

NEURO UNIT 2
EXPLAINED ANSWERS TO PRACTICE QUESTIONS

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Audition—Sound, External, and Middle Ear

1. Which of the following statements is **FALSE**?
 - A. TRUE
 - B. FALSE** the ear is most sensitive to frequencies around 4000HZ (or 4kHz)
 - C. TRUE the ear is most sensitive to frequencies around 4000HZ (or 4kHz)
 - D. TRUE the louder the stimulus the greater amplitude of motion of basilar membrane
 - E. TRUE the ear is most sensitive to frequencies around 4000HZ (or 4kHz)

2. Which of the following statements is **TRUE** regarding decibel notation as it applies to sound?
 - A. TRUE**
 - B. FALSE is a measure of its intensity/loudness
 - C. FALSE db is plotted on the Y axis, frequency on the X axis
 - D. FALSE important part of the audiogram
 - E. FALSE see only A

3. Which of the following statements is **FALSE** regarding the external ear?
 - A. TRUE
 - B. TRUE
 - C. FALSE** external ear=auricle and external auditory meatus
 - D. TRUE real tough!!
 - E. TRUE like protection! In some case, helps to get a date for the Blackbag or Malpractice Ball?

4. Which of the following statements is **TRUE** regarding the middle ear or structures within the middle ear?
 - A. FALSE duh!
 - B. FALSE the communication is via the auditory/Eustachian tube
 - C. FALSE the malleus is in contact with the tympanic membrane; the stapes is in contact with the oval window—remember that tiny little thing from anatomy?
 - D. TRUE**
 - E. FALSE In a normal state, you don't have any fluid until you hit the inner ear
(This is not a Classic National Board! Yeah, I know, why is it a practice question?)

5. Which of the following statements is **FALSE** regarding the middle ear or structures within the middle ear?
 - A. FALSE** sound hits fluid=30dB loss/99.9% of energy. As Dan says, "Ever yell at your fish?"
 - B. TRUE see A
 - C. TRUE this is called "impedance matching"
 - D. TRUE via the malleus and incus
 - E. TRUE 27.3x increase in pressure versus 30db loss

6. Which of the following statements is **FALSE**?

A. **TRUE** this is true for low frequencies. Let's use an example of what happens at a single point on the basilar membrane. Say we are playing a pure tone of 4kHz and studying the response of the cells at the spot on the basilar membrane where the greatest amplitude of deflection takes place and in turn the greatest number of hair cells are firing. At this spot the cells will fire most often with a 4kHz tone, but they will also fire to other tones of lower frequencies because the traveling wave associated with these lower frequency tones roll through this area on the way to more apical areas of the basilar membrane. Let's say the hair cells at this spot fired 100 spikes for the 4kHz, 50 for a 3 kHz and 10 for a 1kHz (all fictional numbers). **NOW**, let's stiffen the ossicular chain via the tensor tympani and stapedius and consider the same spot on the basilar membrane! Now the hair cells at this spot will fire 100 spikes for a 5kHz tone, 10 for a 3 kHz and nothing for a 1kHz tone (again, all fictional numbers). The result is that during normal conversation or whatever the increase in stiffness of the basilar membrane will result in some lower frequency tones being lost and the higher frequencies in the conversation will dominate. Think about high up in an airplane and how the tinny sounds of the silverware dominate.

B. **TRUE** see A

C. **TRUE** the reflex is too slow. Takes 100 milliseconds from loud sound to muscle contractions tensor tympani and stapedius.

D. FALSE it *increases* the stiffness of the ossicular chain

E. **TRUE** if we consider the example in A, the increase in stiffness would result in an audiogram where the bone conduction would be better than air for low frequency sounds. That is, those low frequency tones that are affected/lost by the increase in stiffness would have to be louder in order to hear them. In contrast, a increase in mass when result in an audiogram in which bone is better than air for higher frequency tones

7. Which of the following associations is correct?

A=incus; B=stapes; C=malleus; D=Eustachian tube; E=tensor tympani

A. **FALSE** C is the malleus

B. **FALSE** the malleus has the longest lever arm

C. TRUE clogging up the Eustachian =problems

D. **FALSE** the stapes/stapedius muscle is controlled by CN VII (motor VII)

E. **FALSE** contraction of tensor tympani=decreases vibration of ear drum

Audition Inner Ear

1. Which of the following statements is **FALSE** regarding the inner ear?

A. **TRUE**

B. FALSE the osseous labyrinth contains the perilymph

C. **TRUE** the membranous labyrinth contains endolymph

D. **TRUE** the inner ear is not just for hearing!

E. **TRUE** oval=scala vestibuli; round=tympani Classic.....

2. Which of the following statements is **FALSE** regarding the inner ear?
- A. **FALSE** it is the connection between the scala vestibuli and the scala tympani
 - B. TRUE oval=scala vestibuli; round=tympani Classic.....
 - C. TRUE
 - D. TRUE oval=scala vestibuli; round=tympani Classic.....
 - E. TRUE helicotema=Greek helix= a coil, and trema = hole
3. Which of the following statements is **FALSE** regarding the inner ear?
- A. TRUE and filled with endolymph
 - B. TRUE the sensory epithelium hair cells (and supporting cells) of the inner ear is called the organ of Corti after the Italian scientist who first described it.
 - C. **FALSE** the scala vestibuli and tympani contain perilymph while scala media/cochlear duct contain endolymph
 - D. TRUE
 - E. TRUE the stereocilia on the three rows of outer hair cells contact the tectorial membrane but those on the single row of inner hair cells do not
4. Which of the following statements is **FALSE** regarding auditory hair cells?
- A. TRUE
 - B. TRUE there is no kinocilium in adults, but the stereocilia are oriented from short to tallest
 - C. **FALSE** it is necessary for them to oriented in the same direction so that shearing in one direction excites the hair cells and shearing in the opposite direction inhibits them
 - D. TRUE
 - E. TRUE
5. Which of the following statements is **TRUE** regarding the inner ear?
- A. FALSE Reissner's membrane separates scala vestibuli from media
 - B. FALSE the basilar membrane separates scala media from scala tympani
 - C. FALSE the basilar membrane is widest at the apex of the cochlea
 - D. FALSE the basilar membrane is the stiffest at the base
 - E. **TRUE**
6. Which of the following statements is **TRUE** regarding the inner ear?
- A. FALSE each spiral ganglion/CN VIII axon conveys information from a single inner hair cell. However, each inner hair cell can be associated with as many as 20 axons (each of which contacts only that hair cell!)
 - B. FALSE about 95% of the auditory nerve afferent fibers destined for the brain originate at the base of *inner* hair cells
 - C. FALSE information destined for the central nervous system is conveyed primarily by the *inner* hair cells INNER=INFO IN
 - D. FALSE the information running from the CNS/brain stem *to* the inner ear reaches the *outer* hair cells
 - E. **TRUE**

7. Which of the following statements is **TRUE**?

- A. TRUE**
- B. FALSE the part near the base moves first
- C. FALSE a low frequency tone will result in maximum deflection of the basilar membrane at its *apex* **BASE=HIGH—APEX=LOW**
- D. FALSE high frequency tones produce maximal deflection of the basilar membrane near the base **BASE=HIGH—APEX=LOW**
- E. FALSE only A

8. Which of the following statements is **FALSE**?

- A. TRUE an eighth nerve fiber receives information from a hair cell and conveys it to the cochlear nuclei. Such a fiber has a “characteristic” frequency, ie, the frequency to which it is most sensitive
- B. TRUE this is called the “Place Theory”= the “place” at which the basilar membrane is displaced depends on the frequency of the sine wave
- C. TRUE the axons whose cell bodies lie in the brain stem (versus the spiral ganglion) terminate on the outer hair cells in the organ of Corti and control the shape of these cells and the mechanics of the tectorial membrane
- D. FALSE** REVIEW OHC=3 rows, stereocilia touch the tectorial membrane, receive signals from the brain IHC=1 row, stereocilia do not touch the tectorial membrane, send signals into the brain
- E. TRUE

9. Which of the following associations are **FALSE**?

A=supporting cell; B=tectorial membrane; C=inner hair cell; D=outer hair cell

- A. FALSE** D is an outer hair cell
- B. TRUE D is an outer hair cell and does receive input from the brain stem/superior olive
- C. TRUE C is an inner hair cells and it contains vesicles that release transmitter to turn on the peripheral processes of spiral ganglion cells
- D. TRUE A is in fact a supporting cell
- E. TRUE B sit on top of the hair cells=tectorial membrane

10. Which of the following associations are **TRUE**?

A=Reissner’s membrane; B=scala vestibuli; C=scala media; D=scala tympani; E=basilar membrane

- A. FALSE B=scala vestibuli
- B. TRUE** C=scala media
- C. FALSE A=Reissner’s membrane
- D. FALSE D=scala tympani
- E. FALSE E=basilar membrane

11. Which of the following statements about otoacoustic emissions is **TRUE**?

A. **FALSE** they are generated by outer hair cells (OHCs) **What follows is a JKH diatribe! YOU NEED TO KNOW NOTHING MORE.** However, OAEs are interesting and clinically important! Read on, only if interested and you have nothing else to do.

The function of the outer hair cell in hearing is now perceived as that of a “cochlear amplifier” that refines the sensitivity and frequency selectivity of the basilar membrane. Their role in hearing is both sensory and mechanical. When the organ of Corti begins to vibrate in response to the incoming sound, each OHC will sense the vibration through the bending of its stereocilia. The bending results in a change in the OHC’s internal electrical potential which drives electromotility (lengthening and shortening of the OHC). If the resulting mechanical force is at the natural frequency of that portion of the basilar membrane, then the magnitude of the vibration will increase at that location. In contrast, if the resulting mechanical force is not at the natural frequency of that portion of the cochlea/basilar membrane, then the magnitude of the vibration will decrease. The system now has greater sensitivity and frequency selectivity than when the outer hair cells are missing or damaged.

Without active outer hair cell function, sound energy is lost from the traveling wave before it peaks. Peaks broaden and are of reduced size. Outer hair cells generate replacement vibration which sustains and even amplifies the traveling wave, resulting in higher and sharper peaks of excitation to the inner hair cells. Most of the sound vibration generated by the outer hair cells becomes part of the forward traveling wave, but a fraction escapes. It then travels back (via movement of the endolymph) out of the cochlea to cause secondary vibrations of the middle ear at the foramen ovale and the ear drum. The whole process can take 3 to 15 milliseconds. These cochlear driven vibrations are the source of OAEs.

You know that cells in the brain stem (superior olive) innervate the OHCs. Even without a major auditory stimulus occurring, the OHCs cause movement of the tectorial membrane, the endolymph, the oval window, the ear ossicles and the tympanic membrane. This is evident when a sensitive microphone is placed in the ear and a faint echo can be detected resonating back out again. These spontaneous OAEs are considered normal; in fact, their presence in screening exams of newborn babies is thought to be indicative of healthy hearing. However, in certain cases, OAEs can be so intense that they are audible without the aid of special equipment. In some people, you can actually hear them. The loudest ones ever recorded were in a dog in Minnesota, whose owner noticed the sound coming out of the animal’s ear (tell me this is not interesting!) and took the dog to a specialist, who did recordings and analysis. What may be happening is that the amplification system driven by the movements of outer hair cells is generating feedback, like a public address system that’s tuned up too high. OAEs gone awry may account for certain unusual forms of tinnitus, or ringing in the ear.

In addition to spontaneous OAEs, the integrity of the inner ear can also be checked by presenting a click or a tone to one ear and recording an instantaneous OAE from a microphone in the external auditory meatus. What happens is that the tone turns on a point on the basilar membrane, the IHCs and OHCs are turned on, the IHCs send the information in via CN VIII for perception. However, OHCs also vibrate to the tone. Remember, while most of the sound vibration generated by the outer hair cells becomes part of the forward traveling wave, a fraction escapes and travels back (via movement of the endolymph) out of the cochlea to cause secondary vibrations of the middle ear at the foramen ovale and the ear drum to be recorded as an instantaneous OAE. This is normal—you want this to happen in your patient. If it doesn’t, something is wrong.

B. TRUE see diatribe in A

C. **FALSE** see diatribe in A

D. **FALSE** see diatribe in A —You want to record them—they are normal. However, they may cause some forms of tinnitus if gone awry.

E. **FALSE** only B

Audition—Central Auditory System

1. Which of the following is **TRUE**. The major interaural cues for sound localization are:
 - A. **FALSE** they are first detected at the brain stem level and in particular via the medial superior olive (MSO) and lateral superior olive (LSO)
 - B. **FALSE** you have to compare sounds from both ears in order to use interaural cues—there can be no comparison at the level of the cochlea
 - C. **FALSE** MSO/LSO
 - D. TRUE** if low frequency/timing
 - E. **FALSE** double duh (same as B)

2. Which of the following statements is **FALSE**.
 - A. **TRUE** LSO=high freq/intensity level differences
 - B. **TRUE**
 - C. **TRUE** MSO= low freq/timing differences
 - D. **TRUE** MSO= low freq/timing differences
 - E. FALSE** LSO=high freq/intensity level differences

3. Which of the following is **FALSE** regarding the ascending auditory pathways:
 - A. FALSE** the only thing mapped on the basilar membrane is frequency
 - B. **TRUE** MSO= low freq/timing LSO=high freq/intensity level differences
 - C. **TRUE** such topography is seen in every station “above” the cochlear nuclei
 - D. **TRUE** via that wonderful brachium of the IC
 - E. **TRUE** DCN=cellular responses NOT identical to inputs (modulation/integration occurring)———
VCN=responses identical to inputs (no modulation/integration occurring)

4. The ability to localize the source of a sound:
 - A. **FALSE** high frequencies/intensity level differences
 - B. **FALSE** MSO= low freq/timing
 - C. **FALSE** low frequencies=timing differences
 - D. **FALSE** depends upon filtering of the external ear for sounds varying in vertical position
 - E. TRUE**

5. Which of the following is **FALSE** with regard to binaural hearing:
 - A. **TRUE** duh!
 - B. **TRUE**
 - C. FALSE** central auditory projections are a maze of crossings!
 - D. **TRUE** MSO= low freq/timing
 - E. **TRUE** LSO=high freq/intensity level differences

6. What is **FALSE** with regard to the primary auditory cortex (AI)?
 - A. FALSE** it is located in the temporal lobe on the superior bank of the superior temporal gyrus (areas 41 and 42 of Brodmann). To be exact, in/on the transverse gyri of Heschl
 - B. **TRUE** every area “above” the cochlear nuclei is tonotopically organized
 - C. **TRUE** via the sublenticular limb of the internal capsule
 - D. **TRUE** auditory pathways have lots of crossing and recrossings!
 - E. **TRUE**

7. The following statement is **FALSE**. The cochlear nuclei:

- A. **TRUE** innervated by central processes of spiral ganglion cells
- B. FALSE** the nuclei get different types of information (timing, intensity) and contain cells that differ in morphology. DCN=cellular responses NOT identical to inputs (modulation/integration occurring)——VCN=responses identical to inputs (no modulation/integration occurring)
- C. **TRUE**
- D. **TRUE** all central processes of spiral ganglion cells end in the cochlear nuclei!!! None go further centrally, like to the IC or to those other “subtle” nuclei
- E. **TRUE** this means that the organization of frequency (base=high—apex=low) present in the organ of Corti (“cochlea”) is maintained in the cochlear nuclei

8. The following statement is **FALSE**. Tonotopic organization:

- A. **TRUE**
- B. **TRUE**
- C. **TRUE** stiffness determines the resonant frequency of a vibrating object. When you tune a guitar or a violin, you change the stiffness of the strings to change their resonant frequencies. Because of the change in basilar membrane stiffness from one end to the other, sine waves of different frequencies cause different segments of the membrane to vibrate.
- D. **TRUE**
- E. FALSE** the MSO is tonotopically organized but its sound localization properties (low frequencies/timing) are not referred to as “tonotopic organization.”

9. Which of the following statements is **TRUE**?

- A. **FALSE** terminals of central processes of spiral ganglion neurons synapse in the cochlear nuclei; this is where the afferent fibers in CN VIII end. They ALL synapse in these cochlear nuclei. They do NOT go directly to more “central” auditory nuclei like the superior olive, inferior colliculus or medial geniculate body; the cochlear nuclei project to these nuclei, not CN VIII.
- B. **FALSE** it terminates in the dorsal and ventral cochlear nuclei. Remember: DCN=cellular responses NOT identical to inputs (modulation/integration occurring) while VCN=responses identical to inputs (no modulation/integration occurring).
- C. **FALSE** DCN=cellular responses NOT identical to inputs (modulation/integration occurring) while VCN=responses identical to inputs (no modulation/integration)
- D. **FALSE** DCN=cellular responses NOT identical to inputs (modulation/integration occurring) while VCN=responses identical to inputs (no modulation/integration)
- E. TRUE** VCN=responses identical to inputs (no modulation/integration occurring) so timing (low frequency) info received from CN VIII can then be sent unmodified to MSOs

10. Which of the following statements is **FALSE**?

- A. **TRUE** VCN=responses identical to inputs (no modulation/integration occurring) so timing (low frequency) information received from CN VIII can then be sent unmodified to MSOs. Such information will reach both MSOs from one ear/ventral cochlear nucleus
- B. FALSE** cochlear nuclei project to the ipsi SO directly and to the contra SO via the trapezoid body
- C. **TRUE** remember the difference between basilar pons and all of pontine grey and the pontine tegmentum and all of those ascending sensory pathways and cranial nerve nuclei.
- D. **TRUE** MGB: located in the thalamus, receives input from IC via brachium, and projects to cortex via sublenticular limb of internal capsule; primary auditory cortex: areas 41, 42, transverse temporal gyri of Heschl
- E. **TRUE**

11. The following statement is **FALSE**. The auditory cortex:
- A. TRUE and this gyrus includes the obliquely running gyri of Heschl (areas 41 and 42)
 - B. FALSE** the first location in the auditory pathways where a map of auditory space is present is the inferior colliculus. Such a map is then conveyed to the MGB and primary auditory cortex
 - C. TRUE
 - D. TRUE
 - E. TRUE lateral surface of hemisphere=middle cerebral artery
12. Which of the following statements is **TRUE**?
- A. FALSE
 - B. TRUE**
 - C. FALSE
 - D. FALSE
 - E. FALSE only B

Audition—Review of External and Internal Ear

1. Which of the following is **FALSE** with regard to auditory nerve fibers?
- A. TRUE *and not* in the SO, IC or MGB
 - B. FALSE** hyperpolarization of a hair cell leads to an *decrease* in the action potentials in the associated 8thⁿ nerve afferent fiber
 - C. TRUE
 - D. TRUE
 - E. TRUE cell bodies lie in SO and terminate on OHCs
2. Which of the following statements about the middle ear is **FALSE**?
- A. TRUE a.k.a. malleus, incus and stapes
 - B. TRUE
 - C. TRUE
 - D. TRUE
 - E. FALSE** duh!
3. Your patient was involved in a brawl in which a blow to the head severed the linkage between the ossicles of the middle ear on the left side. The right side is normal. Which of the following would you expect to be **TRUE** when comparing the left and right sides?
- A. FALSE the left ear has a conduction loss
 - B. TRUE
 - C. FALSE the left ear has a conduction loss- the right ear is normal
 - D. TRUE the left ear has a conduction loss—the left cocha is OK
 - E. TRUE** see B and D
4. Which of the following statements about the external ear is **FALSE**?
- A. TRUE and the MSO and LSO help in the horizontal dimension
 - B. TRUE
 - C. TRUE
 - D. FALSE** the physical properties of the basilar membrane account for the tonotopic (base=high freq., apex=low) organization of the organ of Corti
 - E. TRUE carried out by MSO (low freq./timing)

5. Which of the following statements about hair cells in the inner ear is **FALSE**?

- A. TRUE
- B. TRUE
- C. FALSE** 95% associated with IHCs
- D. TRUE
- E. TRUE

Audition—Hearing Tests

1. A person has excessive ear wax buildup in the right, but not the left, ear. Which of the following statements is **FALSE**?

- A. TRUE there is a conductive problem in the right ear. The Weber test would reveal that the patient hears the tone (produced by the vibrating tuning fork being placed on the head in the midline) better in the right ear=conductive loss in right ear
- B. TRUE the left ear is OK and the results of the Rinne test are normal. That is, in normal hearing, tones are louder by **air conduction** than by bone conduction.
- C. TRUE there is a conductive problem in the right ear. In normal hearing, tones are louder by air conduction than by bone conduction. In conductive hearing loss, however, the bone-conduction stimulus is perceived as louder.
- D. TRUE
- E. TRUE**

2. Which of the following statements about the brainstem auditory evoked response is **FALSE**?

- A. TRUE wave 1=generated by cochlea and distal part of CN VIII
- B. FALSE** if there is a conductive loss the latency of wave 1 is also increased
- C. TRUE
- D. TRUE the most specific evoked potential abnormality is the presence of an increase in interwave intervals. Abnormal interwave latencies (I-III or I-V) are the most specific and sensitive abnormalities seen with cerebellopontine angle tumors.
- E. TRUE make sure that you understand that conductive loss (ossicle problem for instance) result in weaker signals and such signals take a longer time to build up and result in longer latency of response.

Auditory Clinical Correlations

1. Acute otitis media is associated with:

- A. TRUE** bone will be better than air. As organisms migrate to the middle ear from the nasopharynx, the fluid changes rapidly from serous to sero-purulent and finally to the purulent stage. There is an increase in the mass of the ear ossicles and high frequency sounds will be especially affected.
- B. FALSE all of the gunk is bad but the organ of Corti and CN VIII are fine.
- C. FALSE
- D. FALSE the tympanogram is abnormal. A middle ear infection will result in most of the sound being reflected back and the tympanogram is flat (low compliance). If the eardrum is functioning normally, more of the sound energy will be 'absorbed' and little will be 'reflected' (i.e., there will be little impedance to sound transmission and this will be reflected in the tympanogram).
- E. FALSE the auditory brain stem response (ABR; or auditory brain stem evoked response, ABER) is abnormal. The conductive hearing loss can lead to an increase in latency of all waves in the auditory brainstem response

2. Acute otitis externa is associated with:

- A. **TRUE** bone will be better than air. Otitis externa is usually caused by a break in the skin of the ear canal and prolonged water exposure—conditions that are favorable for bacterial growth. Otitis externa is often called “swimmer’s ear.”
- B. FALSE the eardrum “itches” but the organ of Cortic and CN VIII are fine
- C. FALSE
- D. FALSE the ABR is abnormal. The conductive hearing loss can lead to an increase in latency of all waves in the auditory brainstem response
- E. FALSE see A

3. Excessive noise exposure is associated with:

- A. FALSE noise does not affect the middle ear unless there is an impact, sound, or pressure so great that it dislodges or fractures the ossicles. Let’s go with the “usual” situation here and say that the ossicles are OK
- B. **TRUE** typically, hair cells are damaged or destroyed when their supporting structures are overworked. With continued exposure to high-level noise the membrane motion is great, and the cell that support the hair cells swell. Eventually, they rupture, and the hair is destroyed or damaged. Only a few hair cells may be lost at a time, but with repeated exposure over days, months, and years, the cumulative effect can be substantial.
- C. FALSE interesting question in light of potential discussed in A. Let’s go with sensorineural only
- D. FALSE outer hair cells are damaged. Outer hair cells are more susceptible to damage than inner hair cells, probably due to their stereocilia being subject to shear forces from the tectorial membrane and the greater displacement they undergo, because of their position on the basilar membrane.
- E. FALSE with an inner ear problem, the tympanogram is normal.

4. An audiogram from a patient with multiple sclerosis would show:

- A. FALSE demyelination of axons would affect CN VIII and result in a sensorineural loss. Of course, you could argue that axons to the stapedius and tensory tympani are affected and this might somehow result in a conductive loss. Or facial nerve axons to the outer ear might cause bone better than air. JKH does not know so let’s go with the demyelination of CN VIII and sensorineural!
- B. **TRUE**
- C. FALSE
- D. FALSE the ABR is abnormal with a bad nerve, especially wave I.
- E. FALSE with an inner ear problem the tympanogram is normal.

5. Otitis media results from:

- A. FALSE
- B. **TRUE**
- C. FALSE
- D. FALSE obstruction of ossicular motion happens in otitis media but does not cause it
- E. FALSE see B

6. Thresholds to bone conducted sound stimuli measure the function of:

- A. FALSE a tuning fork on your mastoid process bypass the outer and middle ears and test the cochlea and its central connections
- B. FALSE see A
- C. **TRUE**
- D. FALSE see A
- E. FALSE see C

7. Thresholds to air conducted sound stimuli measure:

- A. FALSE putting a vibrating tuning fork next to your ear tests everything central. This response is FALSE because it is not “the entire auditory pathway”
- B. FALSE putting a vibrating tuning fork next to your ear tests everything central. This response is FALSE because it is not “the entire auditory pathway”
- C. FALSE putting a vibrating tuning fork next to your ear tests everything central. This response is FALSE because it is not “the entire auditory pathway”
- D. TRUE** finally
- E. FALSE see D

8. Serous otitis media causes a hearing loss by:

- A. FALSE no, the damage is to the middle ear. As organisms migrate to the middle ear from the nasopharynx, the fluid changes rapidly from serous to sero-purulent and finally to the purulent stage. There is an increase in the mass of the ear ossicles and high frequency sounds will be especially affected.
- B. FALSE the effective ratio stays the same even with the gunk
- C. FALSE the lever ratio stays the same even with the gunk
- D. TRUE**
- E. FALSE see D

9. A 65 year old man developed a unilateral *conductive* hearing loss. This may be caused by:

- A. FALSE this would cause a CN VIII (nerve) problem (sensorineural loss)
- B. FALSE this damages OHCs (sensorineural loss)
- C. TRUE** this would reach the middle ear and cause a conductive loss
- D. FALSE aspirin may lead to bilateral sensorineural loss
- E. FALSE see C

10. A 75 year old man developed a unilateral sensorineural hearing loss. This may be caused by:

- A. TRUE** unilateral CN VIII nerve damage (sensorineural loss)
- B. FALSE excessive noise exposure may lead to *bilateral* sensorineural loss
- C. FALSE conductive loss
- D. FALSE bilateral sensorineural loss
- E. FALSE see A

11. A child with acute bilateral otitis media:

- A. FALSE *conductive* loss
- B. TRUE** bony abnormalities of the inner ear may sometimes result in a communication between the middle ear (the bone is so thin) and the subarachnoid space. Patients with this anomaly often present with recurrent meningitis associated with acute otitis media.
- C. FALSE bone conduction bypassed the middle ear
- D. FALSE increased stiffness: hear high freq. better (up in an airplane!)
- E. FALSE increased mass: hear low freq. better

12. Which of the following statements is FALSE?

- A. TRUE duh
- B. TRUE this is a test for cochlea function
- C. TRUE it's always the poor OHCs
- D. FALSE like I said....
- E. TRUE** the descent leads to negative pressure in the middle ear

Audition-Audiograms

Audiogram A= air-bone gap (conductive hearing loss) that runs from 40db at 250Hz and peaks at 60db at 4kHz;

Audiogram B= sensorineural loss that peaks at 4kHz (“notch” at 4kHz);

Audiogram C=gradual sensorineural loss that peaks at almost 100db at 4kHz;

Audiogram D=normal hearing to 4kHz and then falls off at higher frequencies.

1. An 84 year-old woman presents to her primary care physician with slowly worsening hearing over the past several years. She notes difficulty hearing when there is a high level of background noise.

Explanation: The key here is the patient’s age. You should immediately think presbycusis.

Only C really fits presbycusis.

2. A 45 year old woman sees her primary care physician with a chief complaint of hearing loss in the left ear. She had been scuba diving the week before and had sudden severe left-sided ear pain while descending. Although the ear pain went away the next day, she has noted decreased hearing ever since.

Explanation: You should immediately think about a punctured ear drum and a conductive hearing loss (air bone gap!!!). Only A fits.

3. A 43 year old woman sees her primary care physician with a chief complaint of hearing loss in the left ear. She had had an upper respiratory infection two weeks prior that has since improved.

However, the hearing loss has not improved.

Explanation: The upper respiratory infection should clue you in on a middle ear problem/ conductive hearing loss. Only A fits again!

4. A 26 year old man received high dose intravenous gentamicin to treat a pneumonia caused by Pseudomonas sp. Following recovery from the pneumonia, he came to the doctor complaining about dizziness. Audiometry reveal a sensorineural hearing loss above 4kHz.

Explanation: the antibiotic gentamicin kills hair cells in both ears. Guinea pig hair cells commit suicide in response to gentamicin exposure and when hair cells are cultured and exposed to gentamicin in the culture dish, they commit suicide. This results in a sensorineural hearing loss. Often persons with significant vestibular damage from gentamicin sometimes do not notice any change in their hearing (this patient did notice it). Only D fits.

5. A 47 year old farmer has had daily exposure to high intensity noise including a tractor, chain saw and other powered equipment for the past 20 years. He also fires a rifle without hearing protection when he goes out to hunt deer, duck and squirrels.

Explanation: The “notch” in the audiogram is the key for noise induced sensorineural hearing loss. Only B fits!

6. Which of the following statements is **TRUE** regarding the audiogram shown below?

A. TRUE this is a “mixed” hearing loss. Bone is better than air which=a conductive loss.