

LESSON

17

TRAINER MANUAL

## Pure Tone Air Conduction Audiometry

SAMPLE

### Outline

This lesson covers:

- Audiometric symbols
- Air conduction threshold determination

### REQUIRED READING

Textbook  
Chapter 8:  
Pure Tone Audiometry

Workbook  
Lesson 17:  
Pure Tone Air Conduction  
Audiometry

### LEARNING OBJECTIVES

After completing this lesson, the apprentice is expected to:

- ✓ Instruct the patient/client on the listening task and response mode for air.
- ✓ Demonstrate proper placement of air conduction transducers.
- ✓ Determine and document unmasked air conduction thresholds for each ear.
- ✓ Measure and document frequency-specific uncomfortable loudness levels.

### TRAINER TASKS

To help the trainee achieve the learning objectives and show competency in the practical skills, the trainer should complete the following teaching tasks:

- Demonstrate instructing the patient/client for air conduction testing.
- Require the trainee to instruct at least 10 patients/clients for air conduction testing.
- Discuss and demonstrate how to perform air conduction audiometry.
- Require the trainee to perform air conduction audiometry on at least 10 patients/clients.
- Demonstrate documentation of air conduction thresholds for right and left ears.
- Require the trainee to practice documenting, using appropriate symbols, air conduction thresholds for right and left ears for at least 10 patients/clients.
- Demonstrate the measurement and documentation of pure tone UCLs.
- Require the trainee to measure and document frequency-specific UCLs for at least 10 patients/clients.
- Require the trainee to complete the exercise(s) provided for the lesson.

## Audiometric Symbols

- The symbols for air conduction are uniform worldwide (see Figure 17-1).
- Placement is on the frequency line at threshold.
- Measure threshold at each frequency, right and left ear, AC and BC, and record them.
- No response symbols use downward-pointing arrows.
- Connect the symbols with a straight line. Do not connect symbols that indicate no response.

		Right	Left
Air conduction	Unmasked	○	×
	Masked	△	□
Bone conduction	Unmasked	<	>
	Masked	⌈	⌋
No response	AC	Unmasked	○↓
		Masked	△↓
	BC	Unmasked	<↓
		Masked	⌈↓
UCL/IDL		U	U

Figure 17-1. Pure tone symbols.

### SKILL PRACTICE

Does the trainee have the audiometric symbols memorized? Make sure they understand the differences between all of the symbols and when to use each. It may be helpful to have the trainee create a “cheat sheet” card with the audiometric symbol key.

## Air Conduction Threshold Determination

1. Follow appropriate equipment sanitizing and infection control guidelines.
2. Instruct the patient/client as follows: “You and I are going to measure the softest sounds that you can hear. Every time you hear a tone or a beep, raise your hand (or press the response button). Respond no matter how soft or far away the tones become. There will be many tones, each presented one at a time. We’ll start with your (right or left) ear. Do you have any questions?”



### TRAINER TASK

Demonstrate giving instructions to a patient/client. Discuss why you provide instructions the way you do, and give the trainee an opportunity to repeat your instructions or come up with their own version. Ensure they are still getting all relevant information across clearly.

3. Place the AC transducer in the ear canal or over the pinna and check for proper placement (see **Earphone Placement**).
4. Present a 1000 Hz tone at 30 dB. This frequency is easy to hear and has good test—retest reliability.
5. If the patient/client responds, decrease the presentation level in 10 dB steps until there is no response (descending technique). If there is no response at 30 dB, raise the presentation level to 50 dB or higher in 20 dB steps until there is a response. Then, engage the descending technique (decrease stimulus intensity in 10 dB steps) until there is no response.
6. Next, increase the intensity level in 5 dB steps until there is a response (ascending technique).
7. Continue the ascending/descending techniques to determine the threshold. Threshold is defined as the lowest level at which the patient/client responds to the tone on at least 50% of the ascending presentations. This ascending/descending technique is called “bracketing.”
8. Record the threshold on the audiogram using the appropriate symbol.

### SKILL PRACTICE

Though most audiometers automatically record the thresholds, the trainee should practice documenting thresholds by hand on a printed audiogram. Have them do this while observing you or another colleague performing the test for at least 10 patients/clients, then check their work.

9. Test all frequencies using this technique. 1000, 1500, 2000, 3000, 4000, 6000, 8000, retest 1000, 750, 500, 250 Hz.
10. Repeat the above procedure for the other ear.
  - Each tone presented should be about 2 seconds in duration. Vary the timing of presentations to avoid anticipated responses rather than hearing-related responses.

### SKILL PRACTICE

Have the trainee perform air conduction testing for at least 10 patients/clients. Critique their process and give them helpful feedback so they can improve.

## Uncomfortable Loudness Levels

- Measurements that define the upper audiometric limit of the patient's/client's usable auditory area.
- Best practice dictates that pure tone UCLs be measured for a truly individualized hearing aid fitting
- They are used by prescriptive fitting formulas for hearing aid programming of the maximum power output.
- The usable auditory area displayed on the audiogram is the dynamic range. When viewed on an audiogram, it is the space between pure tone AC thresholds and pure tone UCLs.
  - Dynamic range for normal hearing: 0–20 dB HL to about 100 dB HL.
  - SNHL: reduced dynamic range, thresholds are elevated but UCL remains around 100 dB HL or less if a patient/client has recruitment.

### UCL Procedure for Pure Tones

1. Set the audiometer as follows:
  - a. Select output for pure tone
  - b. Select insert earphone as the transducer for the test ear
2. Instruct the patient/client as follows: "We are going to measure the level where sound becomes uncomfortably loud. You are going to hear a tone in one ear at a time. Please raise your hand, or say "stop" when the sound becomes uncomfortably loud and you cannot listen to it any more."
3. Starting with the better ear or the right ear if hearing levels are symmetrical, present a pulsed tone at 1000 Hz at 70 dB HL.
4. Increase the signal in 5 dB steps until the patient/client signals "stop."
5. Repeat the step above.
  - a. If 4. and 5. are less than 10 dB apart, then average them and record this value on the audiogram as the UCL.
  - b. If 4. and 5. are more than 10 dB apart, make another measurement and average all three.
6. Record this value on the audiogram as the UCL at 1000 Hz using the appropriate symbol.
7. Repeat the procedure at 2000 Hz, 3000 Hz, 4000 Hz and 500 Hz.
8. Repeat steps 1 through 7 for the other ear.



Masking is not used during UCL measurements

**TRAINER TASK**

Demonstrate the UCL measurement process and discuss its importance with the trainee. Though they haven't learned much about selecting or programming hearing aids yet, relate the importance of this measurement to future job tasks. Then, give the trainee the opportunity to measure pure tone UCLs for at least 10 patients/clients.

**SAMPLE**

# EXERCISES

The student will complete the exercise(s) printed in the Workbook and/or included in the online learning system before taking the chapter test. Go over the answers with your trainee, using the guidelines below.

## Exercise 1: Determining Threshold

The student will fill in the blanks of the below diagram to complete the process of determining threshold. Review the trainee's answers to ensure application of proper threshold-seeking technique using the Modified Hughson-Westlake procedure.

### Example A

Presentation Level	Response	Next Step
30 dB	Response	Go down (descend) 10 dB
20 dB	Response	Go down 10 dB
10 dB	No Response	<b>Go up (ascend) by 5 dB</b>
15 dB	<b>No Response</b>	go up 5 dB
20 dB	Response	<b>Go down (descend) 10 dB</b>
10 dB	<b>No Response</b>	go up 5 dB
15 dB	No Response	<b>Go up (ascend) by 5 dB</b>
20 dB	Response	<b>Stop</b>

Reinforce that threshold is defined as the softest level where the patient/client responds at least 50% of the time on ascending runs.

Example B

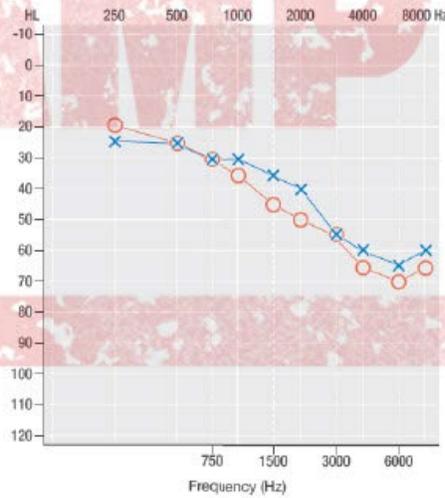
Presentation Level	Response	Next Step
30 dB	No Response	Go up (ascend) 20 dB
50 dB	No Response	<b>Go up (ascend) 20 dB</b>
70 dB	Response	Go down (descend) 10 dB
60 dB	<b>No Response</b>	Go up 5 dB
65 dB	Response	<b>Go down (descend) 10 dB</b>
55 dB	<b>No Response</b>	Go up 5 dB
60 dB	No Response	<b>Go up 5 dB</b>
65 dB	Response	Go down (descend) 10 dB
55 dB	No Response	Go up 5 dB
60 dB	No Response	<b>Go up 5 dB</b>
65 dB	Response	<b>Stop</b>

Review the process with the trainee, reminding them that if there is no response at 30 dB, raise the presentation level to 50 dB or higher in 20 dB steps until there is a response. Then, engage the descending technique (decrease stimulus intensity in 10 dB steps) until there is no response.

### Exercise 2: AC Thresholds on the Audiogram

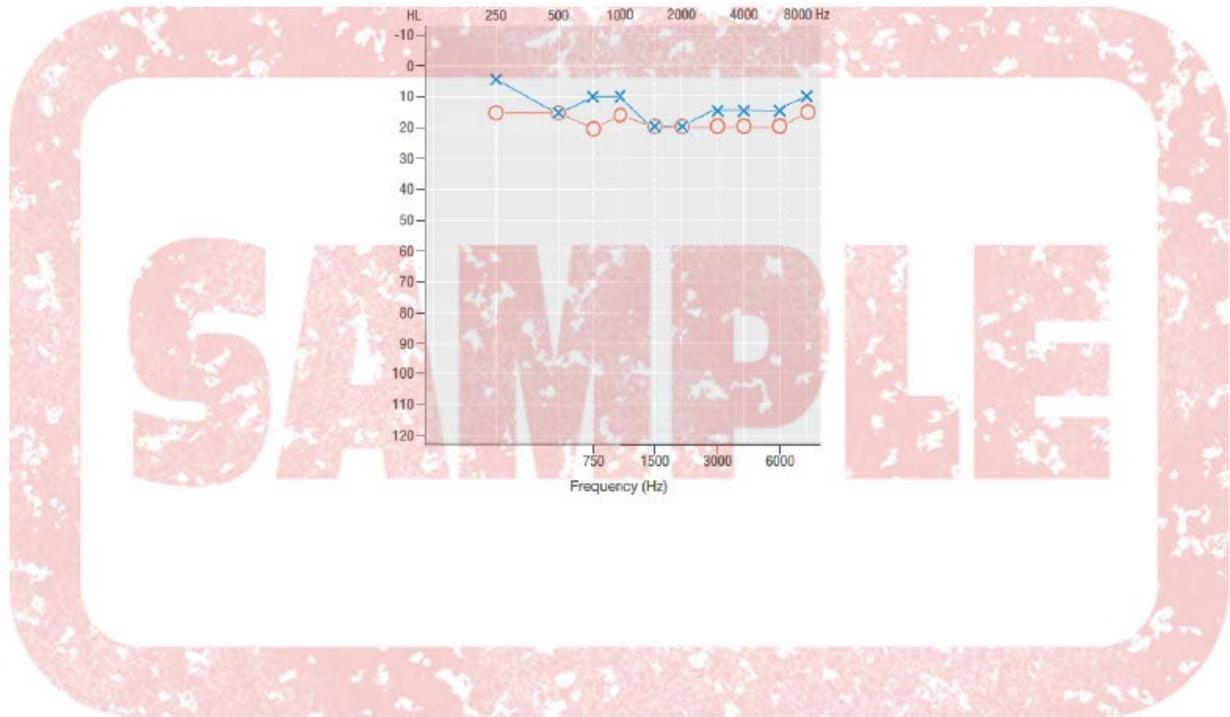
The student must plot the following air conduction thresholds on the audiogram. Be sure to check that the trainee has plotted the correct levels in reference to the frequencies, as well as used the correct air conduction symbols

Frequency	Right Ear	Left Ear
250 Hz	20	25
500	25	25
750	30	30
1000	35	30
1500	45	35
2000	50	40
3000	55	55
4000	65	60
6000	70	65
8000	65	60



### Exercise 3: Audiometer Simulation

The student must log on to the online learning system to access this exercise. They will be linked to the Counsel Ear audiometer simulator and be instructed to complete air conduction testing for a sample patient/client and record their audiogram results in the workbook. Instructions on how to use the simulator are included in the online learning system as well as the Trainer Toolbox.



## Lesson Evaluation

Use this section to evaluate the trainee's performance in this lesson. Ensure that you have completed all necessary trainer tasks. Review the trainee's comprehension of the text, completion of the exercises, performance on the chapter test, and achievement of the learning objectives.

### Trainer's Checklist

Hours Trained	Trainer Initials	Trainer Tasks	Tasks Tally
		Demonstrate instructing the patient/client for air conduction testing. Require the trainee to instruct at least 10 patients/clients for air conduction testing.	
		Discuss and demonstrate how to perform air conduction audiometry. Require the trainee to perform air conduction audiometry on at least 10 patients/clients.	
		Demonstrate documentation of air conduction thresholds for right and left ears. Require the trainee to practice documenting, using appropriate symbols, air conduction thresholds for right and left ears for at least 10 patients/clients.	
		Demonstrate the measurement and documentation of pure tone UCLs. Require the trainee to measure and document frequency-specific UCLs for at least 10 patients/clients.	
		Require the trainee to complete the exercise(s) provided for the lesson.	

### Practical Training Assessment

Date of Proficiency	Trainer Initials	Learning Objectives	Assessment
		Instructs the patient/client on the listening task and response mode for air conduction audiometry.	<div style="text-align: center;"> </div> <input type="text"/>
		Demonstrates proper placement of air conduction transducers.	<input type="text"/>
		Determines and documents unmasked air conduction thresholds accurately for each ear.	<input type="text"/>
		Measures and documents frequency-specific uncomfortable loudness levels.	<input type="text"/>



**UNIT 03** Audiometric Assessment and Additional Testing

*Evaluate performance in this lesson:*

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*Specific areas that need more work:*

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*Date for follow-up review: \_\_\_\_/\_\_\_\_/\_\_\_\_*

*Trainee comments:*

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Lesson 17 Completion	
Trainee Signature:	Date:
Trainer Signature:	Date: