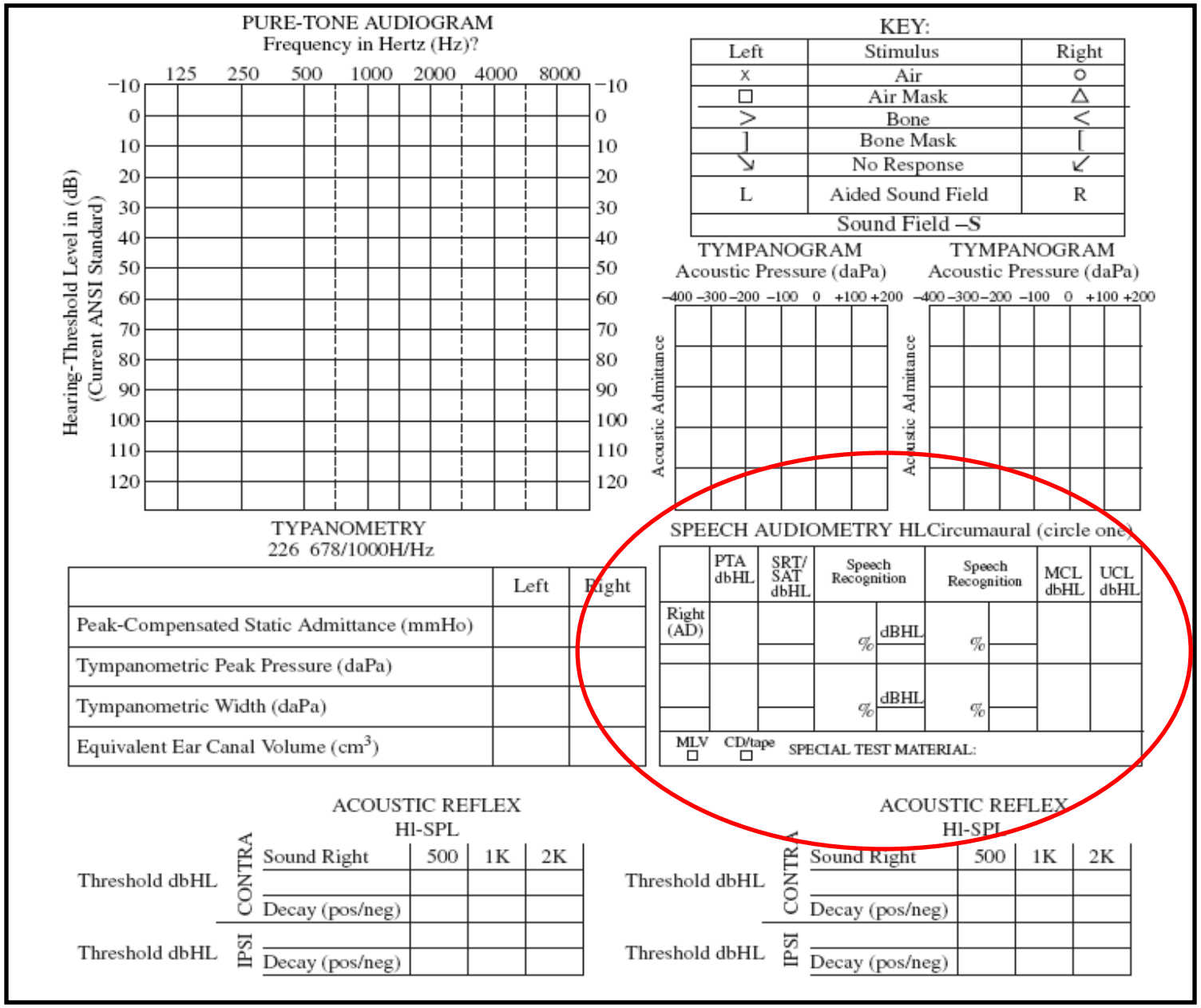


Answer: ?

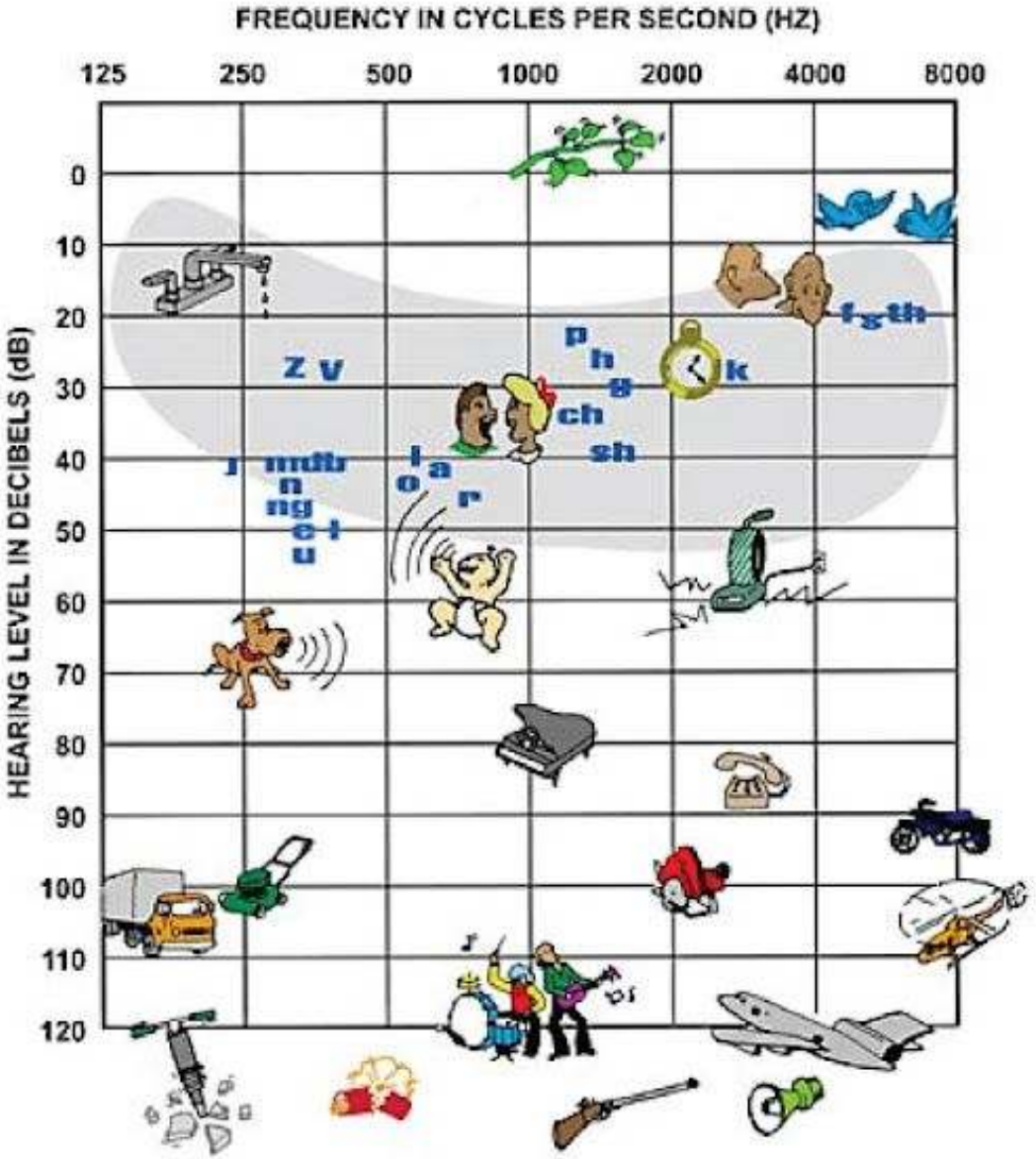
Speech Audiometry

- Purpose
  - Attempt to measure the ability to understand everyday conversational communication

The Audiogram



AUDIOGRAM OF FAMILIAR SOUNDS



Speech results when hearing is normal.

SPEECH AUDIOMETRY HLCircumaural (circle one)

	PTA dbHL	SRT/ SAT dbHL	Speech Recognition		Speech Recognition		MCL dbHL	UCL dbHL
Right (AD)	10	10	100 %	50 dBHL	%		50	100
Left (AS)	10	10	100 %	50 dBHL	%		50	100
MLV ☐ CD/tape ☐ SPECIAL TEST MATERIAL:								

Typical speech results when there is a significant hearing loss.

SPEECH AUDIOMETRY HLCircumaural (circle one)

	PTA dbHL	SRT/ SAT dbHL	Speech Recognition		Speech Recognition		MCL dbHL	UCL dbHL
Right (AD)	50	50	60 %	85 dBHL	%		85	90
Left (AS)	50	50	60 %	85 dBHL	%		85	90
MLV ☐ CD/tape ☐ SPECIAL TEST MATERIAL:								

Can you read these two sentences?

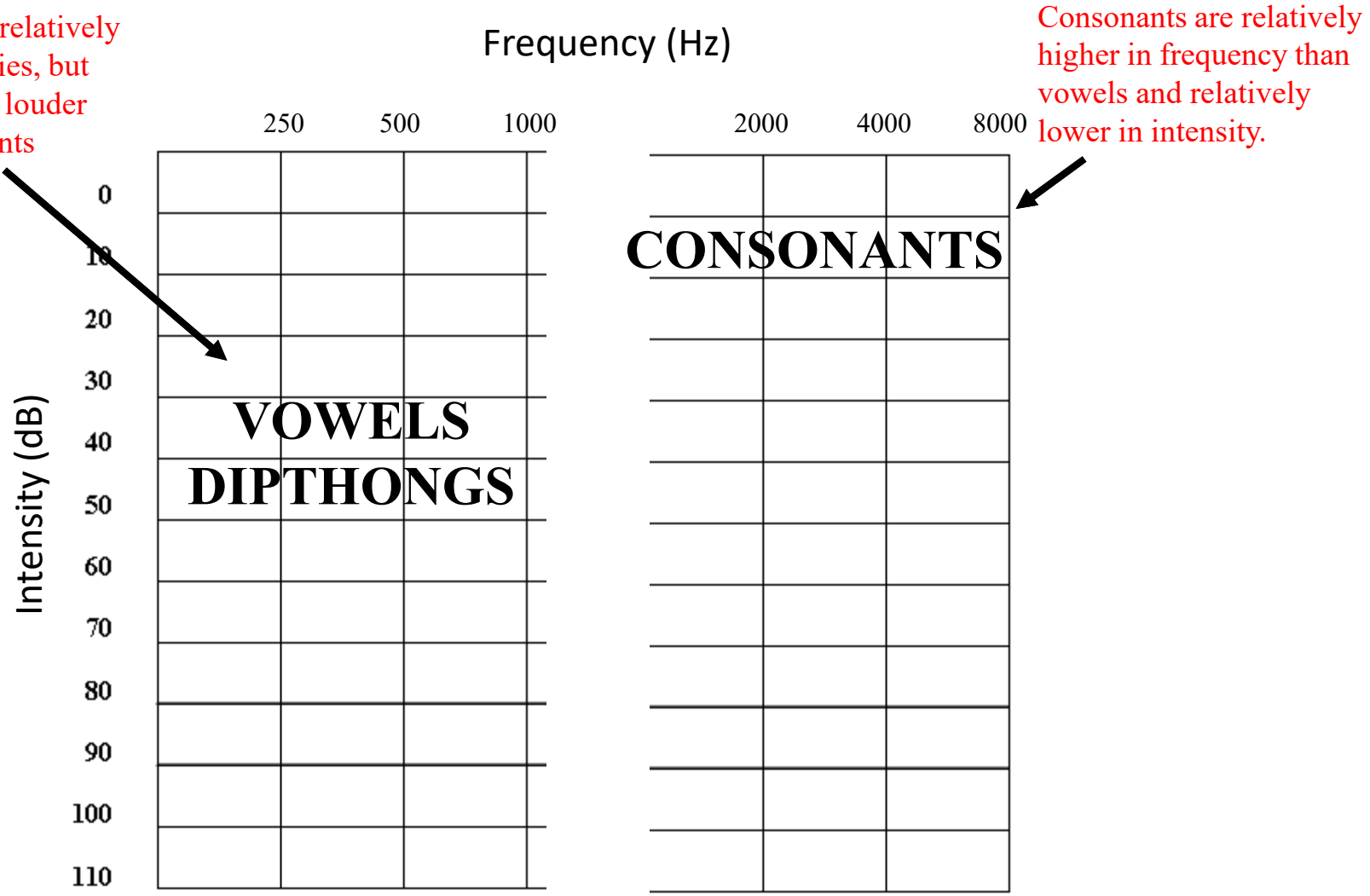
1. _I_ _AL_Y _AILOR_ A_E _AN_WI_ _E_ _Y
   _ _ E O_EAN.

2. _ ALLY _ OLD _ EA _ _ ELL _ _ Y _ _ E _ EA
   _ _ ORE.

Not likely if high frequency consonant sounds are missing.

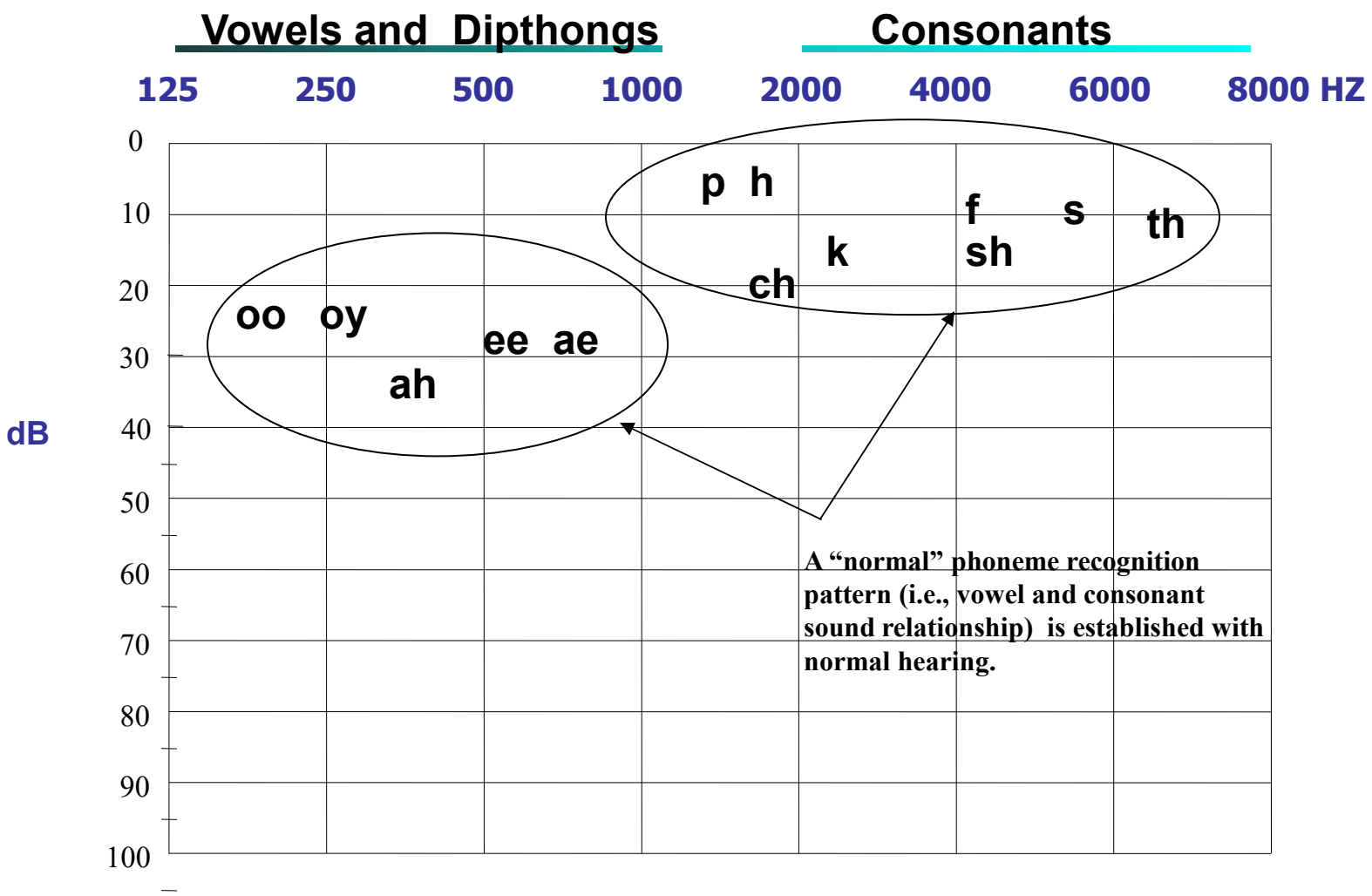
The Split Audiogram for speech

Vowels have relatively low frequencies, but are relatively louder than consonants

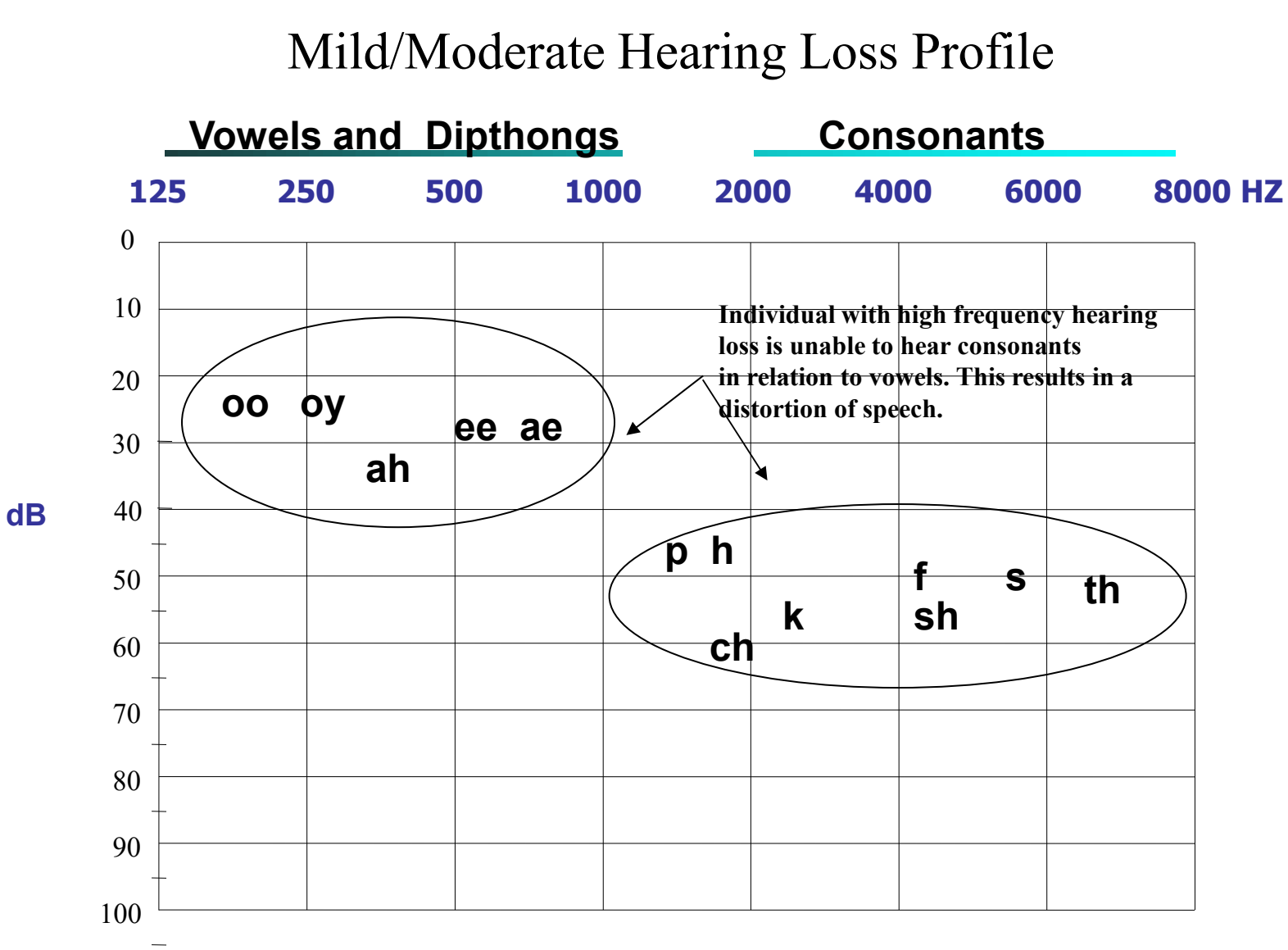


Consonants are relatively higher in frequency than vowels and relatively lower in intensity.

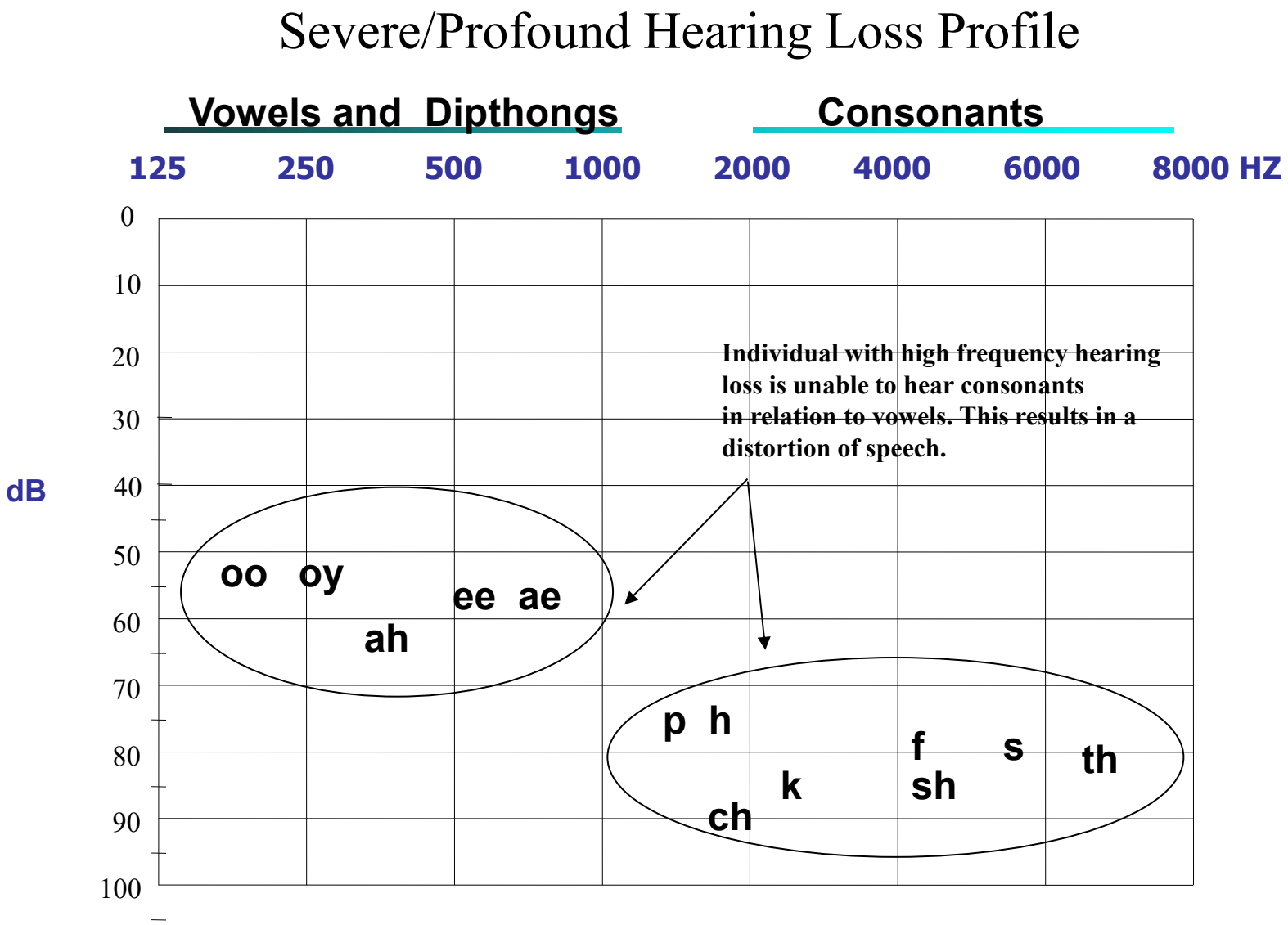
Speech Sounds: Relative frequency and intensity levels.



Speech Sounds: Relative frequency and intensity levels.

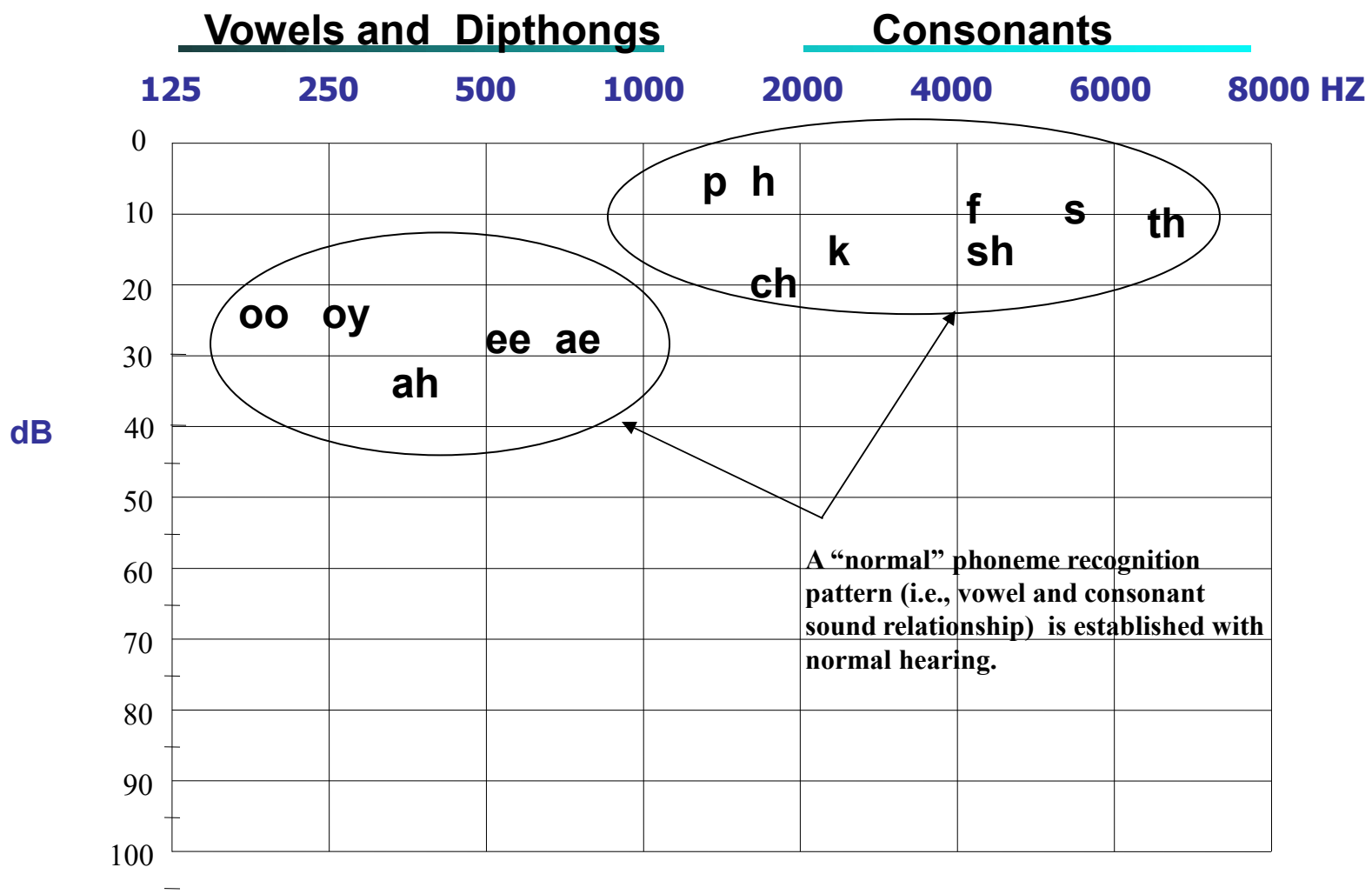


Speech Sounds: Relative frequency and intensity levels.



Speech Sounds: Relative frequency and intensity levels.

Restored Normal Hearing Profile



Can you read these sentences now?

1. SIX SALTY SAILORS ATE SANDWICHES BY THE OCEAN.

2. SALLY SOLD SEASHELLS BY THE SEASHORE.

You should because the consonants were added. Consonants provide speech intelligibility. Vowels provide speech energy.

Useful resources regarding the auditory system

https://www.babyhearing.org/

https://successforkidswithhearingloss.com/for-professionals/typical-auditory-development/

https://www.boystownhospital.org/knowledge-center/supporting-auditory-skills-development-home

http://www.asha.org/uploadedFiles/AIS-Noise.pdf

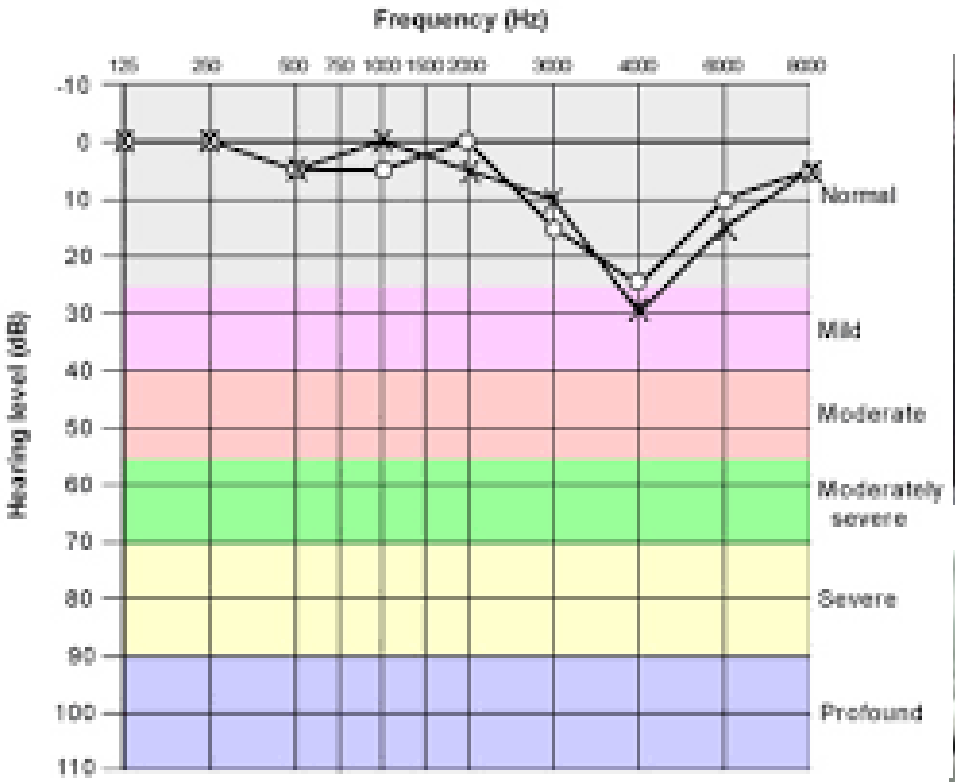
http://www.cdc.gov/niosh/docs/96-110/

http://www.cdc.gov/niosh/topics/noise/hearingchecklist.html

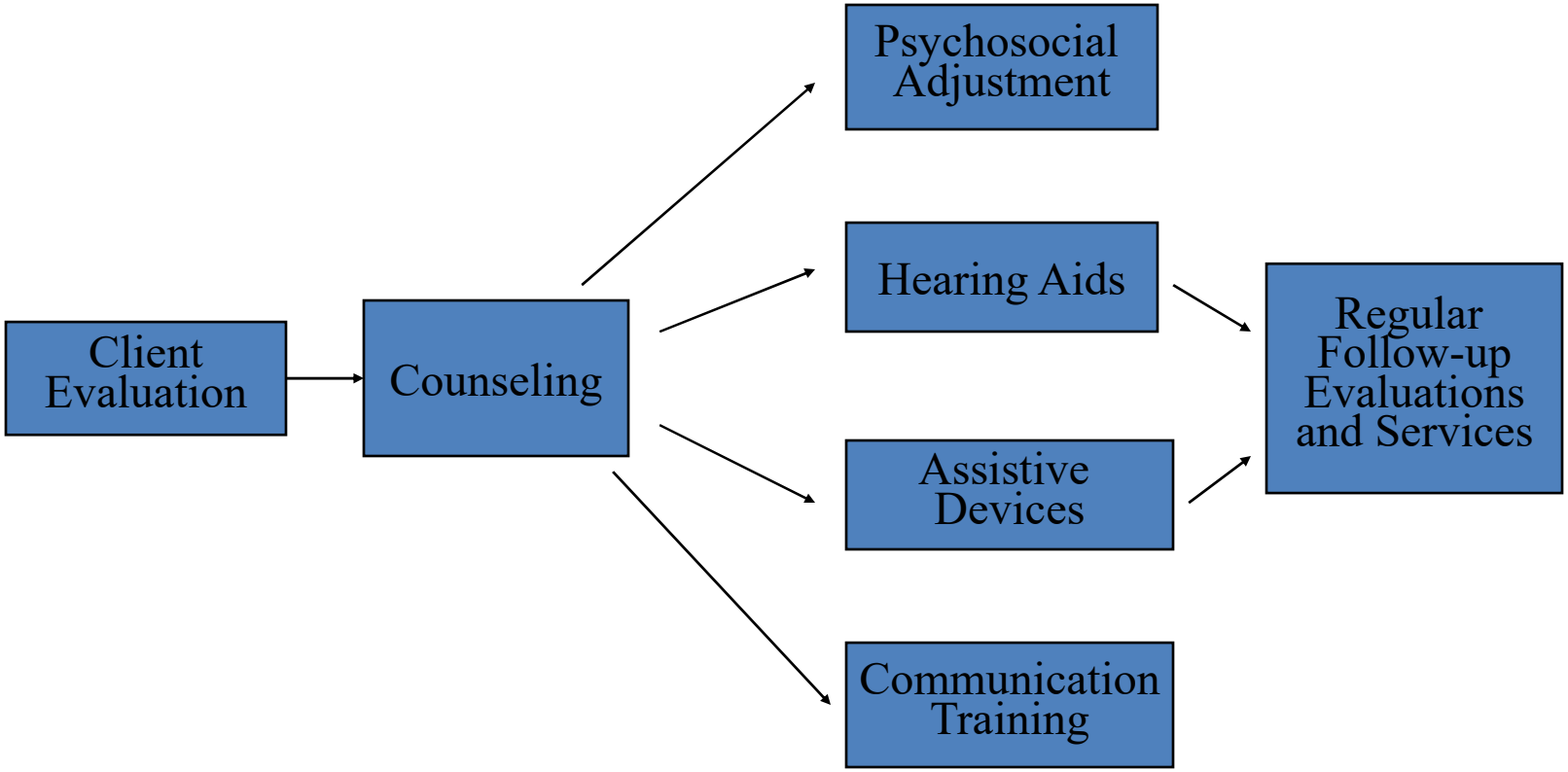
Part Two

Auditory (Re)Habilitation

Wellness and Prevention of Hearing Loss



Aural Rehabilitation Plan



Nancy Tye-Murray, Foundations of Aural Rehabilitation, Singular Publishing Group, 1998 p.271 (with permission)

Client Evaluation

- Case History
- Diagnostic audiometric evaluation
  - Pure tone air and bone conduction thresholds
  - Speech reception thresholds
  - Speech discrimination performance
  - Most comfortable listening level
  - Uncomfortable listening level
- Hearing handicap assessment
- Disclosure of test results and consultation
- Determination of the need for amplification
  - Soundfield assessments
  - Hearing aid trial

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Hearing Handicap Inventory for the Elderly (HHIE)

The purpose of this scale is to identify the problems your hearing loss may be causing you. Check 'Yes', 'Sometimes', or 'No' for each question. Do not skip any questions. If you use a hearing aid, please answer the way you hear without a hearing aid. **(Five sample questions here; 25 in total)**

S-1. Does a hearing problem cause you to use the phone less often than you would like? Yes (4) Sometimes (2) No (0)

E-2. Does a hearing problem cause you to feel embarrassed when meeting new people? Yes (4) Sometimes (2) No (0)

S-3. Does a hearing problem cause you to avoid groups of people? Yes (4) Sometimes (2) No (0)

E-4. Does a hearing problem make you irritable? Yes (4) Sometimes (2) No (0)

E-5. Does a hearing problem cause you to feel frustrated when talking to members of your family? Yes (4) Sometimes (2) No (0)

(S questions address situational issues; E questions address emotional or behavioral issues)

Informational and Affective Counseling

- Provision of counseling based on personal needs of client, making psychosocial adjustments (Affective counseling)
- Counseling regarding the vocational and social effects of hearing loss (Affective counseling)
- Provision of information pertaining to the operation of hearing aids and auditory systems (Informational counseling)
- Provision information pertaining to the purchase or acquisition of hearing aids and other hearing healthcare products(Informational counseling)
- Provision of information pertaining to the availability of social services, rehabilitation services in community. (Informational counseling)

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Psychosocial Adjustment

- Reduction in the perception of the hearing handicap
- Better use of communication strategies and personal adjustment
- Improved quality of life due to a reduction in social, emotional, and psychological issues.

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Alternative Communication Training

- Provision of speechreading (lipreading) training
- Provision of assertiveness training techniques (i.e., asking for assistance)
- Facilitating use of assistive communication systems in public venues
- Orientation to the use of non-verbal, communication methods, i.e., sign language, fingerspelling, writing, etc.

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Follow-up

- Clients are encouraged to follow-up on all recommendations
- Clients are reevaluated at least on an annual basis or sooner if changes in hearing acuity or performance change
- Clients are kept apprised of new discoveries and/or innovations in hearing healthcare

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Aural Habilitation

- Auditory-Oral
- Auditory-Verbal
- Cued Speech
- Total Communication
- ASL
  - Bilingual-Bicultural

Hierarchy of Auditory Skill Development

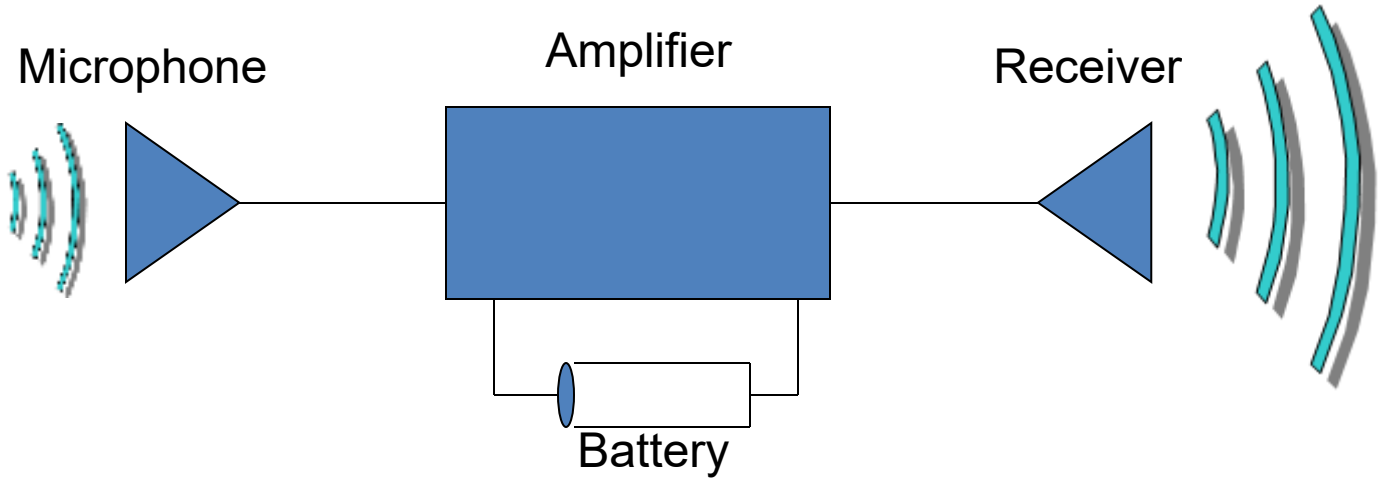
- Detection
- Discrimination
- Identification
- Comprehension

As the child becomes a more skilled listener, auditory activities become more language based

Hearing Aids and Assistive Communication Devices

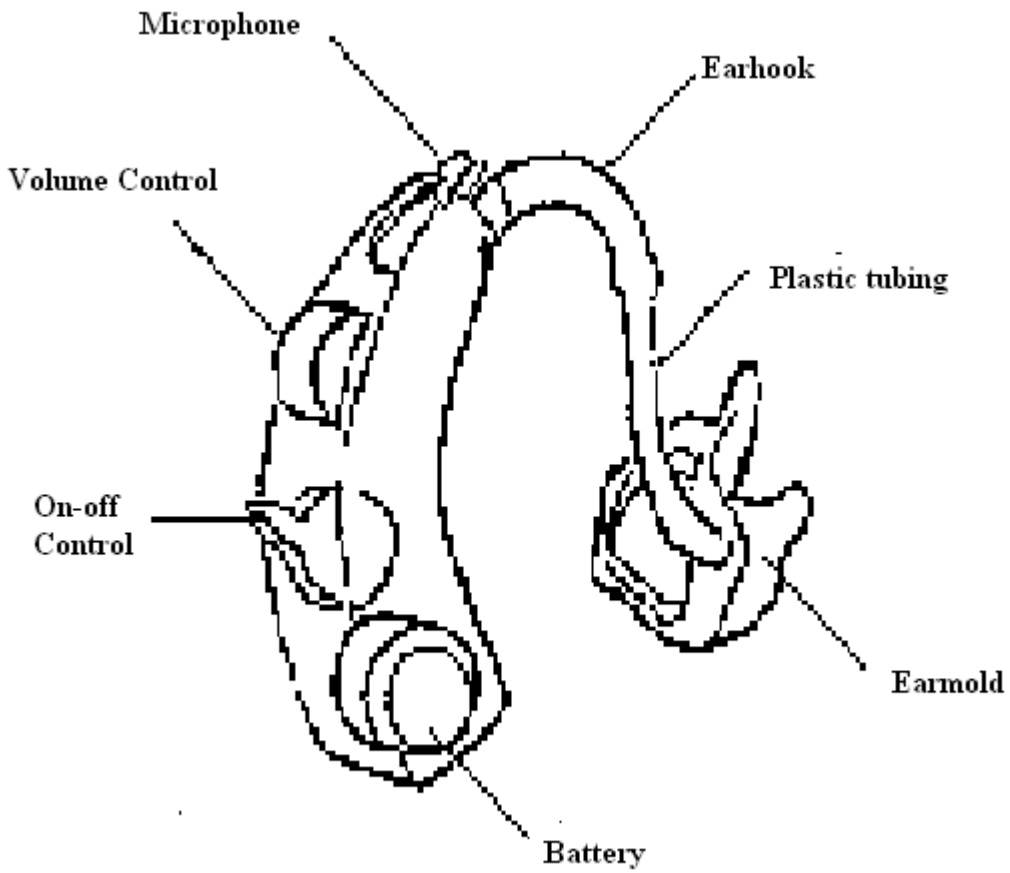
"The magazine says, 'Improve Your Hearing Without Hearing Aids or Surgery! Immediate Results! Only $50!' Yep, you got ripped off, all right."

Basic Hearing Aid Components

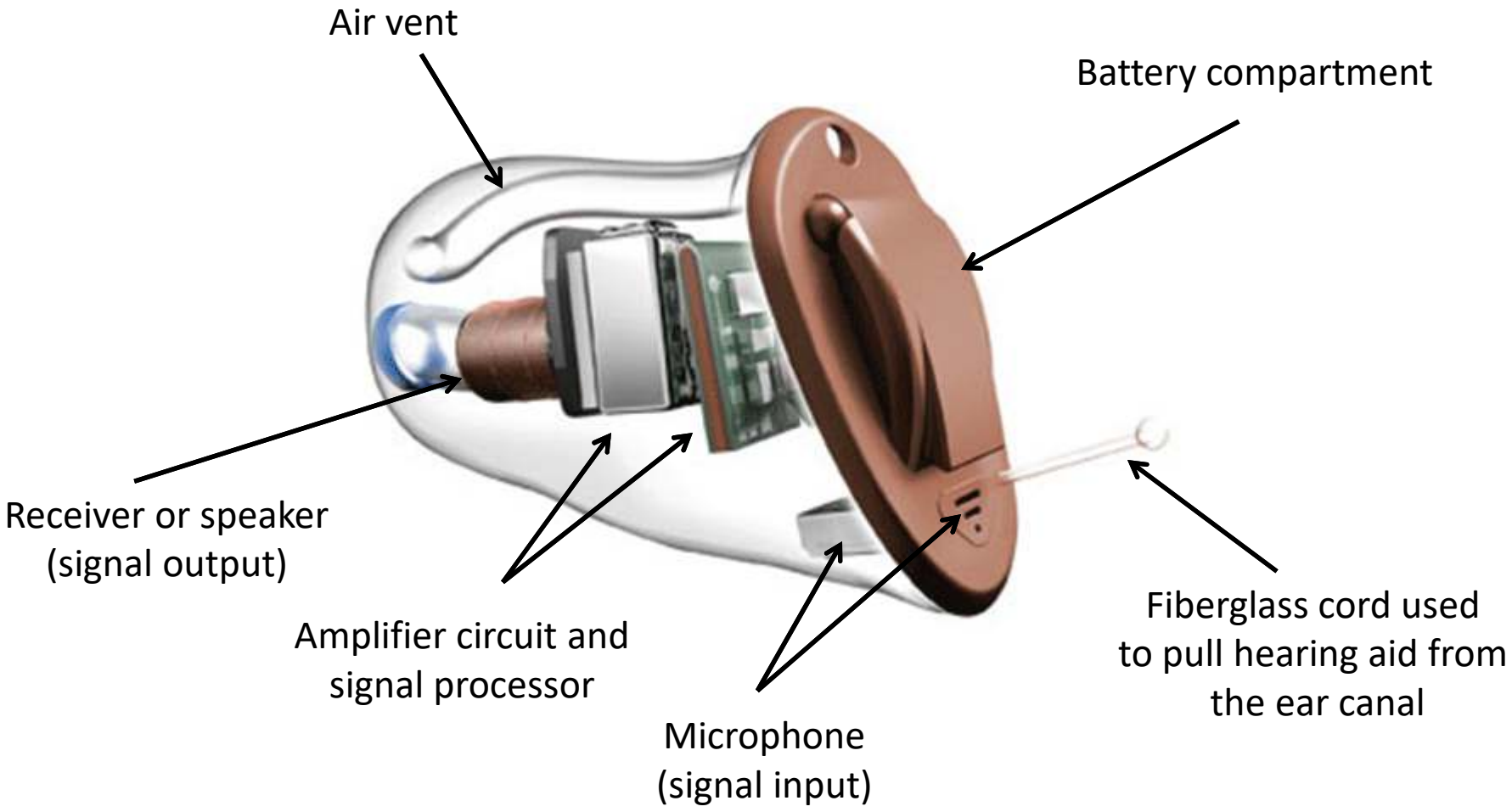


The typical analog hearing aid consists of a **microphone**, an **amplifier,** a **receiver, and a battery**. The microphone detects acoustical (sound) energy and transforms it into electrical impulses. The amplifier, powered by the battery, increases or amplifies the power of the electrical signal and delivers it to the receiver, which transforms the now amplified electrical impulses back into stronger or louder acoustical energy.

Behind the ear hearing aid parts

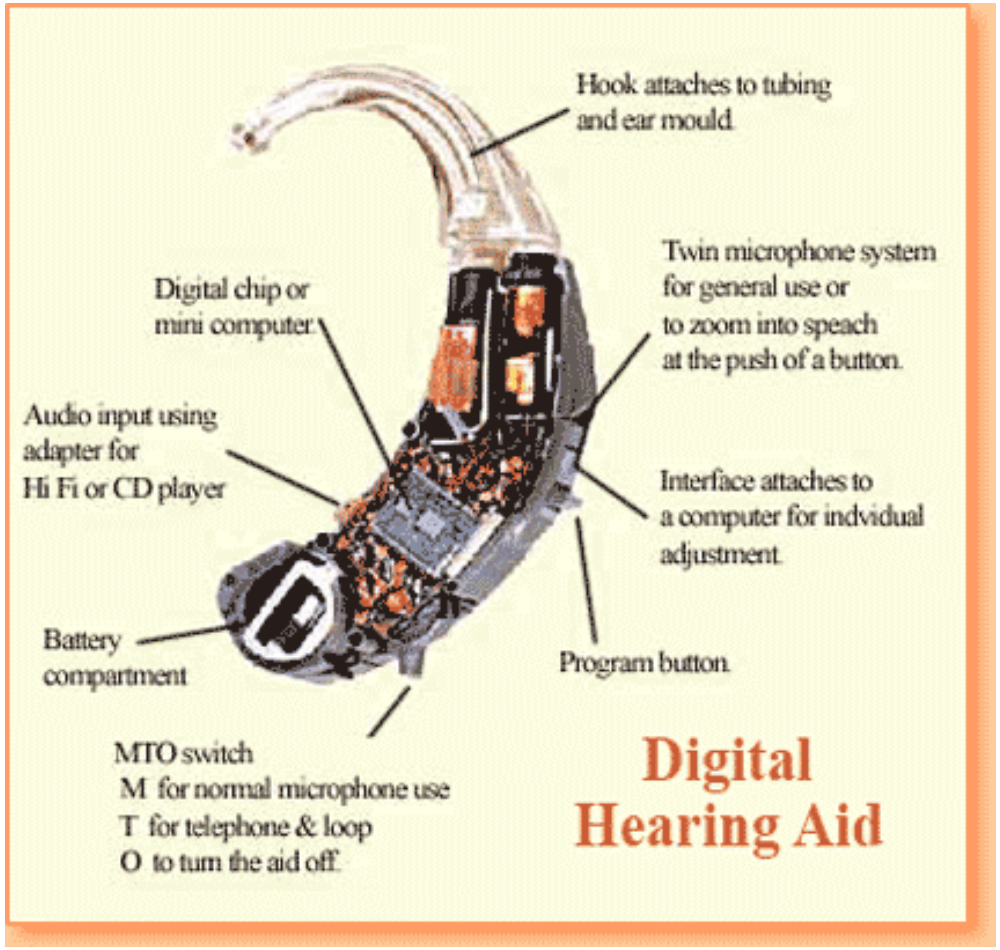


Components of an in-the-canal hearing aid



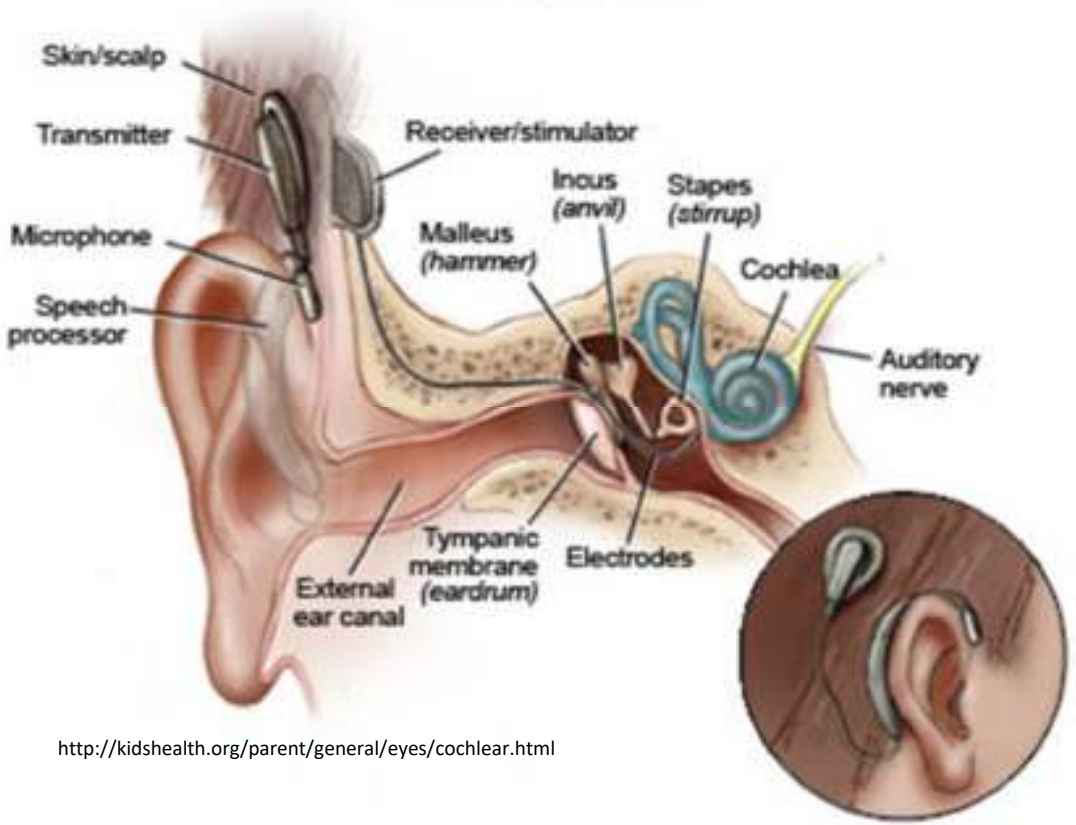
Remote volume control available

Digital Hearing Aids



Fully digital hearing aids are miniaturized computers that can be programmed to meet individual needs and adjust automatically to changing levels of sound in the environment.

Cochlear Implant



http://kidshealth.org/parent/general/eyes/cochlear.html

The cochlear implant is an electronic device which restores partial hearing to a totally deaf ear, appropriate only for those who "are unable to understand speech even with powerful hearing aids" in one or both ears. This device replaces the work of hair cells in the temporal bone (*cochlea*) in the inner ear, *when the hair cells do not work but the hearing nerve does*. The cochlear implant consists of a *sound processor* worn in the ear, which translates sounds into electrical signals, and *electrodes*, which are implanted directly into the cochlea to transmit these signals directly to the normal hearing nerves.

Bone Anchored Implant Hearing Aid

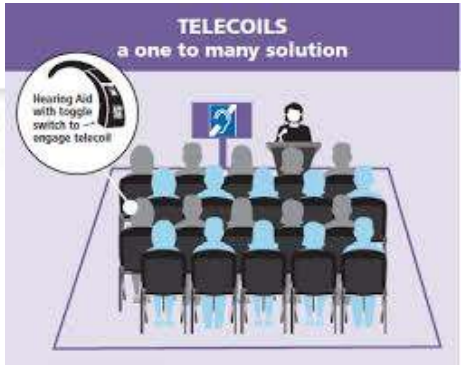
Conditions that warrant use of a BA implant:

- Malformation of the ear canal or middle ear
- Infection of the ear canal with chronic draining ears
- Chronic otitis media
- Congenital atresia
- Cholesteatoma
- Middle ear dysfunction/disease

Bone-anchored hearing aids use a surgically implanted strut to transmit sound by direct conduction through bone to the inner ear, bypassing the external auditory canal and middle ear. A titanium prosthesis is surgically embedded into the skull with a small processor exposed outside the skin.

Hearing Assistive Technology

http://www.hdscenter.org/adc.asp



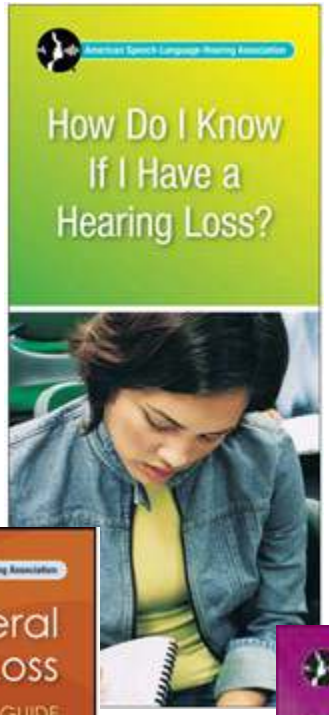
Images: Phonak.com, Oticon.com

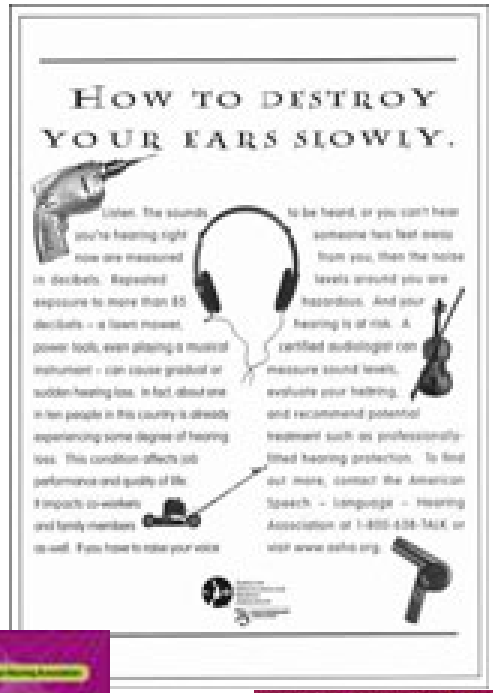
Loopseattle.org

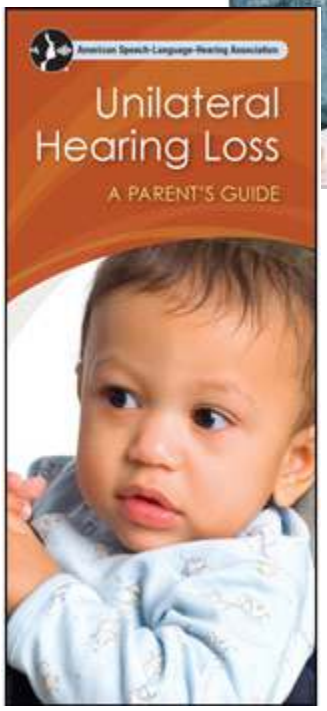
Assistive devices for hard of hearing, school-age children

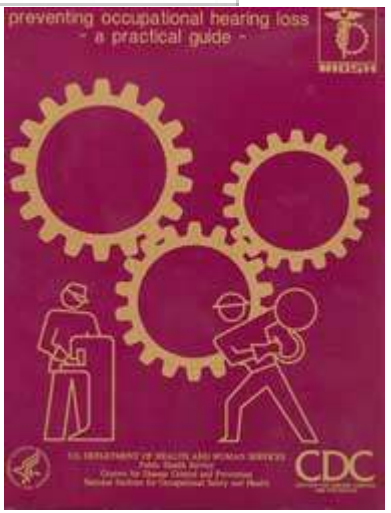
Personal and Sound Field Options
DM—digital modulation (Roger)
FM—Frequency modulation

Images—Phonak.com









Source: ASHA. org

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2. Vohr B. Overview: infants and children with hearing loss—part I. Ment Retard Dev Disabil Res Rev. 2003;9:62–64.
3. Mitchell RE, Karchmer MA. Chasing the mythical ten percent: Parental hearing status of deaf and hard of hearing students in the United States. Sign Language Studies. 2004;4(2):138-163.
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6. Based on calculations performed by NIDCD Epidemiology and Statistics Program staff: (1) using data from the 1999-2010 National Health and Nutrition Examination Survey (NHANES); (2) applying the definition of disabling hearing loss used by the 2010 Global Burden of Disease Expert Hearing Loss Team (hearing loss of 35 decibels or more in the better ear, the level at which adults could generally benefit from hearing aids).
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8. Based on calculations performed by NIDCD Epidemiology and Statistics Program staff: (1) tinnitus prevalence was obtained from the 2008 National Health Interview Survey (NHIS); (2) the estimated number of American adults reporting tinnitus was calculated by multiplying the prevalence of tinnitus by the 2013 U.S. Census population estimate for the number of adults (18+ years of age).
9. Based on calculations by NIDCD Epidemiology and Statistics Program staff using data collected by (1) the National Health Interview Survey (NHIS) annually for number of persons who have ever used a hearing aid [numerator], and (2) periodic NHANES hearing exams for representative samples of the U.S. adult and older adult population [denominator]; these statisticis are also used for tracking Healthy People 2010 and 2020 objectives. See also Use of Hearing Aids by Adults with Hearing Loss (chart).
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Case Studies and Questions

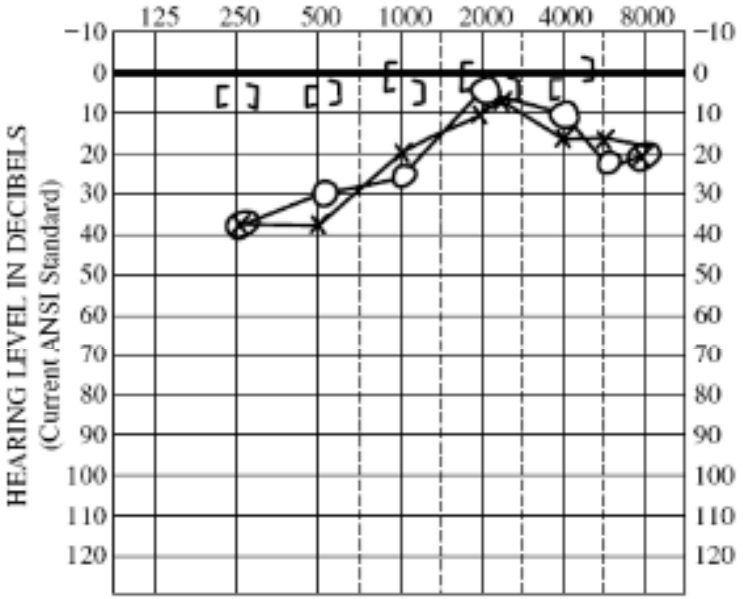
Kim

Kim's Case Study

Kim is a 6-year old girl whose parents brought her to the audiology clinic because she has been having academic trouble in school. According to her classroom teacher, Kim has difficulty following directions. She appears to stare blankly when the teacher is speaking to the class and never answers questions. Kim reportedly has had three sinus infections in the past eight months that have been treated by her pediatrician. She is scheduled to see an allergist next month.

PURE-TONE AUDIOGRAM

Frequency in Hertz (Hz)



Earphones: supra-aural□ (insert□)

KEY:

Right	Stimulus	Left
o	Air	x
<	Bone	>
△	Masked Air	□
[	Masked Bone	]
↓	No Response	↓
R	Aided Sound Field	L
Sound Field –S		

SPEECH AUDIOMETRY

	PTA (dB HL)	SRT/ SAT (dB HL)	Speech Recognition		Speech Recognition		MCL (dB HL)	UCL (dB HL)
Right (AD)	20	15	? %	dB HL	%	dB HL		
mskg								
Left (AS)	22	15	? %	dB HL	%	dB HL		
mskg								

MLV □ CD/tape □ SPECIAL TEST MATERIAL:

TYMPANOMETRY

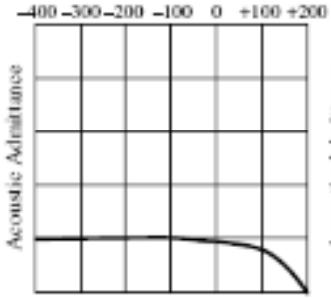
(226) 678/1000 Hz (circle one)

	Left	Right
Peak-Compensated Static Admittance (mmho)	∅	∅
Tympanometric Peak Pressure (daPa)	No peak	No peak
Equivalent Ear Canal Volume (cm^3)	N/A	N/A
Tympanometric Width (daPa)	0.4	0.48

TYMPANOGRAM

Right

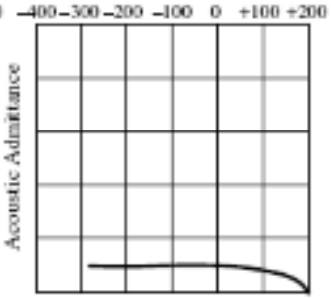
Ear Canal Pressure (daPa)



TYMPANOGRAM

Left

Ear Canal Pressure (daPa)



ACOUSTIC REFLEX

	Stimulus Right	500	1K	2K
CONTRA	Threshold (dB HL)	Ab	Ab	Ab
	Decay (pos/neg)			
IPSI	Threshold (dB HL)	Ab	Ab	Ab
	Decay (pos/neg)			

ACOUSTIC REFLEX

	Stimulus Left	500	1K	2K
CONTRA	Threshold (dB HL)	Ab	Ab	Ab
	Decay (pos/neg)			
IPSI	Threshold (dB HL)	Ab	Ab	Ab
	Decay (pos/neg)			

1. Based on the audiometric and case history information provided, which of the following is the most likely etiology for Kim's hearing loss?

    A. Otosclerosis
    B. Chronic otitis media
    C. Bilateral atresia
    D. Impacted cerumen
    E. Perforated tympanic membranes

1. Based on the audiometric and case history information provided, which of the following is the most likely etiology for Kim's hearing loss?

    A. Otosclerosis
    B. Chronic otitis media
    C. Bilateral atresia
    D. Impacted cerumen
    E. Perforated tympanic membranes

2. Which of the following scores are most likely to be obtained if word recognition/discrimination is assessed using an age appropriate test at a 40dB SL (e.g., 40dB above her SRTs)?

A. 70% right ear, 66% left ear
B. 60% right ear, 80% left ear
C. 80% right ear, 72% left ear
D. 88% right ear, 90% left ear
E. 100% right ear, 70% left ear

2. Which of the following scores are most likely to be obtained if word recognition/discrimination is assessed using an age appropriate test at a 40dB SL (e.g., 40dB above her SRTs)?

A. 70% right ear, 66% left ear
B. 60% right ear, 80% left ear
C. 80% right ear, 72% left ear
D. 88% right ear, 90% left ear
E. 100% right ear, 70% left ear

3. Which of the following would the audiologist most likely recommend to the classroom teacher to accommodate Kim?

A. A binaural bone anchored hearing aid
B. Use of a classroom amplification system (FM) to augment hearing performance in noise.
C. Individual tutoring outside the classroom for 3 hours a day.
D. Use of classroom amplification system to augment hearing performance in noise.
E. Preferential classroom seating and regular monitoring of middle ear status

3. Which of the following would the audiologist most likely recommend to the classroom teacher to accommodate Kim?

A. A binaural bone anchored hearing aid
B. Use of a classroom amplification system (FM) to augment hearing performance in noise.
C. Individual tutoring outside the classroom for 3 hours a day.
D. Use of classroom amplification system to augment hearing performance in noise.
E. Preferential classroom seating and regular monitoring of middle ear status

4. According to IDEA, the audiologist's recommendations for this child should be addressed in which of the following documents?

A. Individual Family Service Plan
B. Individual Education Plan
C. Report Card
D. Behavioral Intervention Plan
E. Cumulative Academic Record

4. According to IDEA, the audiologist's recommendations for this child should be addressed in which of the following documents?

A. Individual Family Service Plan
B. Individual Education Plan
C. Report Card
D. Behavioral Intervention Plan
E. Cumulative Academic Record

Answers

#1 B. Chronic otitis media

#2 D. 88% right ear, 90% left ear

#3 E. Preferential classroom seating and regular monitoring of middle ear status

#4 B. Individual Education Plan

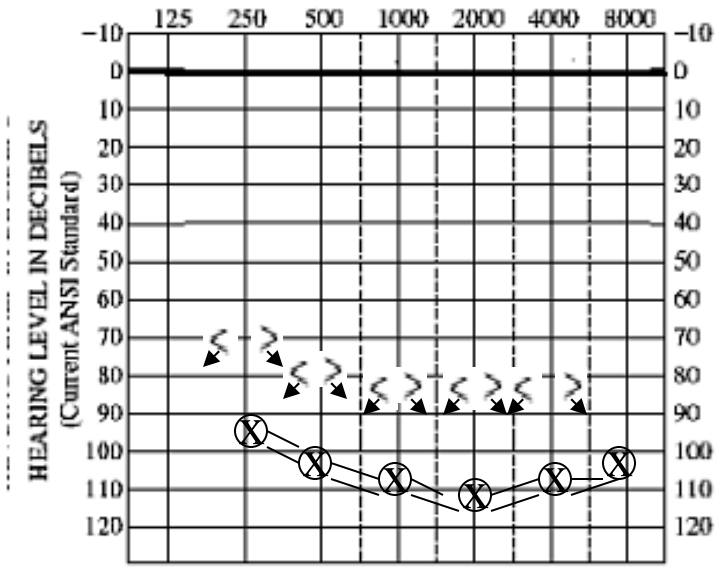
Devin

Devin's Case Study

Devin is an 8-year old boy who has been wearing binaural behind-the-ear hearing aids since his hearing loss was first discovered when he was 1 year of age. Devin is currently enrolled in a self-contained class for children with severe to profound hearing losses. He receives weekly pull-out speech and language services to improve his speech articulation and voice performance, as well as vocabulary skills. His aided hearing is pretty good (considering the level of his loss), particularly when supplemented by his speech-reading. Devin's parents have recently asked his audiologist about the use of cochlear implants. They want Devin "mainstreamed" with normal hearing children.

PURE-TONE AUDIOGRAM

Frequency in Hertz (Hz)



Earphones: supra-aural□ (insert□)

KEY:

Right	Stimulus	Left
○	Air	x
<	Bone	>
△	Masked Air	□
[	Masked Bone	]
↓	No Response	↓
R	Aided Sound Field	L
Sound Field –S		

SPEECH AUDIOMETRY

	PTA (dB HL)	SRT/ SAT (dB HL)	Speech Recognition		Speech Recognition		MCL (dB HL)	UCL (dB HL)
Right (AD)	-	(.)	%	dB HL	%	dB HL		
mskg	95	90	DNT					
Left (AS)	-		%	dB HL	%	dB HL		
mskg	95	90	DNT					

MLV □ CD/tape □ SPECIAL TEST MATERIAL:

TYMPANOMETRY

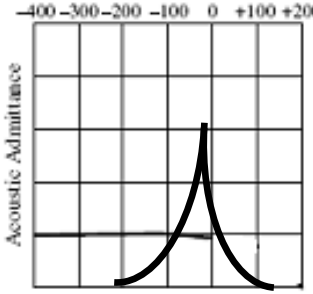
(226) 678/1000 Hz (circle one)

	Left	Right
Peak-Compensated Static Admittance (mmho)	∅	∅
Tympanometric Peak Pressure (daPa)	No peak	No peak
Equivalent Ear Canal Volume (cm^3)	N/A	N/A
Tympanometric Width (daPa)		

TYMPANOGRAM

Right

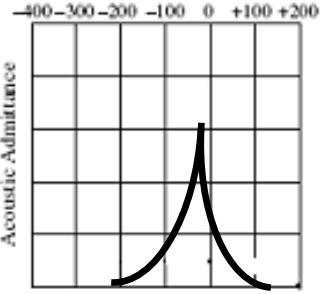
Ear Canal Pressure (daPa)



TYMPANOGRAM

Left

Ear Canal Pressure (daPa)



ACOUSTIC REFLEX

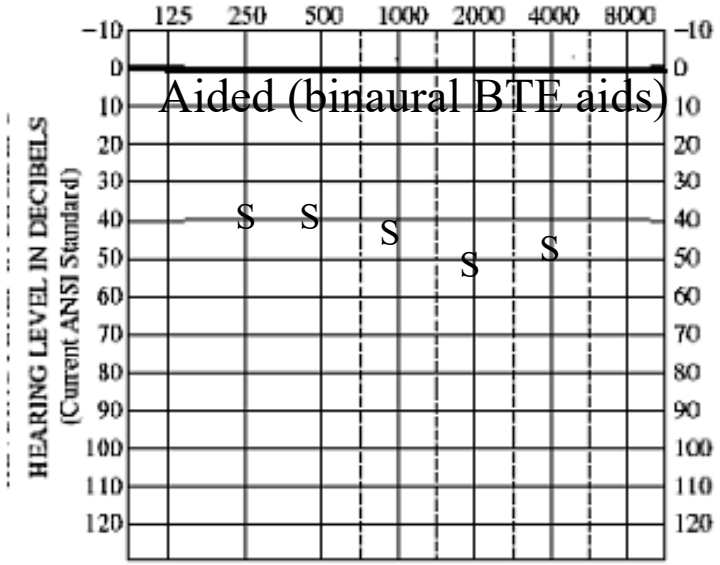
	Stimulus Right	500	1K	2K
CONTRA	Threshold (dB HL)	Ab	Ab	Ab
CONTRA	Decay (pos/neg)			
IPSI	Threshold (dB HL)	Ab	Ab	Ab
IPSI	Decay (pos/neg)			

ACOUSTIC REFLEX

	Stimulus Left	500	1K	2K
CONTRA	Threshold (dB HL)	Ab	Ab	Ab
CONTRA	Decay (pos/neg)			
IPSI	Threshold (dB HL)	Ab	Ab	Ab
IPSI	Decay (pos/neg)			

PURE-TONE AUDIOGRAM

Frequency in Hertz (Hz)



KEY:

Right	Stimulus	Left
○	Air	X
<	Bone	>
△	Masked Air	□
[	Masked Bone	]
↓	No Response	↓
R	Aided Sound Field	L
Sound Field –S		

SPEECH AUDIOMETRY

	PTA (dB HL)	SRT/ SAT (dB HL)	Speech Recognition		Speech Recognition		MCL (dB HL)	UCL (dB HL)
Right (AD)	-	45	S %	dB HL	%	dB HL		
mskg								
Left (AS)	-		%	dB HL	78 %	dB HL		
mskg								
MLV ☐ CD/tape ☐	SPECIAL TEST MATERIAL:							

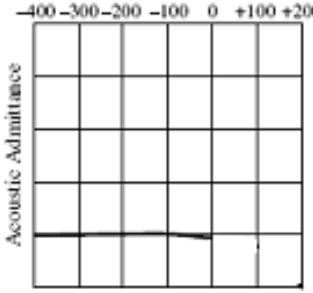
Earphones: supra-aural☐ (insert☐)

TYMPANOMETRY

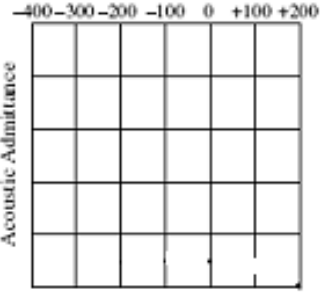
(226)678/1000 Hz (circle one)

	Left	Right
Peak-Compensated Static Admittance (mmho)	∅	∅
Tympanometric Peak Pressure (daPa)	No peak	No peak
Equivalent Ear Canal Volume (cm^3)	N/A	N/A
Tympanometric Width (daPa)		

TYMPANOGRAM
Right
Ear Canal Pressure (daPa)



TYMPANOGRAM
Left
Ear Canal Pressure (daPa)



ACOUSTIC REFLEX

	Stimulus Right	500	1K	2K
CONTRA	Threshold (dB HL)	Ab	Ab	Ab
	Decay (pos/neg)			
IPSI	Threshold (dB HL)	Ab	Ab	Ab
	Decay (pos/neg)			

ACOUSTIC REFLEX

	Stimulus Left	500	1K	2K
CONTRA	Threshold (dB HL)	Ab	Ab	Ab
	Decay (pos/neg)			
IPSI	Threshold (dB HL)	Ab	Ab	Ab
	Decay (pos/neg)			

1. Based on the audiometric and case history information provided, which of the following is the most likely etiology for Devin's hearing loss?

    A. Meningitis
    B. Otitis media
    C. Presbycusis
    D. Impacted cerumen
    E. Not enough information available to determine etiology

1. Based on the audiometric and case history information provided, which of the following is the most likely etiology for Devin's hearing loss?

   A. Meningitis
   B. Otitis media
   C. Presbycusis
   D. Impacted cerumen
   E. Not enough information available to determine etiology

2. Why were unaided speech recognition tests not performed?

A. Devin's hearing aids were not available at time of test.
B. Devin cannot hear and understand speech.
C. Unaided speech recognition test levels would exceed the limits of the audiometer.
D. Without speech reading, speech recognition would be invalid
E. Unaided speech recognition tests are never valid for persons with significant hearing losses.

2. Why were unaided speech recognition tests not performed?

A. Devin's hearing aids were not available at time of test.
B. Devin cannot hear and understand speech.
C. Unaided speech recognition test levels would exceed the limits of the audiometer.
D. Without speech reading, speech recognition would be invalid
E. Unaided speech recognition tests are never valid for persons with significant hearing losses.

3. Which of the following would the audiologist most likely recommend to Devin's parents?

A. That Devin undergo a multidisciplinary cochlear implant candidacy evaluation.
B. That Devin discontinue using his binaural behind-the-ear hearing aids
C. That Devin learn American Sign Language to prepare for a mainstream classroom.
D. Continued placement in a self-contained class, but focus on improving speech articulation and voice performance to prepare for mainstream placement in the near future.

3. Which of the following would the audiologist most likely recommend to Devin's parents?

A. That Devin undergo a multidisciplinary cochlear implant candidacy evaluation.
B. That Devin discontinue using his binaural behind-the-ear hearing aids
C. That Devin learn American Sign Language to prepare for a mainstream classroom.
D. Continued placement in a self-contained class, but focus on improving speech articulation and voice performance to prepare for mainstream placement in the near future.

Answers

#1 E. Not enough information available to determine etiology

#2 C. Unaided speech recognition test levels would exceed the limits of the audiometer.

#3 A. That Devin undergo a multidisciplinary cochlear implant candidacy evaluation.

and

D. Continued placement in a self-contained class, but focus on improving speech articulation and voice to prepare for mainstream placement in the near future.

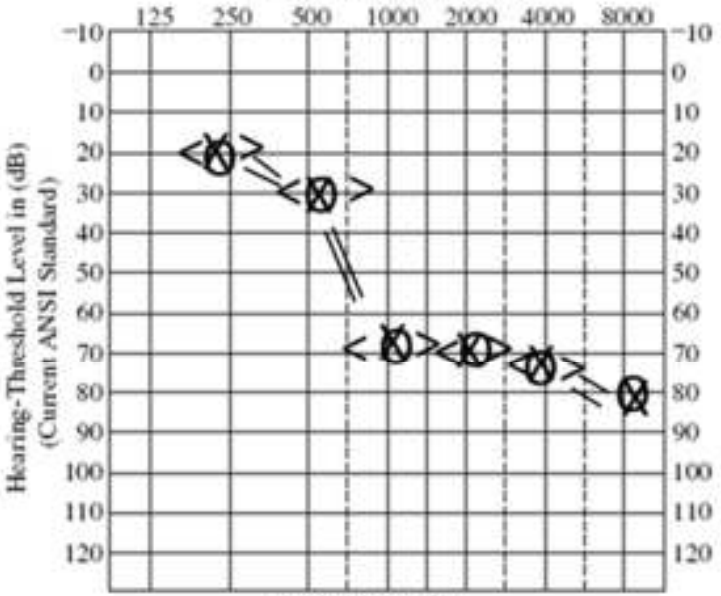
Mr. K

Mr. K's Case Study

Mr. K, age 68 years, was seen at ENT Associates for a comprehensive audiological evaluation and aural rehab assessment. Mr. K reported having problems with intermittent ear discomfort in both ears. He also complains of experiencing increased difficulty hearing the television and enjoying social outings with his family. He finds he has to ask is wife to repeat what others say. He seems amenable to the idea of trying hearing aids, if needed. No other health issues or problems were reported at this time. Mr. K. does have a primary care physician who will monitor his audiological management.

PURE-TONE AUDIOGRAM

Frequency in Hertz (Hz)?

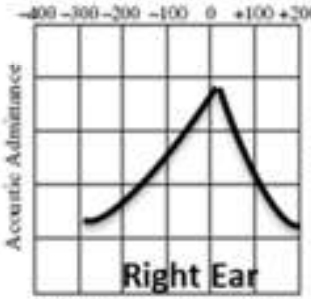


KEY:

Left	Stimulus	Right
X	Air	O
□	Air Mask	△
>	Bone	<
⌋	Bone Mask	⌊
↘	No Response	↙
L	Aided Sound Field	R
Sound Field –S		

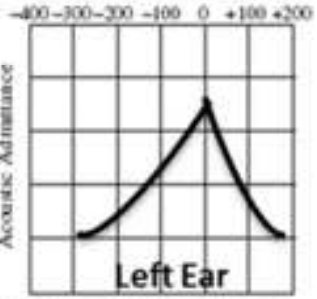
TYMPANOGRAM

Acoustic Pressure (daPa)



TYMPANOGRAM

Acoustic Pressure (daPa)



TYPANOMETRY

226 678/1000H/Hz

	Left	Right
Peak-Compensated Static Admittance (mmHo)		
Tympanometric Peak Pressure (daPa) NA		
Tympanometric Width (daPa)		
Equivalent Ear Canal Volume (cm^3)		

SPEECH AUDIOMETRY HLCircumaural (circle one)

	PTA dbHL	SRT/ SAT dbHL	Speech Discrimination				MCL dbHL	UCL dbHL
Right (AD)	57	55	64 %	dBHL 80	DNT	%	80	95
Left (AS)	57	60	64 %	dBHL 90		%	90	95
MLV □ CD/tape □ SPECIAL TEST MATERIAL:								

ACOUSTIC REFLEX

HI-SPL

		Sound Right	500	1K	2K
Threshold dbHL	CONTRA				
		Decay (pos/neg) DND			
Threshold dbHL	IPSI				
		Decay (pos/neg)			

ACOUSTIC REFLEX

HI-SPL

		Sound Right	500	1K	2K
Threshold dbHL	CONTRA				
		Decay (pos/neg) DND			
Threshold dbHL	IPSI				
		Decay (pos/neg)			

1. Based on the audiometric and case history information provided, which of the following is the most likely etiology for Mr. K's hearing loss?

    A. Meningitis
    B. Otitis media
    C. Presbycusis
    D. Impacted cerumen
    E. Not enough information available to determine etiology

1. Based on the audiometric and case history information provided, which of the following is the most likely etiology for Mr. K's hearing loss?

   A. Meningitis
   B. Otitis media
   C. Presbycusis
   D. Impacted cerumen
   E. Not enough information available to determine etiology

2. Which of the following would the audiologist most likely recommend for Mr. K's rehabilitation plan?

   A. That Mr. K be fitted with a binaural set of cochlear implants
   B. That Mr. K be fitted with a set of binaural ear level hearing aids and followed for continued AR support as needed
   C. That Mr. K receive a psychological assessment to determine if he is depressed because of his hearing loss.
   D. Referral to an otolaryngologist for an inner ear treatment, then follow-up hearing therapy.

2. Which of the following would the audiologist most likely recommend for Mr. K's rehabilitation plan?

A. That Mr. K be fitted with a binaural set of cochlear implants
B. That Mr. K be fitted with a set of binaural ear level hearing aids and followed for continued AR support as needed
C. That Mr. K receive a psychological assessment to determine if he is depressed because of his hearing loss.
D. Referral to an otolaryngologist for an inner ear treatment, then follow-up hearing therapy.

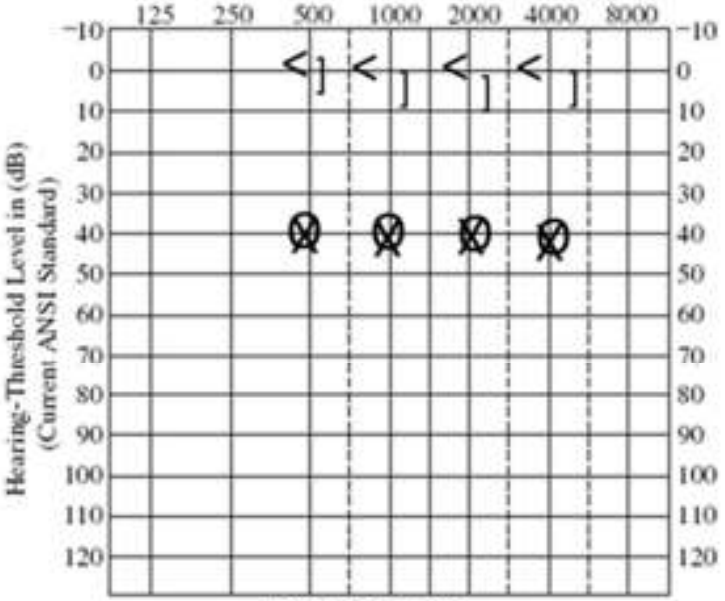
Ally's Case Study

Two weeks ago, Ally (a 6-year old) suffered a high fever and a serious head cold. A few days later she began vomiting, and was finally seen by her pediatrician. Her doctor examined her ears and found that the tympanic membranes in both ears were infected and slightly retracted.

While at the pediatrician's office Ally's mother mentioned that she was becoming very concerned about Ally's speech articulation.

PURE-TONE AUDIOGRAM

Frequency in Hertz (Hz)?

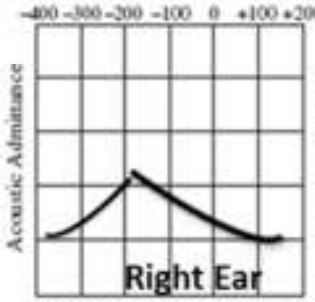


KEY:

Left	Stimulus	Right
x	Air	o
□	Air Mask	△
>	Bone	<
]	Bone Mask	[
↘	No Response	↙
L	Aided Sound Field	R
Sound Field –S		

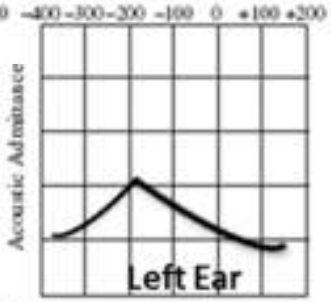
TYMPANOGRAM

Acoustic Pressure (daPa)



TYMPANOGRAM

Acoustic Pressure (daPa)



TYPANOMETRY

226 678/1000H/Hz

	Left	Right
Peak-Compensated Static Admittance (mmHo)		
Tympanometric Peak Pressure (daPa) NA		
Tympanometric Width (daPa)		
Equivalent Ear Canal Volume (cm^3)		

SPEECH AUDIOMETRY HLCircumaural (circle one)

	PTA dbHL	SRT/ SAT dbHL	Speech Discrimination				MCL dbHL	UCL dbHL
Right (AD)	43	40	98 %	dBHL 75	% DNT		75	DNT
Left (AS)	40	40	96 %	dBHL 75	%		75	DNT

MLV □ CDTape □ SPECIAL TEST MATERIAL:

ACOUSTIC REFLEX

HI-SPL

		Sound Right	500	1K	2K
Threshold dbHL.	CONTRA				
		Decay (pos/neg) DND			
Threshold dbHL.	IPSI				
		Decay (pos/neg)			

ACOUSTIC REFLEX

HI-SPL

		Sound Right	500	1K	2K
Threshold dbHL.	CONTRA				
		Decay (pos/neg) DND			
Threshold dbHL.	IPSI				
		Decay (pos/neg)			

1. Based on the audiometric and case history information provided, which of the following is the most likely etiology for Ally's hearing loss?

    A. Meningitis
    B. Otitis media
    C. Presbycusis
    D. Impacted cerumen
    E. Not enough information available to determine etiology

1. Based on the audiometric and case history information provided, which of the following is the most likely etiology for Ally's hearing loss?

   A. Meningitis
   B. Otitis media
   C. Presbycusis
   D. Impacted cerumen
   E. Not enough information available to determine etiology

2. What recommendation(s) do you think Ally's pediatrician will make?

   A. That Ally be seen by an internist for her stomach issues.

   B. That Ally be seen by an audiologist to be fitted with a hearing aid.

   C. That Ally complete a regimen of antibiotics and return in two weeks for follow-up.

   D. That Ally be seen by a speech-language pathologist to evaluate her speech performance.

2. What recommendation(s) do you think Ally's pediatrician will make?

   A. That Ally be seen by an internist for her stomach issues.

   B. That Ally be seen by an audiologist to be fitted with a hearing aid.

   C. That Ally complete a regimen of antibiotics and return in two weeks for follow-up.

   D. That Ally be seen by a speech-language pathologist to evaluate her speech performance.

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5. Lin FR, Niparko JK, Ferrucci L. Hearing loss prevalence in the United States. [Letter] Arch Intern Med. 2011 Nov 14; 171(20): 1851-1852.
6. Based on calculations performed by NIDCD Epidemiology and Statistics Program staff: (1) using data from the 1999-2010 National Health and Nutrition Examination Survey (NHANES); (2) applying the definition of disabling hearing loss used by the 2010 Global Burden of Disease Expert Hearing Loss Team (hearing loss of 35 decibels or more in the better ear, the level at which adults could generally benefit from hearing aids).
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8. Based on calculations performed by NIDCD Epidemiology and Statistics Program staff: (1) tinnitus prevalence was obtained from the 2008 National Health Interview Survey (NHIS); (2) the estimated number of American adults reporting tinnitus was calculated by multiplying the prevalence of tinnitus by the 2013 U.S. Census population estimate for the number of adults (18+ years of age).
9. Based on calculations by NIDCD Epidemiology and Statistics Program staff using data collected by (1) the National Health Interview Survey (NHIS) annually for number of persons who have ever used a hearing aid [numerator], and (2) periodic NHANES hearing exams for representative samples of the U.S. adult and older adult population [denominator]; these statisticis are also used for tracking Healthy People 2010 and 2020 objectives. See also Use of Hearing Aids by Adults with Hearing Loss (chart).
10. Estimates based on manufacturers' voluntary reports of registered devices to the U.S. Food and Drug Administration, December 2012.
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14. Northern and Downs (1991). Hearing in Children, 4th ed, Baltimore: Williams and Wilkins
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17. http://www.hearlifeclinic.com/bs/show/index/id/63/title/Types-of-Hearing-Loss
18. http://www.hearingloss.org/content/basic-facts-about-hearing-loss
19. http://www.hdscenter.org/adc.asp
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Questions
Anyone?

Audiometric Screening Protocol

Tone being tested .5kHz

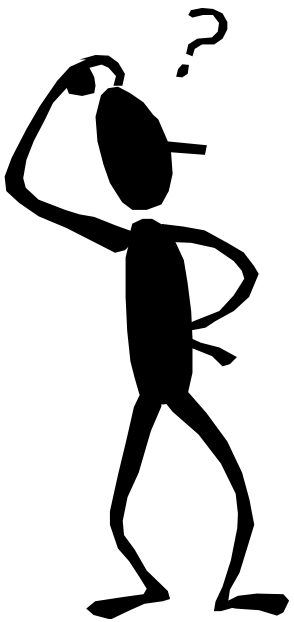
(Click above to hear what a 500Hz pure tone signal sounds like).

Decibel Scale: (dB HTL)

25 dB 30 dB

Right ear

500 Hz
1000 Hz
2000 Hz
4000 Hz



Left ear

500 Hz
1000 Hz
2000 Hz
4000 Hz

You must click on the dB values above caricature's head to activate the simulation.

Back

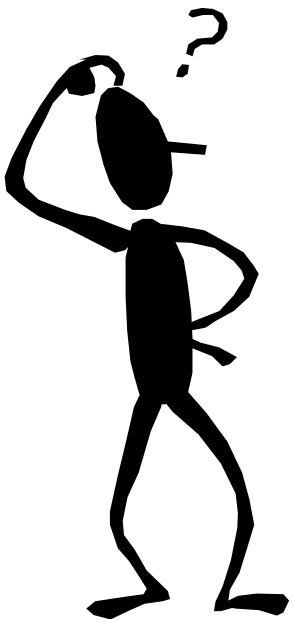
Audiometric Screening Protocol

Tone being tested 1000Hz

(Click above to hear what a 1000Hz pure tone signal sounds like).

Decibel Scale: (dB HTL)

25 dB 30 dB



Right ear

500 Hz
1000 Hz
2000 Hz
4000 Hz

Left ear

500 Hz
1000 Hz
2000 Hz
4000 Hz

You must click on the dB values above caricature's head to activate the simulation.

Back

Audiometric Screening Protocol

Tone being tested 2000Hz

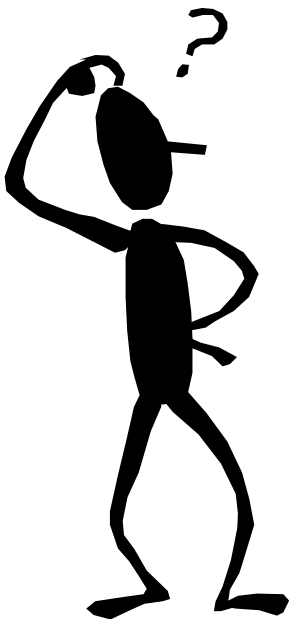
(Click above to hear what a 2000Hz pure tone signal sounds like).

Decibel Scale: (dB HTL)

25 dB 30 dB

Right ear

500 Hz
1000 Hz
2000 Hz
4000 Hz



Left ear

500 Hz
1000 Hz
2000 Hz
4000 Hz

You must click on the dB values above caricature's head to activate the simulation.

Back

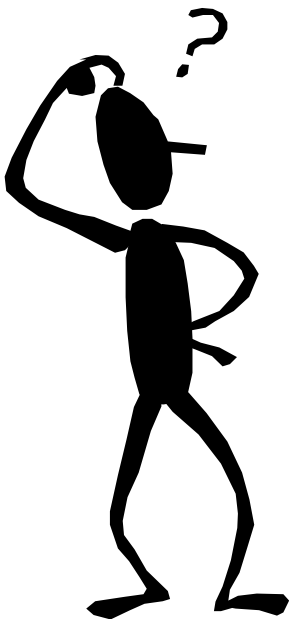
Hearing Screening Protocol

Tone being tested 4000Hz

(Click above to hear what a 4000Hz pure tone signal sounds like).

Decibel Scale: (dB HTL)

25 dB 30 dB

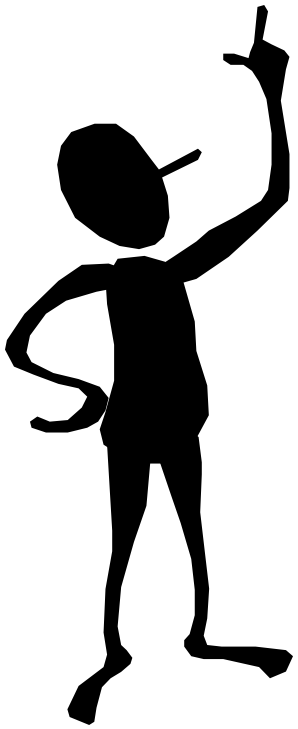


Right ear	Left ear
500 Hz	500 Hz
1000 Hz	1000 Hz
2000 Hz	2000 Hz
4000 Hz	4000 Hz

You must click on the dB values above caricature's head to activate the simulation.

Back

Hearing Screening Protocol

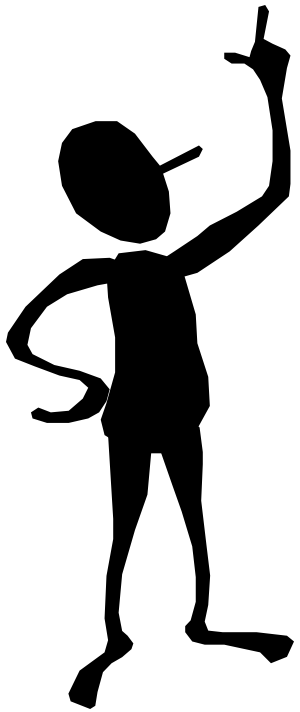


"I hear it."

Tone being tested .5kHz

Click here to resume screening

Hearing Screening Protocol

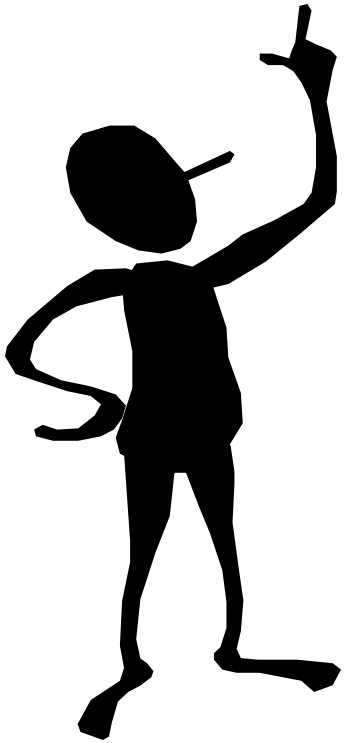


"I hear it."

Tone being tested 1kHz

Click here to resume screening

Hearing Screening Protocol

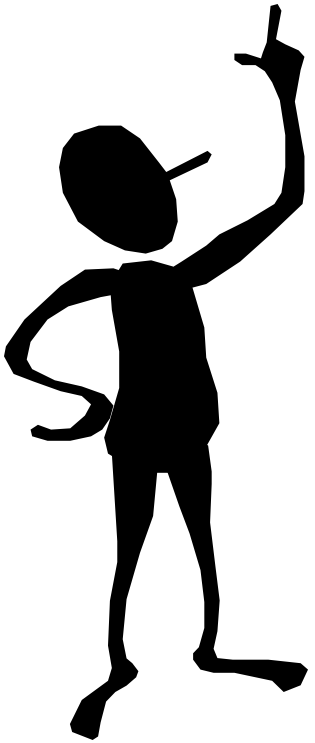


"I hear it."

Tone being tested 2kHz

Click here to resume screening

Hearing Screening Protocol

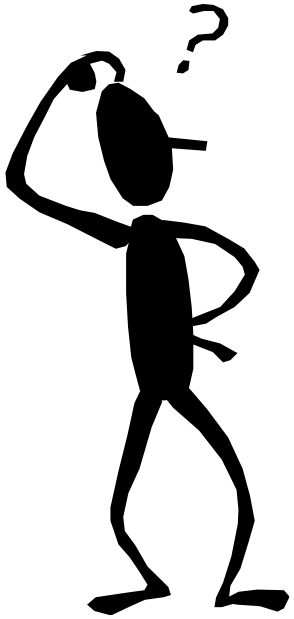


"I hear it."

Tone being tested 4kHz

Click here to resume screening

Hearing Screening Protocol

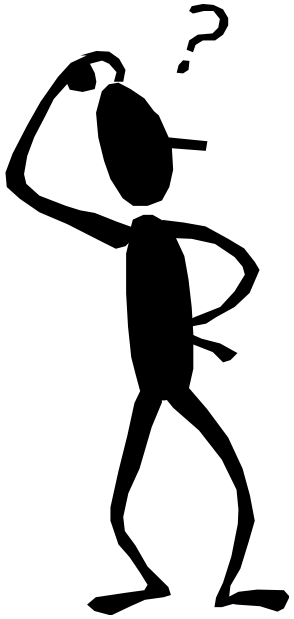


"I don't hear anything."

Tone being tested 2kHz

Click here to resume screening

Hearing Screening Protocol



"I don't hear anything."

Tone being tested 4kHz

Click here to resume screening

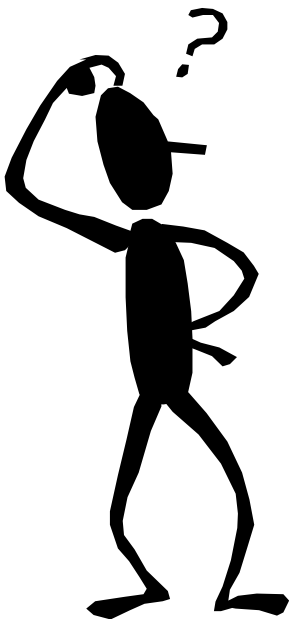
Audiometric Screening Protocol

Tone being tested 2000Hz

(Click above to hear what a 2000Hz pure tone signal sounds like).

Decibel Scale: (dB HTL)

25 dB 30 dB



Right ear

500 Hz
1000 Hz
2000 Hz
4000 Hz

Left ear

500 Hz
1000 Hz
2000 Hz
4000 Hz

You must click on the dB values above caricature's head to activate the simulation.

Hearing Screening Protocol

Tone being tested 4000Hz

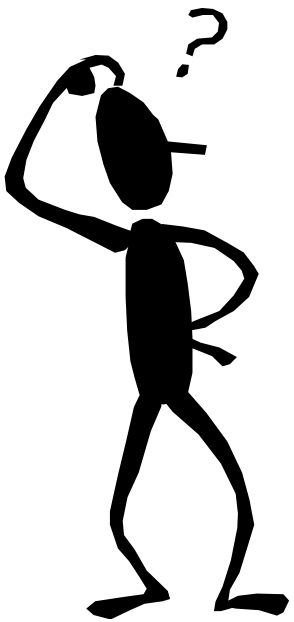
(Click above to hear what a 4000Hz pure tone signal sounds like).

Decibel Scale: (dB HTL)

25 dB 30 dB

Right ear

500 Hz
1000 Hz
2000 Hz
4000 Hz



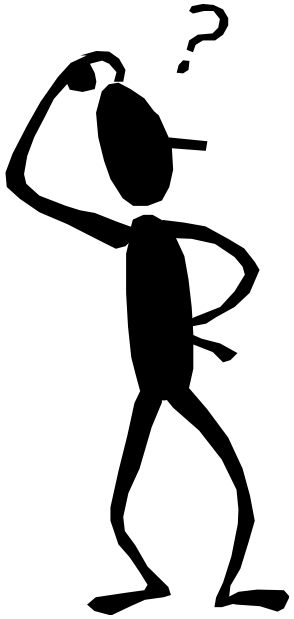
Left ear

500 Hz
1000 Hz
2000 Hz
4000 Hz

You must click on the dB values above caricature's head to activate the simulation.

Return to PPT

Hearing Screening Protocol

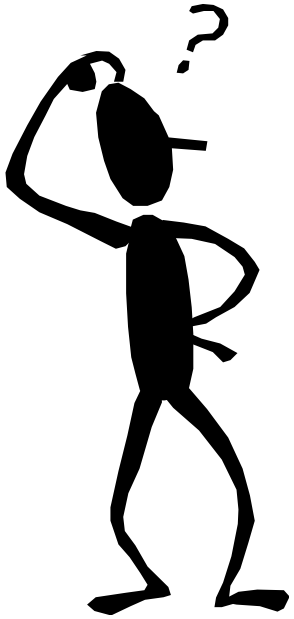


"I don't hear anything."

Tone being tested 2kHz

Click here to resume screening

Hearing Screening Protocol

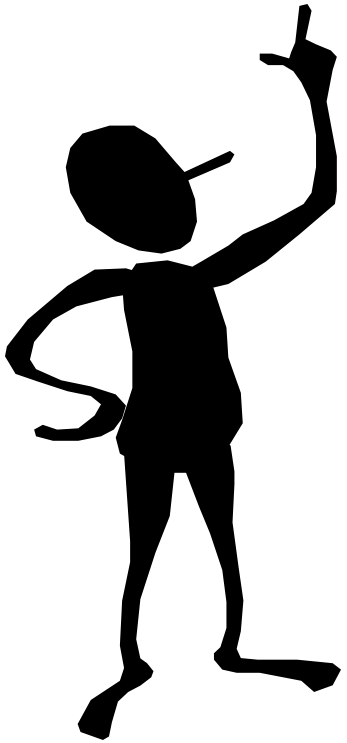


"I don't hear anything."

Tone being tested 4kHz

Click here to resume screening

Hearing Screening Protocol

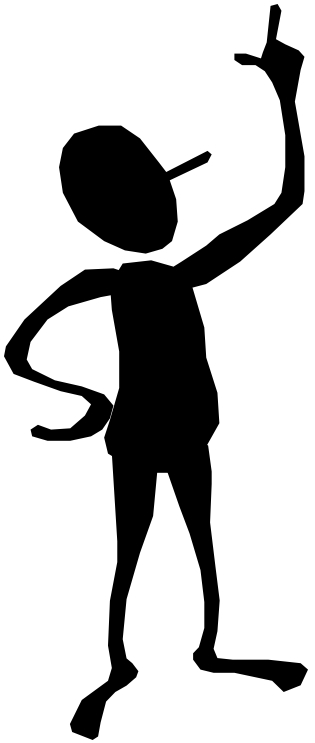


"I hear it."

Tone being tested 2kHz

Click here to resume screening

Hearing Screening Protocol



"I hear it."

Tone being tested 4kHz

Click here to resume screening

Audiometric Threshold Finding Protocol
Air Conduction

Back

Decibel Scale: (dB HTL)

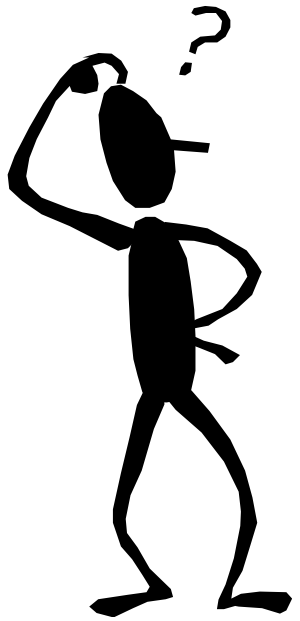
Select ear

R L

Start test at this level →

-10	55
-5	60
0	65
5	70
10	75
15	80
20	85
25	90
30	95
35	100
40	105
45	110
50	

Go to 1000 Hz
2000 Hz
4000 Hz
8000 Hz
500 Hz
250 Hz



Tone being tested 1k

Ear being tested right

Exit

Audiometric Threshold Finding Technique
Air Conduction

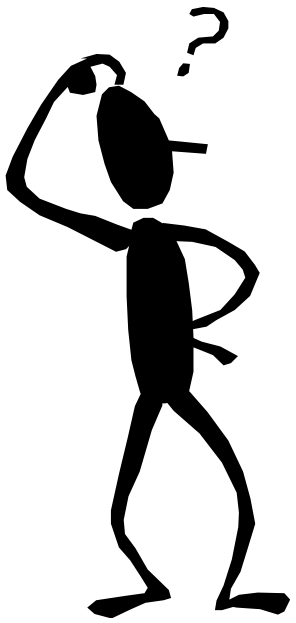
Back

Decibel Scale: (dB HTL)

Select ear

R L

-10
-5
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
105
110



Go to 1000 Hz
2000 Hz
4000 Hz
8000 Hz
500 Hz
250 Hz

Exit

Tone being tested 2k
Ear being tested right

Audiometric Threshold Finding Technique
Air Conduction

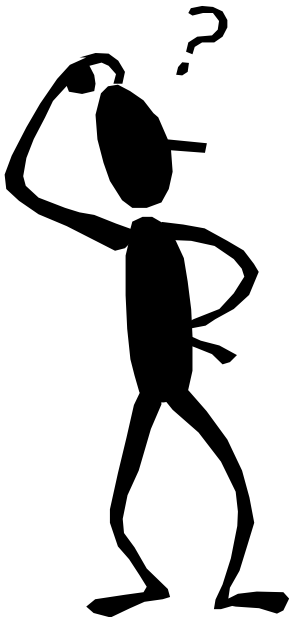
Back

Decibel Scale: (dB HTL)

Select ear

R L

-10
-5
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
105
110



Go to 1000 Hz
2000 Hz
4000 Hz
8000 Hz
500 Hz
250 Hz

Exit

Tone being tested 4k

Ear being tested right

Audiometric Threshold Finding Technique
Air Conduction

Back

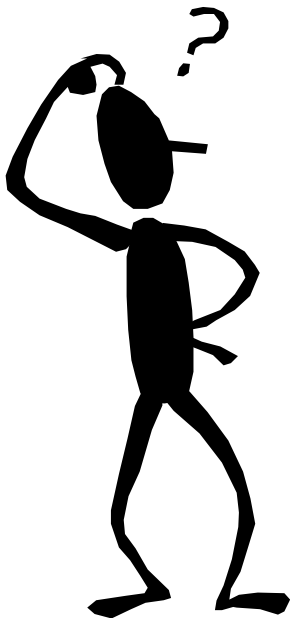
Decibel Scale: (dB HTL)

Select ear

R L

-10 -5 0 5 10 15 20 25 30 35 40 45 50

55 60 65 70 75 80 85 90 95 100 105 110



Go to 1000 Hz
2000 Hz
4000 Hz
8000 Hz
500 Hz
250 Hz

Exit

Tone being tested 8k
Ear being tested right

Audiometric Threshold Finding Technique
Air Conduction

Back

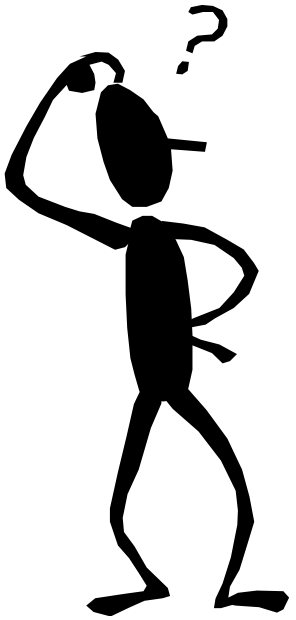
Decibel Scale: (dB HTL)

Select ear

R L

-10 -5 0 5 10 15 20 25 30 35 40 45 50

55 60 65 70 75 80 85 90 95 100 105 110



Go to 1000 Hz
2000 Hz
4000 Hz
8000 Hz
500 Hz
250 Hz

Exit

Tone being tested .5k
Ear being tested right

Audiometric Threshold Finding Technique
Air Conduction

Back

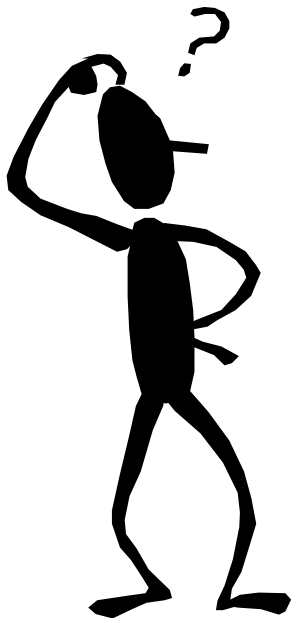
Decibel Scale: (dB HTL)

Select ear

R L

Go to 1000 Hz
2000 Hz
4000 Hz
8000 Hz
500 Hz
250 Hz

-10
-5
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
105
110



Tone being tested .25k

Ear being tested right

Exit

Return to Test

“I hear it.”

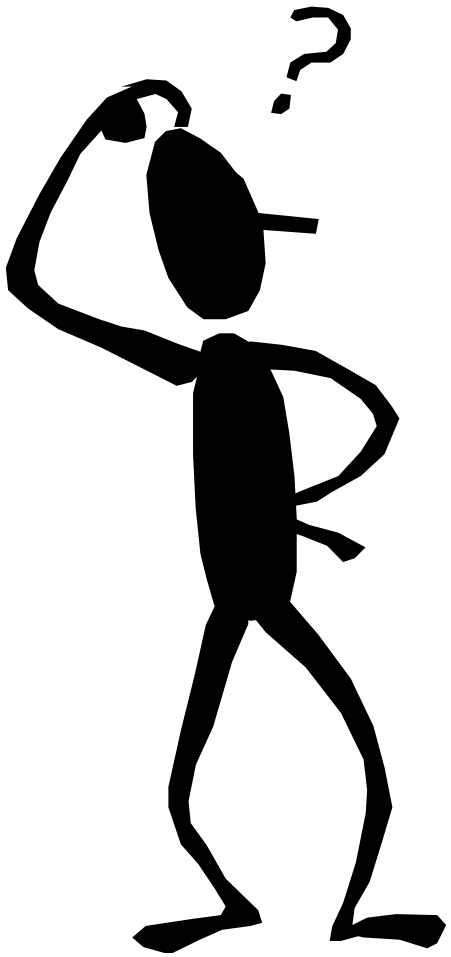
1k

Return to Test

“That’s too loud.”

1k

Return to Test



"Huh? I don't hear anything"

1k

[Return to Test]

“I hear it.”

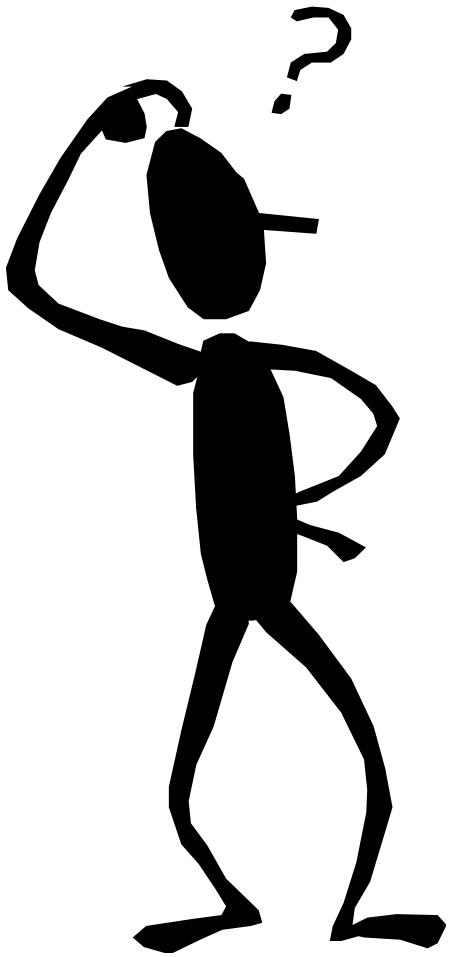
2k

[Return to Test]

“That’s too loud.”

Return to Test

“Huh? I don’t hear anything”



2k

[Return to Test]

“I hear it.”

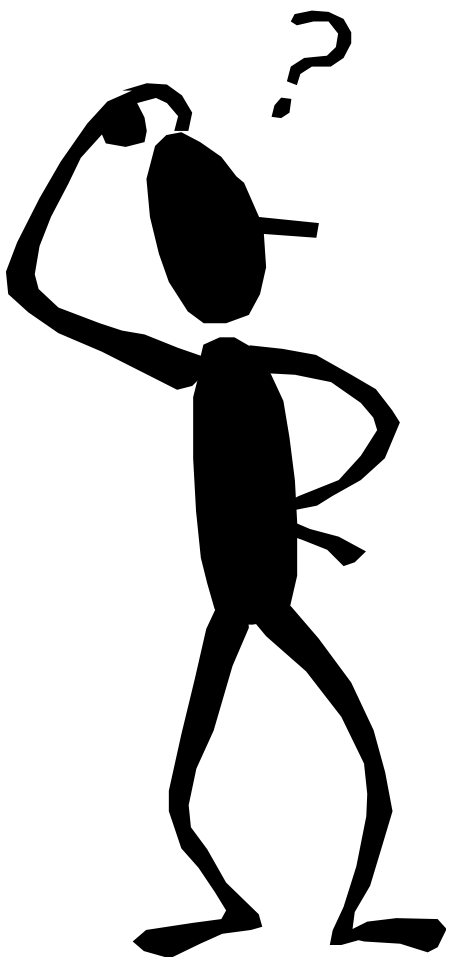
4k

Return to Test

“That’s too loud.”

4k

[Return to Test]



"Huh? I don't hear anything"

4k

Return to Test

“I hear it.”

8k

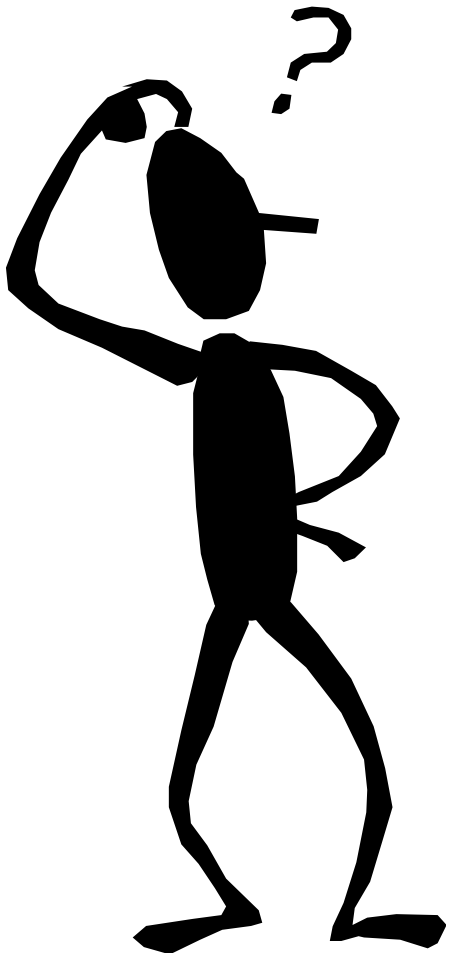
Return to Test

“That’s too loud.”

8k

[Return to Test]

"Huh? I don't hear anything"



8k

[Return to Test]

“I hear it.”

.5k

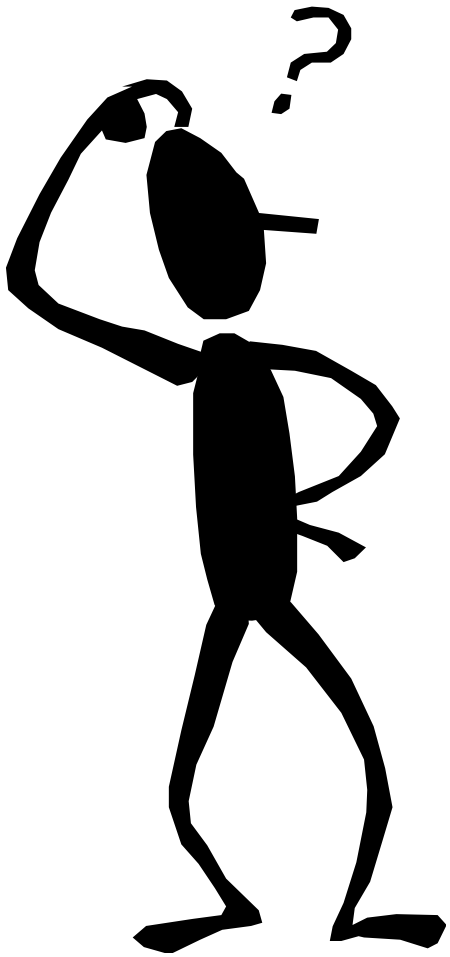
Return to Test

“That’s too loud.”

.5k

[Return to Test]

"Huh? I don't hear anything"



.5k

[Return to Test]

“I hear it.”

.25k

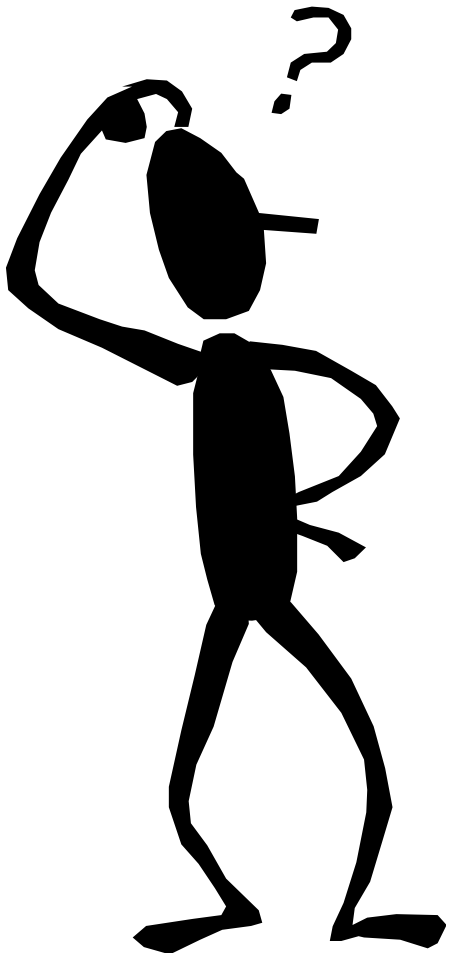
[Return to Test]

“That’s too loud.”

.25k

[Return to Test]

"Huh? I don't hear anything"



.25k

Audiometric Threshold Finding Protocol
Air Conduction

Decibel Scale: (dB HTL)

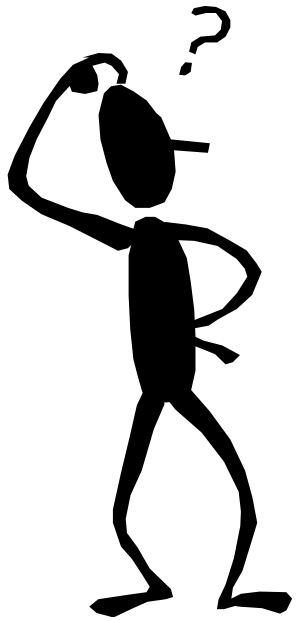
Select ear

R L

Start test at this level →

Go to 1000 Hz
2000 Hz
4000 Hz
8000 Hz
500 Hz
250 Hz

-10	55
-5	60
0	65
5	70
10	75
15	80
20	85
25	90
30	95
35	100
40	105
45	110
50	



Tone being tested 1k
Ear being tested left

Exit

Audiometric Threshold Finding Technique
Air Conduction

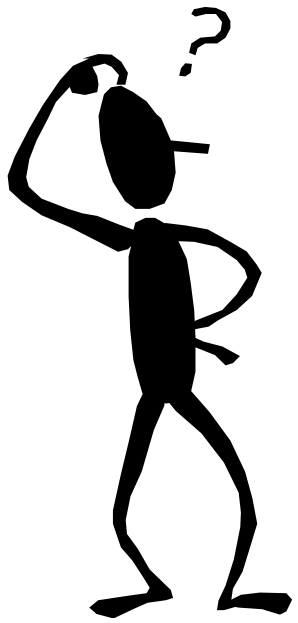
Decibel Scale: (dB HTL)

Select ear

R L

-10 -5 0 5 10 15 20 25 30 35 40 45 50

55 60 65 70 75 80 85 90 95 100 105 110



Go to 1000 Hz
2000 Hz
4000 Hz
8000 Hz
500 Hz
250 Hz

Exit

Tone being tested 2k
Ear being tested left

Audiometric Threshold Finding Technique
Air Conduction

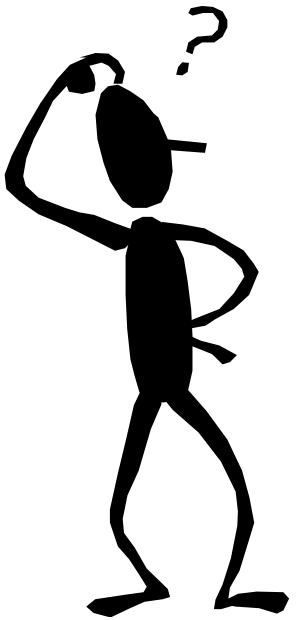
Decibel Scale: (dB HTL)

Select ear

R L

-10 -5 0 5 10 15 20 25 30 35 40 45 50

55 60 65 70 75 80 85 90 95 100 105 110



Go to 1000 Hz
2000 Hz
4000 Hz
8000 Hz
500 Hz
250 Hz

Exit

Tone being tested 4k
Ear being tested left

Audiometric Threshold Finding Technique
Air Conduction

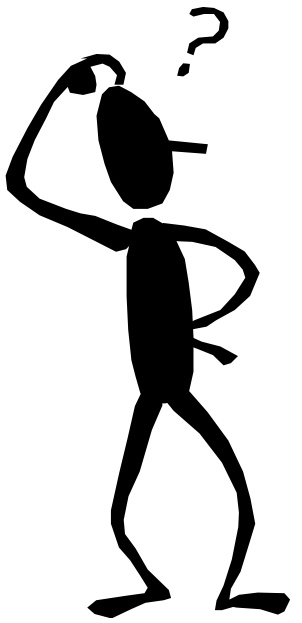
Decibel Scale: (dB HTL)

Select ear

R L

-10 -5 0 5 10 15 20 25 30 35 40 45 50

55 60 65 70 75 80 85 90 95 100 105 110



Go to 1000 Hz
2000 Hz
4000 Hz
8000 Hz
500 Hz
250 Hz

Exit

Tone being tested 8k
Ear being tested left

180

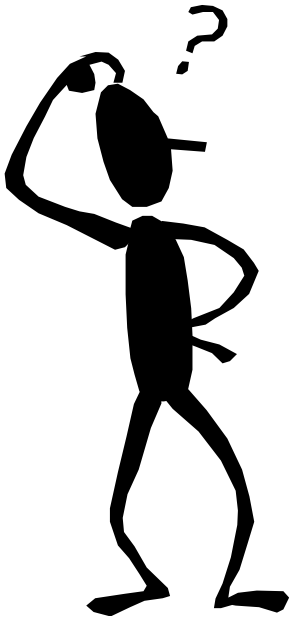
Audiometric Threshold Finding Technique
Air Conduction

Decibel Scale: (dB HTL)

Select ear

R L

-10
-5
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
105
110



Go to 1000 Hz
2000 Hz
4000 Hz
8000 Hz
500 Hz
250 Hz

Exit

Tone being tested .5k
Ear being tested left

Audiometric Threshold Finding Technique
Air Conduction

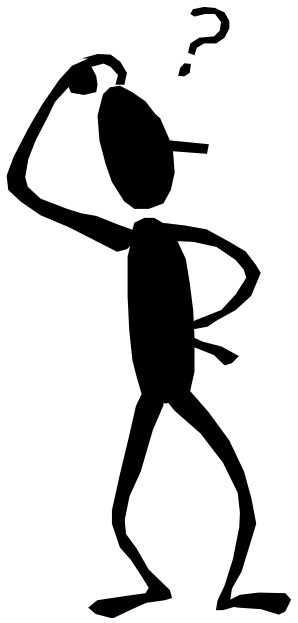
Decibel Scale: (dB HTL)

Select ear

R L

Go to 1000 Hz
2000 Hz
4000 Hz
8000 Hz
500 Hz
250 Hz

-10
-5
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
105
110



Tone being tested .25k

Ear being tested left

Exit

Return to Test

“I hear it.”

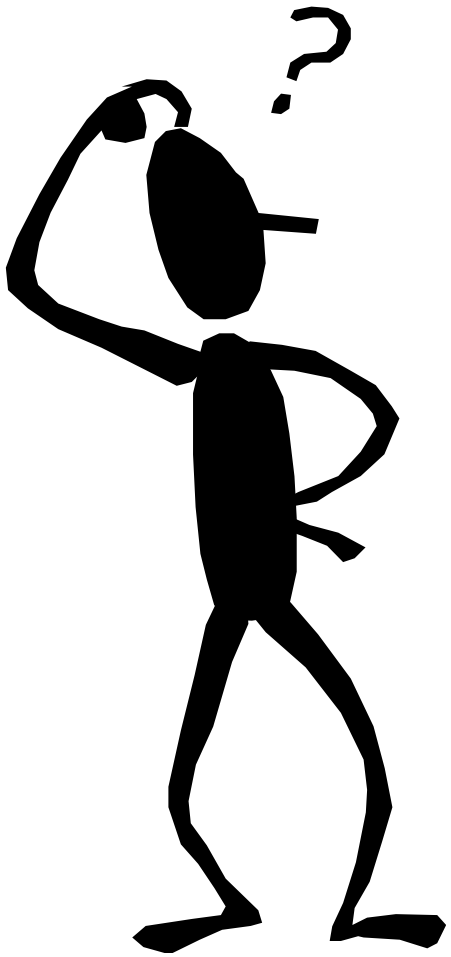
1k

Return to Test

“That’s too loud.”

1k

[Return to Test]



"Huh? I don't hear anything"

1k

[Return to Test]

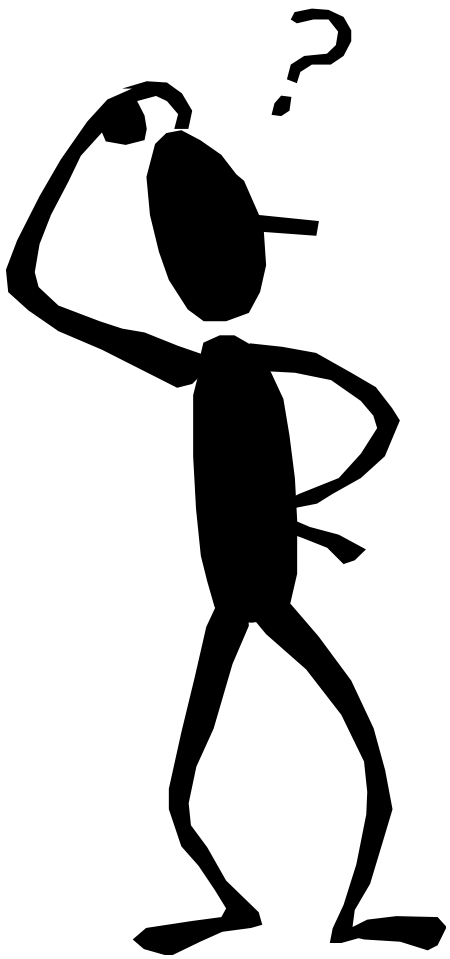
“I hear it.”

2k

Return to Test

“That’s too loud.”

[Return to Test]



"Huh? I don't hear anything"

[Return to Test]

“I hear it.”

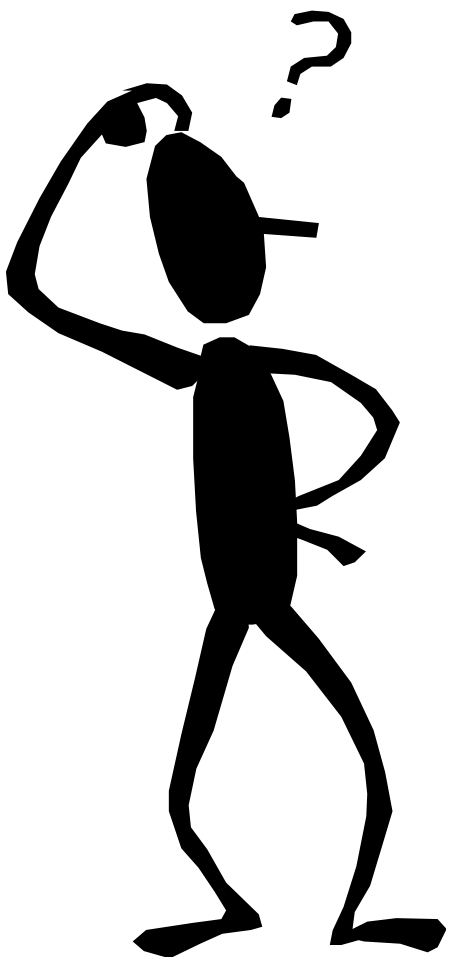
4k

Return to Test

“That’s too loud.”

4k

Return to Test



"Huh? I don't hear anything"

4k

[Return to Test]

“I hear it.”

8k

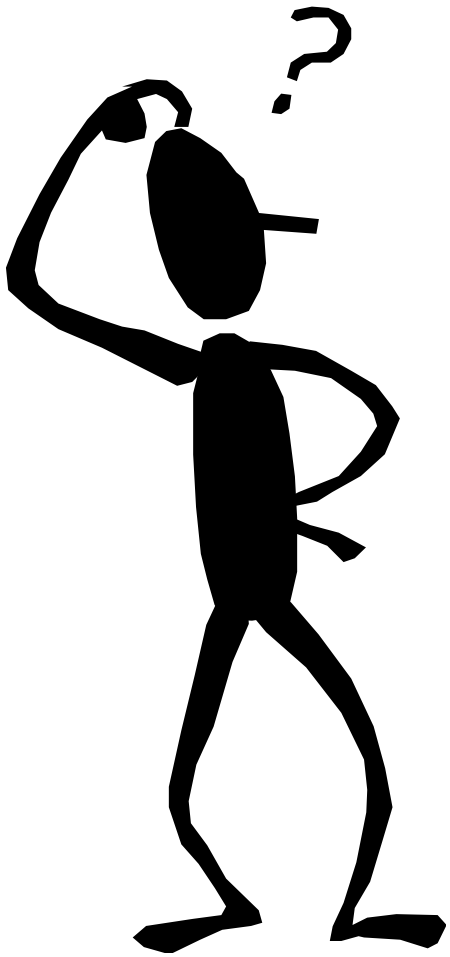
Return to Test

“That’s too loud.”

8k

[Return to Test]

"Huh? I don't hear anything"



8k

[Return to Test]

“I hear it.”

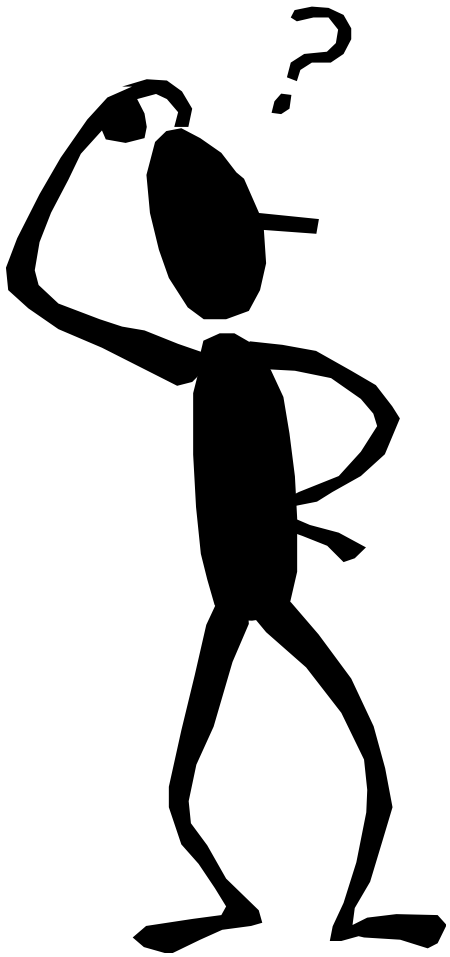
.5k

Return to Test

“That’s too loud.”

.5k

Return to Test



"Huh? I don't hear anything"

.5k

[Return to Test]

“I hear it.”

.25k

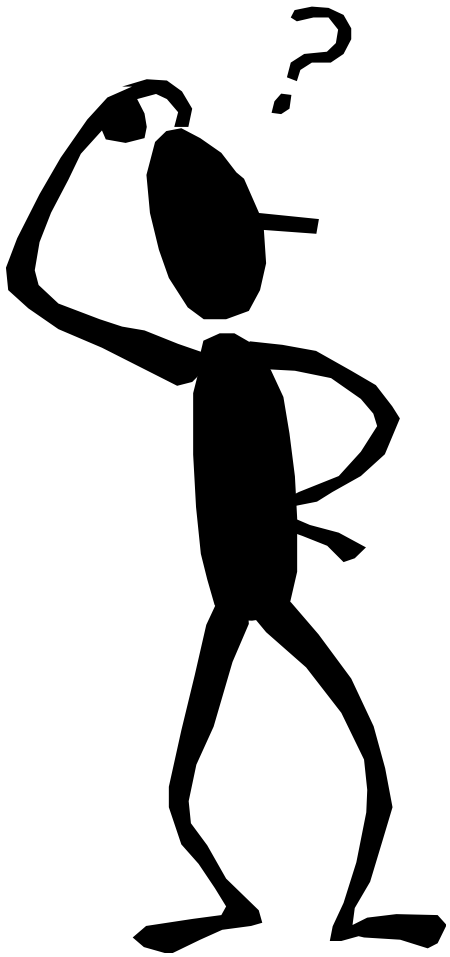
Return to Test

“That’s too loud.”

.25k

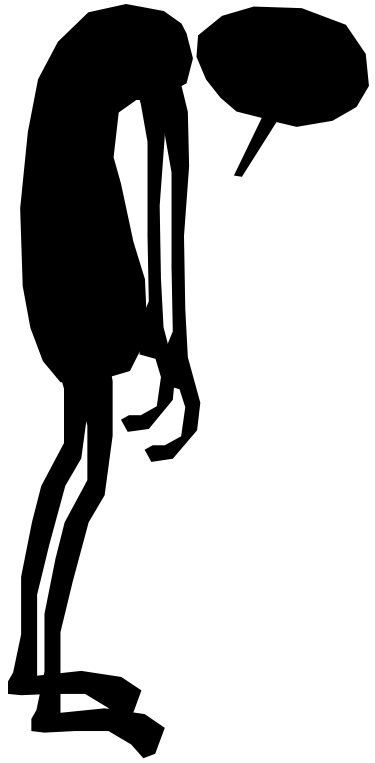
[Return to Test]

"Huh? I don't hear anything"



.25k
200

“You’re Finished”



Click here to return to Start