Unit 1: Phonetics

This unit presents the theoretical background to phonetics as a scientific study of speech sound.

1 INTRODUCTION
Phonetics, as a branch of Linguistics, concerns the scientific study of how speech sounds are produced (articulatory), transmitted (acoustic) and perceived (auditory) for the purpose of communication. These form the three major types of phonetics. The other purpose of a phonetic study is to describe and explain each of these sounds.

2 OBJECTIVES
Learners should, by the end of this unit, be able to:
- define what phonetics is
- identify the concern of phonetic study
- list phonetician’s working tools
- explain the three main branches of phonetics.

3.1 THEORETICAL BACKGROUND ON PHONETICS
A phonetician concerns with the scientific study of all possible human sounds that are meant for speech communication. Thus, it is possible for him to investigate the speech sounds of a language he does not quite understand, speak, read or write. He must learn how they are produced, transmitted and perceived. To achieve this, he needs to observe, listen, record and analyse what he hears. He must be a good observer, listener, recorder and analyst. He must also have some tools handy to do all this, such as: a good audio recording machine, video recording machine, and software, too.

A phonetician represents the speech sounds in signs called phonetic symbols, usually in square brackets [ ] and agree upon the IPA, an abbreviation for both the name of the association (International Phonetic Association) and the alphabet or symbols used for transcription (International Phonetic Alphabet).

3.2 ARTICULATORY PHONETICS
In speech making, certain speech organs are brought together at various places and manners. These organs come together to shape or moderate the sound signals produced from the larynx. These organs are the lips, teeth, teeth ridge, tongue, pharynx, and even the nose, etc. All these are usually categorised into the pharyngeal, oral and nasal cavities, which form what is called the vocal tract. These organs come together in the formation or articulation of the speech sounds. Articulatory phonetics, therefore, is the branch of phonetics that is concerned with the study of how the speech sounds are produced. It concerns with the study of the vowel and the consonant sounds which concentrates on three main areas: 1) place of articulation, 2) manner of articulation, and 3) quality of production.

3.2.1 Place of Articulation of Speech Sounds
This relates to the identification and description of the organs involved in the production of a specific sound, such as: a front vowel sound [i], centre vowel sound [ə] or back
vowel sound [ɑ], the production of the bilabial consonant sounds [p, b, m], labiodental consonant sounds [f, v], or dental consonant sounds [ð, θ]. Other places of articulation of consonant sounds are: at the alveolar, velar, uvula, nasal, pharynx and glottis.

### 3.2.2 The Manner of Speech Production
The manner of speech production concerns with the various ways or how these articulators produce speech sounds. For the consonant sounds, it is possible to say that some sounds are produced with total closure of the articulators (stops or plosives), or friction (Affricates/Fricatives). Another sound might be produced by the vibration of the tip of the tongue, slightly touching the palate (Rolled) or just tapping it (Tap-Flap). It is also possible to shape the mouth such that a sound is allowed to pass through a space at both sides of the blade of the tongue and the mouth (Lateral), or allow the sound to come out of the vocal tract with little or no obstruction of the articulators (Approximant or Semi Vowel).

As for the manner of producing the vowel sounds, the lips may be rounded, neutral or spread; the mouth may be open, close, partially open or partially close. Also, a vowel sound may be produced while the tongue is high, level or low.

### 3.2.3 The Quality of Speech Production
The quality of speech production means: (a) the quantity or length of time expended on a sound; (b) the amount of force or pressure exerted on a sound; (c) the presence or absence of laryngeal vibrations while producing the sound; or (d) a combination of a-c.

A voiceless consonant [p] is produced with greater force or pressure than its voiced counterpart [b], which might be produced with a weaker force (lenis or lax). We spend a long time producing an /uː/ sound, and a short time to produce /tæ/. We also notice that some sounds are voiced because we have produced them with some vibrations coming from our larynx. Some others are voiceless because they are produced with no laryngeal vibrations.

### 3.3 Acoustic Phonetics
Acoustic phonetics region starts from the larynx below the glottis, or at the subglottal region. It moves through the pharyngeal, oral and nasal cavities and beyond the two lips and the nose into the outer environment. Consequently, acoustic phonetics can be described as the scientific study of the properties of the signals that lead to speech and how they are propagated by man.

Any sound, non-human or human, non-speech or speech, travels through a medium such as the air or water or metal. A sound is usually propagated or transmitted by wave, which is defined as the periodic displacement of pressure from one point to the other. Through these periodic movements, the wave is able to transmit or propagate a sound from one fixed place to the other. Specifically, human speech is transmitted by the sound waves that originate from the lungs into the larynx or what is called the voice box. The larynx is usually referred to as the voice box, mainly, because it houses the
vocal folds whose precursor is the generation of the vibrations that give phonation or the sound waves that lead to the voiced sounds.

The Source-Filter Theory recounts that the speech sound generation starts from the lungs, which pump air into the larynx. The air, so pumped, forces the vocal folds housed by the larynx to open and close. When the sound waves that escape through the folds get to the vocal tract, they are moderated by the various speech organs in the vocal tract by the process of filtration and the vocal tract acting as the acoustic filter. The filtering process converts the sound vibrations from the larynx into the individual speech sounds that we hear. Thus, it can be summarised that in speech production, the sound vibrations from the larynx serve as the input, which is filtered by the vocal tract; the result of the filtration is the output, which we hear as speech in the outer world.

In speech production, when the two folds close in order to vibrate, they generate periodic tones that lead to the sonorant sounds that form the voiced sounds such as the vowels, the laterals, the nasals and all other voiced consonants. But when the two vocal folds open and are not vibrating, the air from the lungs passes through them freely into the vocal tract. The tones generated in this process are referred to as aperiodic, and they form the obstruent sounds that generate the voiceless consonants.

3.4 AUDITORY PHONETICS
This is the aspect of phonetics that concerns the natural processing systems of speech reception and perception. The main organ of the human body concerned with this is the ear.

The ear is divided into three sections namely, the outer ear, the middle ear and the inner ear. The outer ear comprises the ear lobe that channels the speech sound signals that come from the mouth, through the environment into the ear. It also contains the eardrum, a sensitive diaphragm, and a narrow canal that connects the outer world to the eardrum. When the sound signals come from the outer world through the channel, the sensitive diaphragm begins to vibrate repeatedly; and as it does, it causes the air molecules in the canal to shake violently. As this goes on, the intensity of the signals are modified so that the weak signals are amplified or increased, while the loud ones are filtered to be reduced or rejected; thus making the eardrum in the outer ear to perform the functions of a resonator.

These modified sound signals then move on to the next part of the ear called the middle ear. This is another air-filled cavity that connects the eardrum to the inner ear, and it contains a chain of three thin bones. The middle ear, too, is a resonator as it further increases or decreases the amplitude (the acoustic measurement of intensity or loudness) so that the sound signals that are too low to be heard by the ear can be increased and those too loud for the ear can be reduced or rejected. In addition, the middle ear acts as a resonator because its vibrations also set into motion the fluid molecules in the inner ear, thereby, transmitting the speech sound waves coming from the outer ear into the inner.

The inner ear is the main organ of the ear that connects the rest of the ear to the brain where the operations on speech reception and perception end. It is made up of what is called cochlear, a coiled conical shape object that looks like a snail. This last part
transmits into the brain through some nerves the received and processed sound information from the mouth.

The process can be summarised in the figure: The Pole of Sound Perception below.

![Diagram of the Pole of Sound Perception]

Where:
SO = Sounds from Outside, which is the input
OE = Outer Ear
ME = Middle Ear
IE = Inner Ear
TB = The Brain.

Between SO and OE, the types of sound signals are different; some look tiny or barely audible while some others are big and too loud. Between OE and TB, the signals appear similar. This is just a simulation of the properties that serve as input into the auditory system, which are of irregular amplitude; how they are transmitted and analysed for enhancement and attenuation; and the output that looks fairly regular, ready for transmission for the brain processing.

4 EXERCISES
a. What can you describe as the vocal tract?
b. Give two examples of sounds produced with an explosion from the lips.
c. With three examples differentiate between lenis and fortis.
d. Define acoustic phonetics.
e. Differentiate between the sub-glottal and supra-glottal regions.
f. Explain the Source-Filter Theory of speech production.
g. What is the concern of auditory phonetics?
h. List the three parts of the auditory system.