
UNIT 1 THE SPEECH MECHANISM

Structure

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1.0 OBJECTIVES

In this unit we shall look at the Speech Mechanism and the three systems that constitute it. We shall familiarise ourselves with the organs of speech that comprise each system and their respective roles in the production of speech. Phonetic criteria for the description and classification of speech sounds will also be considered. We shall also frame exercises for you to apply these criteria to English words and also to ensure your understanding of the functions of the organs of speech. After completing this unit you should be able to

- Understand the functions of the three systems that constitute the Speech Mechanism
- Define the functions of each of the organs of speech in the production of speech
- Identify the phonetic difference between the broad categories 'consonant' and 'vowel'.

1.1 THE SPEECH MECHANISM

1.1.1. Introduction

One of the chief characteristics of human beings is their ability to communicate **with their fellow beings**. They convey complex messages concerning every aspect of life. A child even at a very early age learns to communicate by imitating the **recurrent sound pattern** s/he has become familiar with. It is only later that s/he learns the visual representation of speech i.e. writing.

Even though most Indians can use at least two languages as a means of communication, they generally take speech for granted, and seldom stop to think about the complex speech mechanism that makes spoken language possible. The analysis of the spoken form of a language is by no means simple, because each of us uses an infinite number of speech sounds which combine in different ways to form the strings of words we utter. For the convenience of description and analysis therefore, we need to break up the strings of utterances into the smallest units of sounds possible.

Phonetics is the study and science of speech sounds. When we produce speech sounds we use the Speech Mechanism which comprises of certain organs of the body, such as the muscles of the chest, the tongue, the lips and so on. The movement of these organs causes some disturbance which travels to the ear of the listener in the form of sound waves. The listener then interprets them as sounds. The organs of speech perform different functions in the production of speech. In other words, the air that we breathe is modified in different ways to result in various combinations of consonants and vowels. That is probably why Speech is popularly known as 'modified breathing.'

The organs of speech and their speech functions can be described with reference to three systems: **the Respiratory System, the Phonatory System and the Articulatory System.**

1.1.2 The Respiratory System

The organs of speech of which the Respiratory system is comprised are the lungs, the muscles of the chest and the windpipe or **trachea**. The primary function of the lungs as we all know, is to enable us to breathe or **respire**. The muscles of the chest expand and consequently the lungs expand and draw the outside air in. Thus we breathe in or **inhale** the air which passes through the trachea into the lungs. When the muscles of the chest contract the lungs are compressed and throw the air out. Thus we breathe out or **exhale** the air we have breathed in.

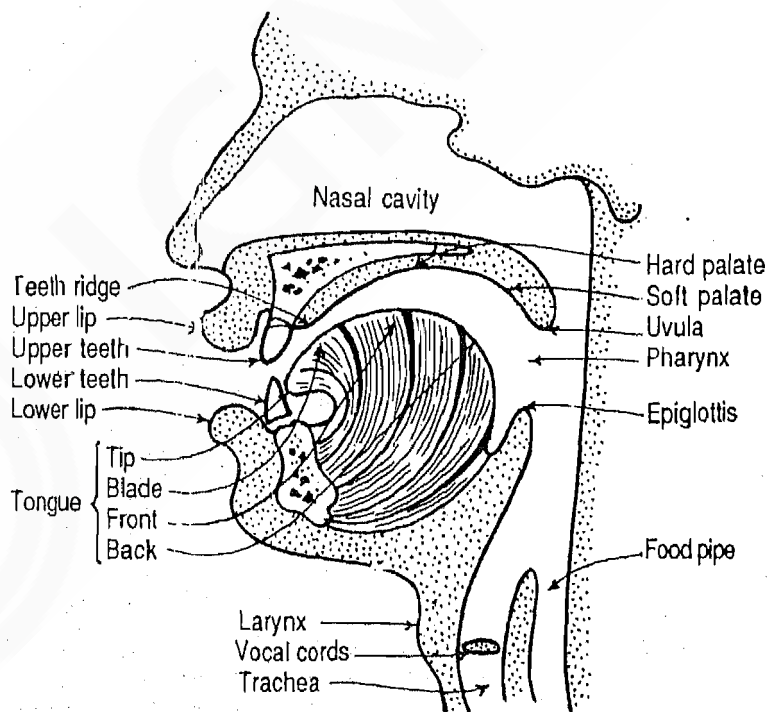


Fig. 1 Organs of speech

The function of the Respiratory system is to provide the air stream which is the basis for the production of speech sounds. It is the air stream that acts as a source of energy and is modified by the speech organs as it passes in and out of the lungs during the normal course of breathing. Besides the lungs there are other organs that can also provide an air stream for the production of speech sounds e.g. **the glottis and the velum**. The **glottal air stream** is the air stream above the glottis which is closed for the production of sounds using this air stream. Similarly, sounds produced with the air in front of the **velum** or the soft palate. The passage of air from the lungs is blocked by the back of the tongue which makes firm contact with the velum. This

is known as the **velaric air stream**. A large number of African languages and some South American languages make use of these air streams for the production of speech sounds. Of the Indian languages only Sindhi uses the glottalic air stream mechanism for the production of some speech sounds.

But the pulmonic or lung air is used by all the languages of the world, and it is the air exhaled from the lungs which initiates the air stream. This air-stream mechanism is known as the pulmonic aggressive air stream mechanism when the air which is breathed initiates the air-stream for speech production. It is known as the **pulmonic egressive air stream mechanism**.

1.1.3 The Phonatory System

The Phonatory system is comprised of the larynx in the throat. As we have already said the air that comes out of the lungs is modified before it meets the outside air. At first, the air is modified in the upper part of the trachea where the larynx is situated. The larynx is a muscular structure. The front part of this structure can be felt in the neck, and is commonly known as the 'Adam's apple'. The Adam's apple is more prominent in men than in women.

The larynx contains a pair of muscular bands or folds called the **vocal cords**. These are placed horizontally from front to back, joined at the front but separated at the back. The space between the cords is called the **glottis**.

As the vocal cords are separated at the back it is possible for them to assume a large number of positions. From among these we shall describe three important positions.

- a) The vocal cords can be **held wide apart** with a wide opening between them (the glottis). The air can pass freely through this opening without setting the vocal cords into vibration. This is the position of the vocal cords when we breathe. A large number of speech sounds are produced with the vocal cords in this position. During the production of these sounds we cannot hear any 'hum' when we plug our ears with our forefingers, or place the palm of the hand on the throat. They are called voiceless sounds. For example, the first sounds in the English words, sit, sheet, fever and think.

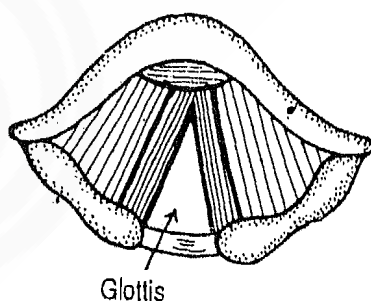


Fig. 2 Vocal cords drawn wide apart

- b) The second position that the vocal cords can assume is one in which **they are held loosely together**. When they are in this position the pressure of air from the lungs makes them vibrate. The sounds produced when the vocal cords vibrate are called **voiced sounds**. During the production of these sounds we can hear the 'hum' we talked about earlier. For example, the consonant sounds underlined in the English words veil, these, zoo, me, nose. Whereas all English vowels are voiced, some English consonants are voiceless and some are voiced.

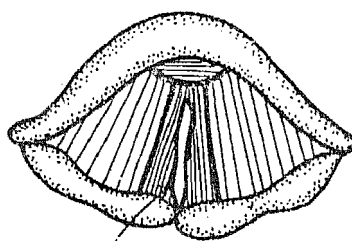


Fig. 3 Vocal cords held loosely together

- c) The vocal cords can be held tightly together along their whole length, so that the glottis is closed and no air can escape through it. This is the position that the vocal cords take when we eat or drink to prevent food or liquid from entering the windpipe.

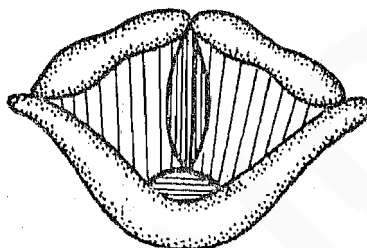


Fig. 4 Vocal cords held tightly together

From this position, if we draw the vocal cords apart suddenly, we produce an explosive sound called the glottal stop. The glottal stop resembles the sound of a mild cough. It can occur before a forceful articulation of words beginning with vowels, e.g. the English words, aunt, end, apple, up. In the speech of some English people, it can also occur in the word-final position in place of /p/, /t/ or /k/. For example, flip, hut, kick.

1.1.4 The Articulatory System

After passing through the larynx the air is further modified by the various shapes that the articulators above the larynx assume, before it meets the air outside. Each modification affects the quality of the sound produced. These articulators, together constitute the **Articulatory System**.

Let us describe the parts of the articulatory system.

a) The Pharynx

The pharynx extends from the top of the larynx to the root of the tongue (the hinder most part of the tongue) which lies opposite it. The muscles of the pharynx can greatly modify the shape and size of the pharyngeal cavity by contracting or expanding. It can also be modified by the movement of the back of the tongue, by the position of the soft palate and by the raising and lowering of the larynx. Each modification affects the quality of the sound we produce.

b) The Lips

The lips, which are in the front most position of the oral tract, have an important part to play in the production of speech sounds. The consonant sounds /p/ प and /b/ ब are produced by closing the lips tightly and then releasing the closure abruptly to let out the air built up behind the closure. The consonant sound /m/ म is produced by bringing the two lips together and allowing the air to escape through the nose. The

quality of all the vowels also depends on the shape the lips assume during their production. For example, the vowel /i:/ ई is produced with the lips spread. The vowel /u:/ ऊ is produced with the lips rounded and protruded. The rounding of the lips makes an important difference between the vowel sound /ʊ/ उ and the vowel sound /a:/ आ. Whereas the former is produced with rounded lips, the latter is produced with unrounded lips.

(c) The Teeth

We produce some consonants with the help of the teeth. The Hindi consonants त, थ, द, ध are, for example produced by the firm contact made by the tip and blade of the tongue with the back of the upper teeth. Similarly, the initial consonant sounds in the English words think, that, are produced by placing the tip of the tongue between the upper teeth and lower teeth and the initial consonants in the English words fan and van are produced by placing the upper teeth very lightly on the lower lip.

(d) The Teeth Ridge

The teeth ridge or the **alveolar ridge**, is the convex part of the roof of the mouth lying just behind the upper teeth. This hard, raised structure can be felt with the tip of the tongue. Many consonant sounds are produced at the teeth ridge. For example, one can produce the initial consonants in the English words top and drill, by making a firm contact at the teeth ridge with the tip of the tongue and releasing the closure suddenly. One can also produce the Hindi consonant स by narrowing the passage of air at the teeth ridge, so that the air is forced through that passage with friction.

(e) The Hard Palate

Beyond the alveolar ridge is a hard bony surface which we can feel if we move our tongue from the alveolar ridge along the roof of the mouth. Some sounds are produced at the hard palate. For example, the Hindi sound ण in and the initial sound in the English word yes.

(f) The Soft Palate

If we continue to move our tongue it cannot go beyond the point in the roof of the mouth where the bony structure ends and the roof of the mouth becomes soft. This soft portion of the roof of the mouth is known as the **soft palate** or the **velum**. A number of sounds are produced at the soft palate. For example, the Hindi sounds क, ग, ख and घ. When we produce these sounds the velum acts in two ways simultaneously. Firstly, it comes into contact with the back of the tongue which moves towards it to make a complete closure and secondly, the soft palate itself is raised to make a closure with the back wall of the pharynx. The first closure is known as a **velar closure** and the second closure is known as a **velic closure**. These are shown below.

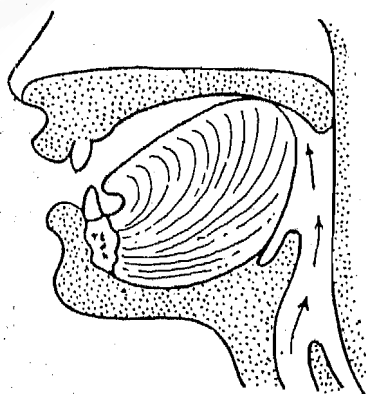


Fig. 5 Velar closure and velic closure

The soft palate can either be raised to make a velic closure or it can be lowered to open a passage. When it is raised the nasal passage is closed so that no air can escape through the nose. It can escape only through the mouth. The sounds produced when there is velic closure or when the velum is raised are known as oral sounds. For example, all the sounds in the English words flat, board, teacher, spray. When the velum is lowered the air escapes through the nose in two possible ways. Either it escapes through the nose **only** if there is a closure at some point in the oral passage, or the air can escape through the mouth as well as the nose. The sounds produced when the velum is lowered are for example, म, न, इ in Hindi and the initial consonants in the English words maid, north, and the final consonant in sing. These are called **nasal** sounds. The sounds produced when the air escapes through the mouth as well as the nose are called **nasalised** sounds for example, the vowel sounds in the Hindi words हिर 'brick', सीस 'breath'.

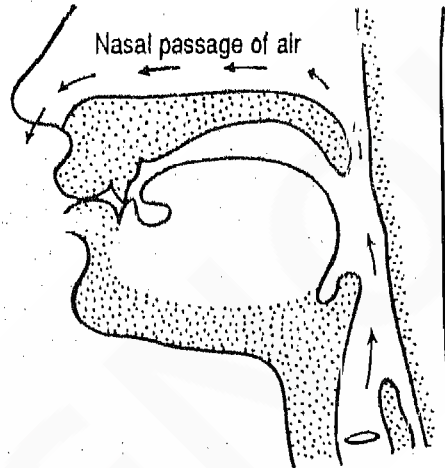


Fig.6 Nasal passage open; oral passage closed

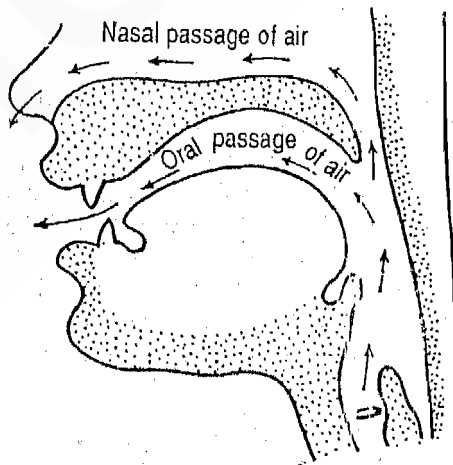


Fig.7 Nasal passage open; oral passage also open

(g) The Uvula

There hangs at the very end of the soft palate a small pendent-like fleshy 'tongue' called the **uvula**. The back of the tongue can make contact with the uvula for the production of sounds such as the initial sound in the Urdu words کریں (near), کون (community).

(h) The Tongue

The tongue is certainly the most flexible of the organs of speech. Its role in the production of speech is very important because it can assume many different shapes

and can take several positions most of which are significant in speech production. For the purpose of describing these shapes and positions we generally find it convenient to divide the tongue into parts. If you look into the mirror when you open your mouth wide and let your tongue rest on the floor of the mouth, you will notice that the tongue is a slightly convex muscle. The part of the tongue that lies behind the lower teeth is the **tip** of the tongue. That part of the tongue which lies opposite the teeth ridge or alveolar ridge is called the **blade**, and the **front** of the tongue lies opposite the hard palate. The part of the tongue lying opposite the velum or soft palate is called the **back** of the tongue. The two sides of the tongue are its **rims**

Any part of the tongue can be raised to any height or even make contact with the part of the roof of the mouth. The tip of the tongue and the rims, for instance, may touch the upper teeth to produce the sounds **त** and **द** in the Hindi words **तेल** and **दूद**. Similarly, the front of the tongue may be raised towards the hard palate to produce the consonants at the beginning of the English words **yellow**, **university**. We shall describe consonants and vowels (with reference to type of articulation) in detail in the next unit. The tip of the tongue can also be curled back so that the underside taps against the alveolar ridge to produce the final sound in the Hindi word **पेड़** (tree).

1.2 PASSIVE AND ACTIVE ARTICULATORS

Before we talk about the description and classification of speech sounds, it is important for us to be aware of an important distinction between **active** and **passive** articulators. Active articulators are those organs of speech that can move and passive articulators are those organs of speech that cannot move. In the production of speech sounds the active articulators move from their position of rest towards the passive articulators. For example, in the production of the t, d, s, n sounds, the tip and blade of the tongue move from their position of rest, to articulate against the teeth ridge. As the lower jaw is movable, while the upper jaw is not, the active articulators are located mostly in the lower jaw and the passive articulators in the upper jaw. There is however, an exception to this. The soft palate is both an active and a passive articulator. When it is raised to shut off the nasal passage of air for the production of oral sounds it is an active articulator. When the back of the tongue is raised and makes contact with the velum to produce sounds such as the initial consonants in the English words, **call** and **get**, the velum is a passive articulator. The velum is indeed an exception to the rule.

1.3 DESCRIBING AND CLASSIFYING SPEECH SOUNDS

In the previous sections we looked at the Speech Mechanism - at how speech sounds are produced. We considered the functions the different organs of speech perform in the production of speech sounds. We shall now discuss how speech sounds can be described and classified.

Normally, when we produce a speech sound, we intend to transmit it so that it is heard. As such, therefore, a speech sound can be studied at three stages - the **production stage**, the **transmission stage** and the **reception stage**. Correspondingly, we can describe and classify a speech sound in **articulatory** terms, **acoustic** terms and **auditory** terms, respectively. In other words, we can describe how the movements of the speech organs modify the air from the lungs in order to produce a given sound (articulatory terms), the physical properties a sound has (acoustic terms) and the features of the sound that are perceived by the listener (auditory terms). Clearly, a complete and exhaustive description of a sound which takes into account articulatory, acoustic and auditory terms would be very complex

and cannot be dealt with at this stage. Therefore, we shall, for the present, concentrate on the description and classifications of sounds mainly in articulatory terms and partly in auditory terms. The sounds regarded as 'vowels' are described in articulatory terms and on the basis of auditory impressions, and those regarded as 'consonants' are best described in terms of their articulation.

1.3.1. Vowel and Consonant

Before we proceed with the description and classification of speech sounds, we need to understand the categories - 'vowel' and 'consonant' and try and define them satisfactorily.

Vowel and Consonant are popularly defined with reference to the letters of the alphabet. Thus the letters a, e, i, o, u are called 'vowels' and the rest are 'consonants'. This definition is misleading because 'vowel' and 'consonant' are essentially categories of **speech** sounds. When we label the letters of the alphabet as 'vowel' and 'consonant' we probably do it on the basis of the assumption that there is perfect correspondence between the letters and the sounds they stand for. This correspondence, unfortunately, is not perfect in any language, least of all in English.

'Vowel' and 'Consonant' are also defined in **phonetic** and linguistic terms. When we define them in phonetic terms, we do so with reference to their production, when we define them in linguistic terms we refer to their function in a given language.

In phonetic terms, a vowel is a sound for whose production the oral passage is unobstructed, so that the air can flow from the lungs to the lips and beyond without being stopped' without having to squeeze through a narrow constriction, which would cause audible friction.

A consonant, on the other hand, is a sound for whose production the air current is completely stopped, or is forced through a narrow constriction which causes audible friction.

Let us look at a few examples. For instance the English word bar. The vowel represented by the letters ar, is produced with the mouth wide open and the tongue low in the mouth. The air passage is unobstructed and the air passes into the atmosphere outside without any friction. The sound is therefore called a vowel. The sound represented by the letter b is produced by a complete closure of the oral passage of air at the two lips, and then the sudden release of the air held behind the closure. Thus, there is an obstruction, for a while, to the flow of air from the lungs. Because of this obstruction the resultant sound is regarded as a consonant.

Take for instance, the English word see. The sound represented by the letter ee is produced by raising the front of the tongue fairly high, so that the passage between the tongue and the hard palate is fairly narrow but not narrow enough to cause any audible friction in the sound produced. The sound is therefore, regarded as a vowel. In the production of the s-sound in the English word see, the tip and blade of the tongue rise so high towards the teeth ridge that the passage of air is very narrow and the air passes out with audible friction. Thus the sound is a consonant.

As we have just seen, the phonetic definition of 'vowel' and 'consonant' does not depend on any other criteria, nor does it depend on the rules of any particular language. But if we describe 'vowel' and 'consonant' in linguistic terms, then we need to study the function of a sound in a given language. Let us take the initial sounds in the English words yell and wind. In the production of these sounds there is no obstruction to the air flow and no narrowing to cause audible friction. The two sounds, in phonetic terms must therefore be regarded as vowels. But the English language regards them as consonants, because they function as consonants. They always occupy the position of consonants in English words, and take the article a,

rather than an before them unlike English vowels. Thus we get a yell, a wind not an yell or an wind.

Having classified sounds into the two broad categories of 'vowel' and 'consonant' we shall further sub-classify each category in the next two units.

But before we do so let us revise what we have talked about in this unit.

1.4 LET US SUM UP

In this Unit we have described the functions of the organs of speech that comprise the three systems, i.e. the Respiratory system, the Phonatory system and the Articulatory system of the Speech Mechanism. We have seen that each of these organs has an important role to play in the production of speech sounds.

We have seen that a speech sound can be studied at the production stage, the transmission stage and the reception stage. Corresponding to these stages a speech sound can be classified and described in articulatory terms, acoustic terms and auditory terms. However, it would not be possible at this stage to describe speech sounds in terms of all these three. For the present it would suffice to describe certain sounds in articulatory terms and certain sounds in auditory as well as articulatory terms.

Speech sounds are classified into two broad phonetic categories i.e. 'vowel' and 'consonant'. A vowel is described as a speech sound in the production of which there is no obstruction or narrowing so as to cause friction. All other sounds are under the category 'consonant'.

'Vowel' and 'Consonant' can also be described in linguistic terms i.e. in terms of their function in a given language.

1.5 KEY WORDS

Trachea:	The windpipe through which the air we breathe in travels to the lungs, and the air we breathe out joins the outside air.
Respiratory System:	The system of organs which enables us to breathe in and breathe out.
Velum:	is another term for the back portion of the roof of the mouth or the soft palate.
Phonatory System:	The organs which enables us to produce speech sounds that are either voiced or voiceless.
The Larynx:	is a muscular structure situated in the upper part of the trachea.
Vocal Cords:	a pair of vocal bands or folds in the larynx or throat.
Glottis:	The opening between the vocal cords in the larynx.
Articulatory System:	The system of speech organs which assists in further modifying the air passing through the larynx and into the mouth, by assuming various shapes for the production of speech sounds,

The Pharynx:	is an organ of speech which extends from the larynx to the hindermost part of the tongue
Alveolar Ridge:	The convex surface of the roof of the mouth just behind the upper teeth.
Hard Palate:	The hard bony surface in the roof of the mouth beyond the alveolar ridge.
Velic Closure:	The raising of the velum to shut off the nasal passage of air for oral sounds.
Velar Closure:	The contact made by the back of the tongue at the velum or soft palate for the production of speech sounds such as the initial sounds in the English words <u>kill</u> and <u>good</u> .
Nasal Sounds:	Sounds in which the velum is lowered to let the air out of the nasal passage while there is an oral closure.
Oral Sounds:	Sounds in the production of which the nasal passage of air is closed and the air passes out through the mouth.
Nasalised Sounds:	Sounds in the production of which both the oral and nasal passage of air are open.
Uvula :	a small pendant-like fleshy tongue that hangs at the very end of the soft palate.
Blade of the tongue:	The part of the tongue that lies opposite the teeth ridge.
Front of the tongue:	The part of the tongue that lies opposite the hard palate.
Back of the tongue:	The part of the tongue lying opposite the soft palate.
Active articulators:	Those organs of speech that are movable.
Passive articulators:	Organs of speech that cannot move.
Phonetic:	Referring only to the production stage of speech.
Linguistic:	Referring to the function of speech sounds in relation to the rules of a particular language.

1.6 SUGGESTED READING

For more information on the Speech Mechanism, and the description and classification of speech sounds, you might like to refer to the following books.

1. Abercrombie, David. *Elements of General Phonetics*. Edinburgh: Edinburgh University Press 1967.

2. Balasubramaniam T. *A Textbook of English Phonetics for Indian students*. Delhi: Macmillan, 1981.
3. Bansal R.K. and J.B. Jarcison, *Spoken English for India*. Hyderabad: Orient Longman, 1983,
4. Jones, Daniel. *An Outline of English Phonetics*. Ninth Edition, Cambridge: Cambridge University Press 1956
5. Sethi, J. and Dhamija P.V. *A Course in Phonetics and Spoken English* Delhi: Prentice Hall of India 1996,

1.4 EXERCISES

Exercise 1

Say whether the following statements are true or false.

1. Most languages of the world use the pulmonic aggressive air stream for speech production ()
2. The glottis is wide open for the production of voiced sounds.()
3. Vowels are best described in auditory as well as articulatory terms. ()
4. To produce an oral sound (like the initial sound in the English word blue), the soft palate must be raised. ()
5. Nasalized sounds are produced through the nose only. ()
6. The lips are kept wide apart for the production of the initial sound in the English word part. ()
7. When we define 'vowel' and 'consonant' with reference to their function in a particular language we define them in phonetic terms. ()
8. In the production of nasal sounds there is no oral closure, ()
9. For the production of vowels there should be no narrowing in the oral passage so as to cause friction. ()
10. When the glottis is closed no air can escape through it. ()
11. The vocal cords can assume only three positions. ()

Exercise 2

Fill in the blanks in the following statements.

1. The organs of speech can be described under _____ systems. They are _____
2. Voiced sounds are produced when the vocal cords _____.

3. The air stream mechanism that uses the air ~~inhaled~~ into the lungs for the production of sounds is known as the _____
4. For the production of nasalised sounds the velum must _____ and at the same time _____
5. The articulatory system is comprised of _____
6. The convex (curved) part of the roof of the mouth lying immediately behind the upper teeth is called the _____
7. When the tongue is in the state of rest, the part of the tongue lying opposite the hard palate is called the _____ and the part lying opposite the soft palate is called the _____
8. The _____ are located in the lower jaw because the lower jaw is _____
9. The bony part of the roof of the mouth behind the alveolar ridge is called _____

Exercise 3

Without referring to the diagram of the organs of speech given earlier, try labelling the organs of speech on the diagram given below.

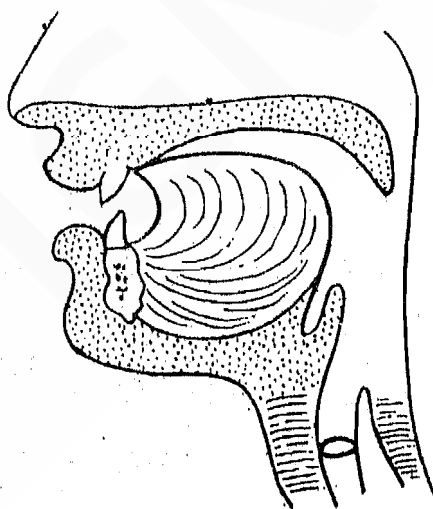


Fig. 9

Exercise 4

Using the 'phonetic' definitions of 'vowels' and 'consonant' say how many vowels and how many consonants there are in the following English words.

1. Call 2. Know 3. Thumb 4. Horses 5. Blessed 6. Leaves.
7. Wish 8. Language 9. Photo 10. Cunning

1.8 ANSWERS TO EXERCISES

Exercise 1

1. True 2. False 3. True. 4. True 5. False 6. False 7. False 8. False
9. True 10. True 11. False.

Exercise 2

1. a) three systems b) the Respiratory system, the Phonatory system, and the Articulatory system
2. Vibrate
3. Pulmonic ingressive air stream mechanism.
4. a) be lowered b) the oral passage must be open.
5. The pharynx, the lips, the teeth
6. Alveolar ridge
7. (a) front of the tongue (b) the back of the tongue
8. (a) active articulators (b) movable
9. the hard palate.

Exercise 3

After labelling the organs of speech on the diagram, compare your diagram with the one given in the text.

Exercise 4

- One vowel represented by the letter a
- Two consonants represented by the letters c and ll.
- One vowel represented by the letters ow.
- One consonant represented by the letters kn
- One vowel represented by the letter u
- Two consonants represented by the letters th and mb
- Two vowels represented by the letters o(r) and e
- Three consonants represented by the letters h, s and g.
- One vowel represented by the letter e
- Four consonants represented by the letters, b, l, ss, and ed.
- One vowel represented by the letters ea.
- Three consonants represented by the letters, l, v, and es.
- One vowel represented by the letter i
- Two consonants represented by the letters - w and sh.
- Two vowels represented by the letters a and ä. Five consonants represented by the letters, l, n, g, u, ge.
- Two vowels represented by the letters o and ö.
- Two consonants represented by the letters ph and t
- Two vowels represented by the letters u and i.
- Three consonants represented by the letters c, n and ng.