UNIT-VIII

FUNDAMENTALS OF ANATOMY, PHYSIOLOGY AND KINESIOLOGY IN SPORTS

Content:

1. Definition and importance of Anatomy, Physiology and Kinesiology.
2. Functions of Skeletal System, Classification of Bones and Types Joints.
3. Properties and Functions of Muscles.
4. Structure and Functions of Respiratory System and Circulatory System.
5. Equilibrium: Dynamic and Static and Centre of Gravity and its application in Sports.

Learning Outcomes:

At the end of this unit, you will be able to:

- identify the importance of anatomy, physiology and kinesiology.
- recognize the main functions of the skeleton.
- understand the functions of bones and identify various types of joints.
- figure out the properties and functions of muscles and understand how they work.
- understand the anatomy of the respiratory system and describe its working.
- identify and analyse the layout and functions of Circulatory System.
- articulate and demonstrate the concept and application of equilibrium and centre of gravity insports.

Quiz

Tick the correct answers.

1. Muscles are connected to bones by
   a. ligaments
   b. cartilage
   c. tendons
2. A flexor
   a. decreases the angle at a joint
   b. extends a limb
   c. moves a limb towards the midline
3. Shoulder and Hip Joints are an example of
   a. ball and socketjoint
   b. hingejoint
   c. saddlejoint
4. Histology refers to the study of the

a. cells of the body
b. history of anatomy
c. tissues of the body

5. The membrane on the surface of a lung is called the
   a. pleura
   b. pericardium
   c. mucosa

8.1.1 DEFINITION OF ANATOMY, PHYSIOLOGY AND KINESIOLOGY

Anatomy is a science that deals with the structure of the body and the relationship between the body parts.

The word anatomy is derived from the Greek words *Ana* which means *apart* and *tomy* meaning *to cut*. Hence, the word *anatomy* refers to *dissection* and it can be defined as the science of the structure of a body learned by dissection. In other words, anatomy is the study of the shape and structure of human body and body parts along with their relationship to one another.

Anatomy is divided into the following categories:

Gross/Macro anatomy is the study of the larger structures of the body, those visible without the aid of magnification. It deals with the large body structures such as heart, lungs and bones. Microscopic anatomy is the study of those structures of body which can't be seen with the naked eye.

Gross anatomy may further be subdivided into the following categories:

1. **Systemic anatomy:** Systemic anatomy is the study of the working and structures of a discrete body system. It is the study of a group of structures that work together to perform a unique body function. e.g., a systemic study of the muscular system would include all of the skeletal muscles of thebody.

2. **Regional anatomy:** is the study of the interrelationships of all of the structures in a specific body region. Regional anatomy helps us appreciate the interrelationships of body structures, such as how muscles, nerves, blood vessels, and other structures work together to serve a particular body region. e.g., the study of an area of the body such as the abdomen would include a study of all organs, blood vessels etc in that part of the body.

3. **Surface anatomy:** this is a study of external features of the body like the bony projections of the body which act as a landmark and help us to locate the other deeper structures. e.g.,skin, nails, hairetc.

Microscopic anatomy includes

1. **Cytology** or the study of the internal structure of cells

2. **Histology** or the study of tissues (groups of cells)

8.1.2 PHYSIOLOGY

Physiology is the science of the functions of living organisms and their parts. The word physiology is derived from the Greek words *phys*or ***nature*** and *logio* which means ***the study of***. Hence, the word physiology refers to the study of the human body and its functions and of the different parts and organs of the body .e.g., the detailed working and function of the skeletal system, respiratory system and the circulatory. Here we understand and study how human body responds to a givens timulus.

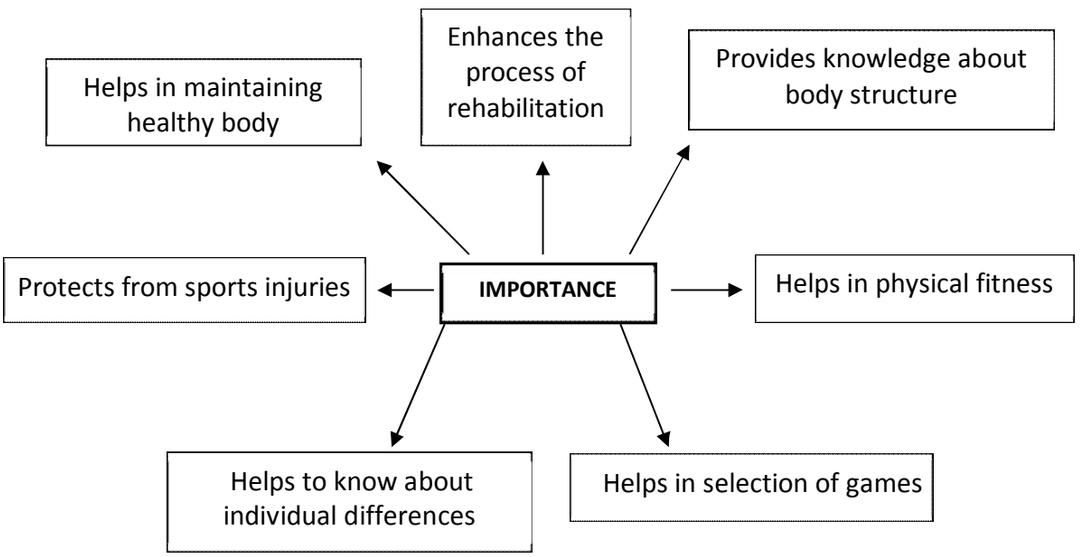
We can also say physiology is the detailed study of life, including the functioning of the smallest of cells, tissues and other organisms.

Physiology is further divided into sub parts which are as follows:

Human physiology: This branch of physiology refers to the study of a specific organism, i.e. the human being.

Cellular and systemic physiology: Cellular physiology is the study of the function of cells while systemic physiology is the study of the function of the body's systems.

8.1.3 IMPORTANCE OF ANATOMY AND PHYSIOLOGY



1. **Helps in physical fitness:** Study of anatomy and physiology helps a sports person to understand the structure and functioning of different parts of the human body and to acquire a fit and healthy body. e.g., building muscle strength, muscle endurance through appropriate exercises.

2. **Provides knowledge about body structure:** Knowing the strengths and weaknesses of one's body can help the sports person develop her/his strength in the field of games or sports which are suitable for as per her/his body structure. e.g., designing exercises based on movement of joints like shoulder rotation, due

to presence of ball and socket joint in the shoulder, and extension and flexion of elbow due to hinge joint in theelbow.

3. **Provides knowledge about the functions of various organs of body:** Knowledge of the capacity or functions of the various body systems like the cardiovascular system or the nervous system, muscular system, excretory system is essential for imparting proper and beneficial training to the athletes by the physical education tea cherora coach. e. g., as printer usually has fast twitch muscle fibres whereas long distance runners have slow twitch muscle fibres.

4. **Helps in selection of games:** On the basis of the knowledge of body structure, a coach or player can choose an appropriate sport for the student. e.g., weight lifting is more appropriate for short statured students in comparison to volley ball and basket ball which are better suited for students who are tall.

5. **Protects from sports injuries:** Injuries related to sports such as sprain, contusion, fracture, dislocation of joints, etc., are fairly common on the sports field. Sports equipment is designed to ensure safety on the basis of knowledge of anatomy. Designing protective equipment in games and sports to provide protection to the soft and delicate organs requires appropriate knowledge about the functions of bones, muscles, tendons and ligaments.

6. **Helps in the process of rehabilitation:** Injuries are common and natural on thes ports field. Knowledge of ligaments, tendons and muscles helps in rehabilitation from the injuries sustained during the game or sport and the injured player can recuperate enough to give a good performance again. e.g., a physiotherapist who helps an injured sportsperson in recuperation and rehabilitation so that she/he can get back to the game.

7. **Helps in maintaining healthy body:** Study of anatomy and physiology provides detailed knowledge about all body parts, their nature and function, adopt good, safe and healthyuse of body. e. g., knowledge of anatomy provides information a bout good and bad posture while sitting, standing, lying down, running.

8. **Helps to learn about individual differences between male and female athletes:** Understanding the basic physiological differences between the body of male and female sports persons is essential because games and sports equipmentis designed differently on the basis of these differences. e.g., the difference in the structure of shoulder among males and females is the reason for difference in the weights of sports equipment such as shotput, discus, hammer and javelin for males and females.

8.1.4 KINESIOLOGY

Have you ever wondered what makes a physical activity as simple and routine as walking possible? The fact is, even such simple movements require an in tricate coordination of muscles, ligaments, and joints. The study of these bodily movements is called Kinesiology. The term Kinesiology is derived from the Greek word *kinesis* which means ***movement*** or ***motion*** and *logio*, or ***the study of***. Thus, Kinesiology is the scientific study of human or non-human body movement. The dictionary defines Kinesiology as “the science dealing with the interrelationship of the physiological

processes and anatomy of the human body with respect to movement." It is an analysis of human motion based upon scientific principles, bio- mechanics, muscular system an atomy and neuro muscular physiology. Therefore, to understand kinesiology, it is imperative we have an adequate knowledge of anatomy and physiology.

Importance of Kinesiology

1. The main focus of Kinesiology is the study of the mechanical concepts related to human movement which is beneficial for every individual even in their daily activities.
2. Kinesiology applies sciences like biomechanics, anatomy, physiology and psychology to better understand how the human body responds to physical activity and various stimuli.
3. Kinesiology and physical education study the role of exercise, physical movement and sports in the development of human health and happiness.
4. It helps to understand the interconnection between human structure and functions.
5. It provides adequate knowledge of movement to athletic trainers who can, then, try to prevent athletes from suffering injuries.
6. It provides knowledge regarding efficient movements as a part of daily living in order to achieve optimum quality of body efficiency.
7. The study of Kinesiology and Physical Education may be used as the basis for a variety of careers which include Gym instructors, Coaches in different sports etc.

I. Tick the correct options

1. The science that deals with the structural aspect of the human body is knownas
   - i. Physiology
   - ii. Anatomy
   - iii. Botany
   - iv. Kinesiology
2. The scientific study about the human or non-human body movements it is knownas
   - i. Physiology
   - ii. Anatomy
   - iii. Biology
   - iv. Kinesiology
3. The study of the larger structures of the body such as heart, lungs and bones isknown as
   - i. Systemic Anatomy
   - ii. Regional Anatomy
   - iii. Surface Anatomy

iv. Microscopic Anatomy

4. The athlete who has a greater dominance of slow twitch muscle fibreis
   i. a sprinter
   ii. a middle distance runner
   iii. a long distance runner
   iv. a long jumper

II. Answer the following questionsbriefly.

1. Differentiate between Anatomy and Physiology.
2. What is the difference between Gross Anatomy and Microscopic Anatomy?
3. Define Kinesiology.
4. List the importance of Kinesiology insports.

III. Answer the following questions in 150-200words.

1. Define Anatomy and Physiology. Elucidate the importance of Anatomy and Physiology in the field of sports.
2. Define Kinesiology. Explain the importance of Kinesiology in the field ofsports.

8.2.1 SKELETAL SYSTEM

The human skeleton is composed of cartilage and bones. The human skeleton is the internal framework of the body. It is composed of around 270 bones at birth – this total decreases to around 206 bones by adulthood after some bones get fused together.

The human skeleton is divided into two functional parts:

Axial skeleton – consists of the vertebral column, the rib cage, the skull and other associated bones.

Appendicular skeleton – is attached to the axial skeleton. It is formed by the shoulder girdle, the pelvic girdle and the bones of the upper and lower limbs.

Functions of the Skeleton

The functions of the skeleton include:

1. This skeletal system provides shape and support to the body.
2. It allows the body to create movement by forming the frame work of the body, to which the muscles are attached. Movement occurs when muscles contract and pull on bones making them create movement in the joint.
3. Internal organs of the body like heart, lungs, liver, brain etc. are soft and delicate. The skeleton protects these organs.
4. The hard substance of the bones also serves as a store house of minerals.
5. Blood cells are also formed within the cavitation of the skeleton which is known as Haematopoiesis.

Do you know?

joint: a point where two or more bones are connected in the body in a manner that permits movement.

cartilage: a form of connective tissue that is semi-rigid yet flexible. It is found in the joints and other places such as the nose, throat, and ears.

tendon: a strong piece of tissue in the body connecting a muscle to a bone

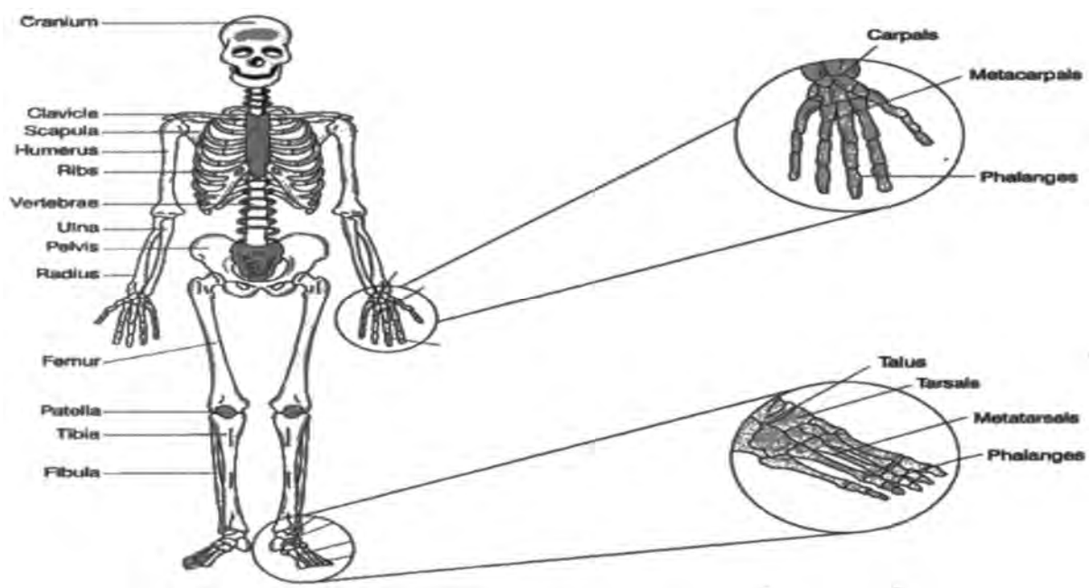
ligament: fibrous cords that bind the bones together at joints

8.2.2 SKELETAL SYSTEM

What makes up the Skeleton

Along with bones, joints and cartilage, the skeleton also includes tendons and ligaments.

1. **Bone** is a rigid part of the skeleton. In the body, bones have a variety of shapes and sizes and serve multiple functions.
2. **Cartilage** is more flexible than the bones. It is found in plenty in the embryo and the foetus. In adults, the surfaces of bones within the movable joints are covered with cartilage. It provides both a firm and a flexible support inside certain structures of the nose, external ears, ribs and trachea.
3. **Tendons and Ligaments** are strong bands of fibrous connective tissues. Tendons connect muscles to bone, whereas ligaments connect one bone to another bone.



Extension Activity

Working in groups of five draw and label the bones of the following parts:

1. Skull
2. Clavicle
3. The kneecap
4. Bones of the fingers of the palm
5. Bones of the fingers of the feet.

8.2.3 CLASSIFICATION OF BONES

Bones can be classified on the basis of different categories:

- Classification is on the basis of bone tissue.
- Classification is on the basis of shape and size.

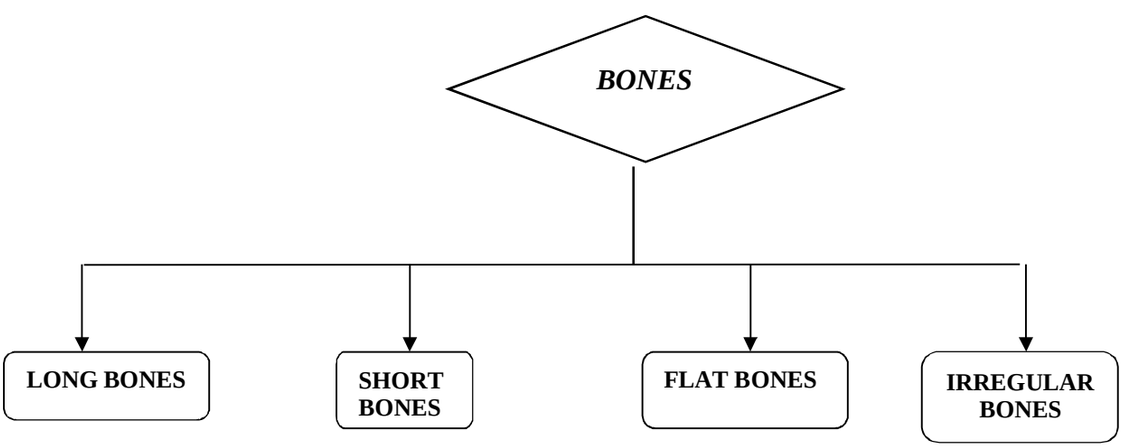
Classification on the basis of bone tissue.

There are 2 Basic types of bone tissue

Compact Bone
It is dense, smooth
small and homogenous

Spongy Bone
Compound of
needle like
pieces of bone

Classification of bones on the basis of shape and size.



1. Long Bones

- Long bones are hard, dense bones that provide strength, structure, and mobility to the body.

- Each long bone is composed of a central shaft and two knobends.
- The long bone is covered with a fibre sheet except where it joins with other bone.
- Where the long bone joins with other bone it is covered with a thin sheet ofcartilage.
- Long bones are found in upper and lower arm (Humerus, Radius and Ulna) and thigh and leg (Femur, Tibia and Fibula). Some bones in the fingers and toes are also classified as long bones, even though they are short in length. This is due to the shape of the bones, not their size
- Long bones contain both yellow bone marrow and red bone marrow, which produce blood cells.

Ulna Radius

Femur

2. Short Bones

- Short bones are about as long as they are wide. In fact, they are in cube shape.
- A short bone is composed of central spongy bone and covered with a thin layer of compactbone.
- The motion of short bones is limited, and they glide on one another.
- The carpals in the wrist and the tarsals in the ankles are examples of short bones..

Capital (carpal) Bone

Talus

3. Flat Bones

- Flat bones are thin and flat.
- They are composed of a central layer of spongy bone between two outer layers of compact bone.

- They form a bony cage and help in the protection of soft internal organs.
- Flat bones are found in cranial bones, ribs, sternum, scapula and hipbone.

Scapula

Sternum

4. Irregular Bones

- Irregular bones vary in shape and structure and therefore do not fit into any other category (flat, short or long).
- They often have a fairly complex shape, which helps protect internal organs. e.g., the vertebrae.Irregular bones of the vertebral column, protect the spinal cord. Some bones of the skull are also irregular bones.

Vertebra

Extension Activity

Working in groups of five draw and complete the following table:

Bone	Type	Where it is found in the body
Radius		
Patella		
Metatarsal		
Femur		

Do You Know?

*The shortest Bone in the human body is the **STAPES** found in the middle ear.*

8.2.4 JOINTS

A joint or articulation (articular surface) is the point where the two or more bones meet and muscles act on them to cause movement.

A joint is usually considered movable, but it's not necessary in all the cases. There are many joints which show limited movement and some that are completely immovable.

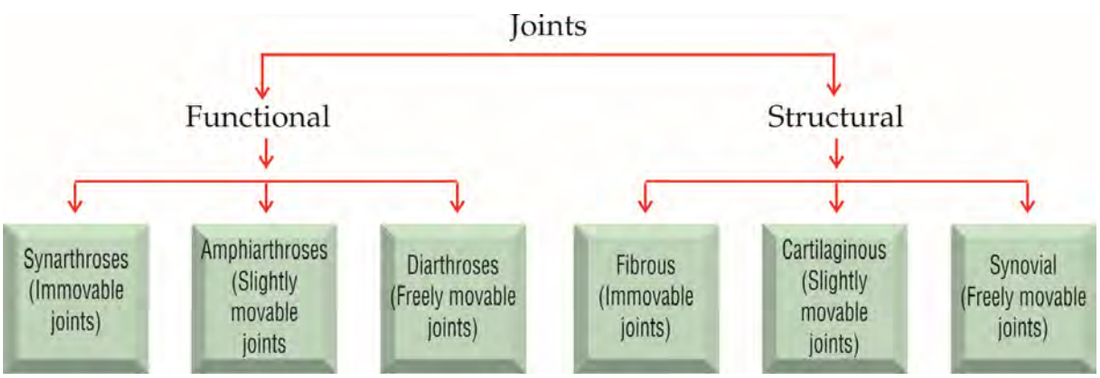
Joints are further classified on the basis of their functions and structure.

Extension Activity

Working in pairs, locate the joints in your

- Shoulder
- Arms
- Wrist
- Fingers
- Hip
- Legs
- Toes

Can you identify the movement in these joints?



The functional classification of joints focuses on the amount of movement permitted by the joint. On the basis of this:

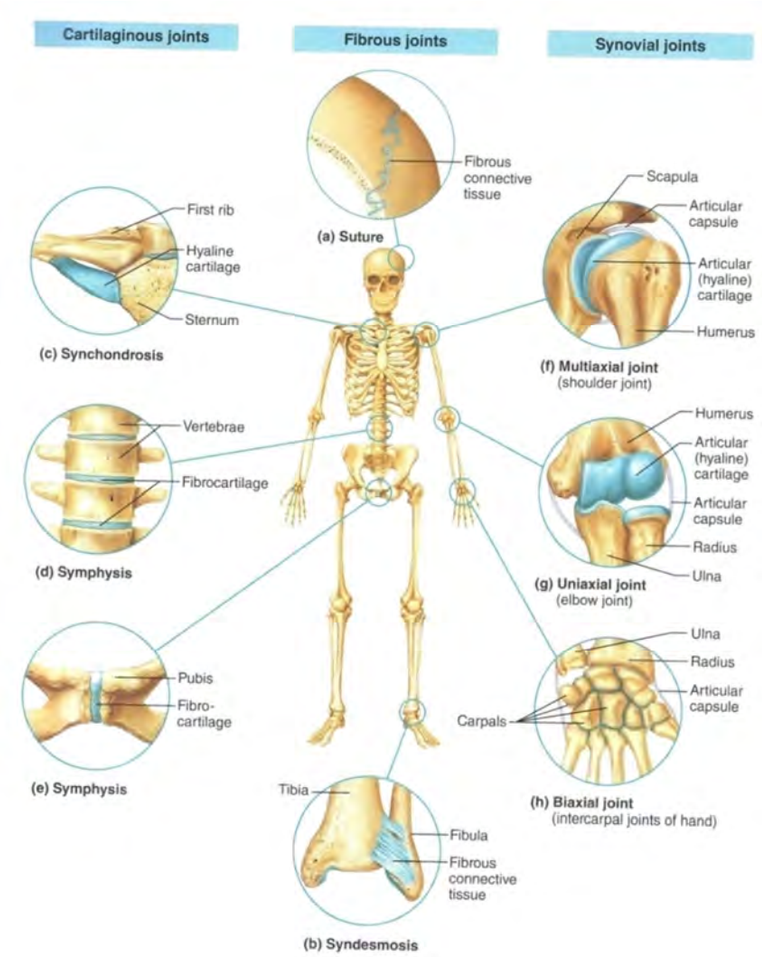
- **Synarthroses** or they may be called **immovable joints**
- **Amphiarthroses** which are also known as **slightly movable** joints
- **Diarthroses** or the **freely movable** joints.

The freely movable joints are majorly found in the limbs, where movement and mobility is of utmost importance. The immovable or slightly movable joints are mostly

to be found in axial skeleton where the priority is protection of internal organs and firm attachments.

In the structural classification mainly there are fibrous, cartilaginous and synovial joints. This type of classification is based on whether fibrous tissue, cartilage, or a joint cavity separates the bony regions at the joint.

Fibrous joints are generally immovable and, synovial joints are freely movable joints. Cartilaginous joints have a combination of both immovable and slightly movable joints.

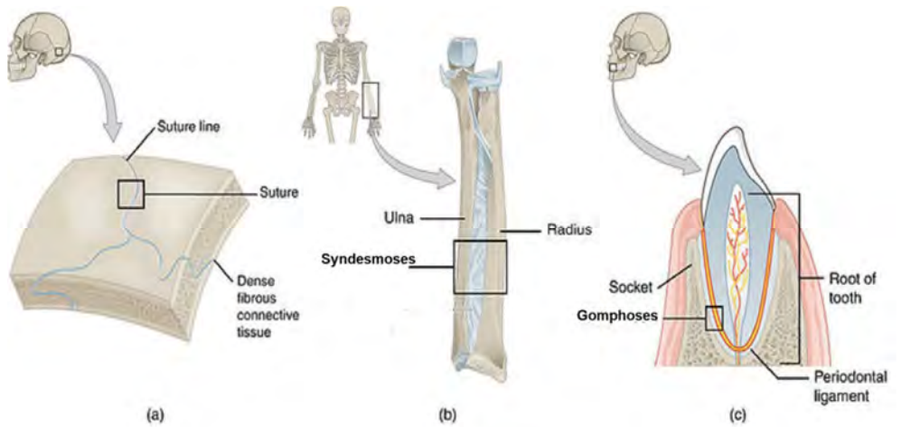


1. **Fibrous Joints** – In this type of joint, the bones are united together by fibrous tissue and show little or no movement. They are again further classified on the basis of structure of the **sutures**, **syndesmoses** or **gomphoses**.

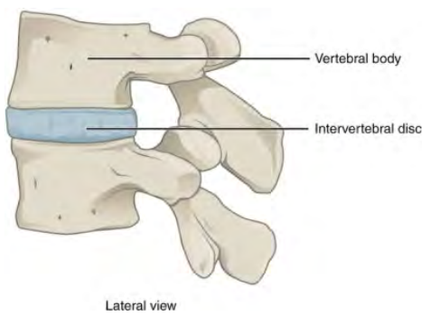
   i. **Sutures** – A suture is a type of fibrous joint forming a tight union between the bones that prevents any movement between them. Sutures are only found between the bones of the skull or the cranium. The skull bones of a foetus are unfused but after birth, the bones slowly begin to fuse to become fixed, making the skull bones immovable in order to protect the brain from impact.

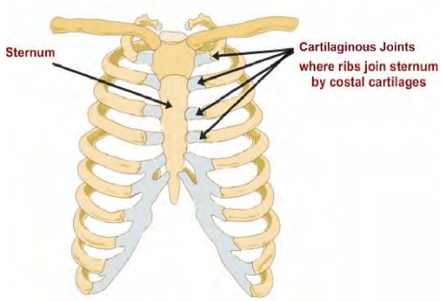
ii. **Syndesmoses** – Syndesmosis is a fibrous joint in which the bones are separated by some distance and united together with the help of ligaments. e.g., fibrous membrane connecting maximum distal parts of the radius and ulna. Due to the lack of flexibility in these joint structures, ligament injuries in syndesmoses joints are common, particularly at the wrist and ankle.

iii. **Gomphoses**–Agomphosis mostly consists of a pegattached into a socket and held by ligaments. The best example of this is the joint between a tooth and its socket.



2. **Cartilaginous Joints** – This type of joint unites two bones by the help of a cartilage.Very slight movement can occur at these joints. Another characteristics of this type of joint is that the articulating bone surfaces are connected by pads (discs) of fibrocartilage. e.g., cartilage of the growing long bones and the cartilages between the ribs and the sternum.

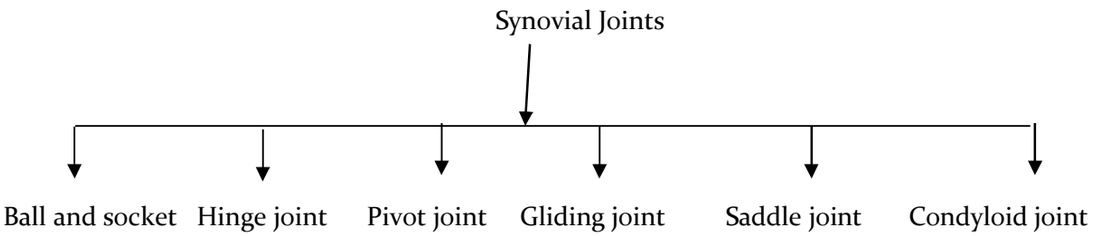




3. **Synovial Joints** - These are freely movable joints. These joints contain synovial fluid. They are mostly found in the limbs.

All synovial joints consist of four distinguishing features.

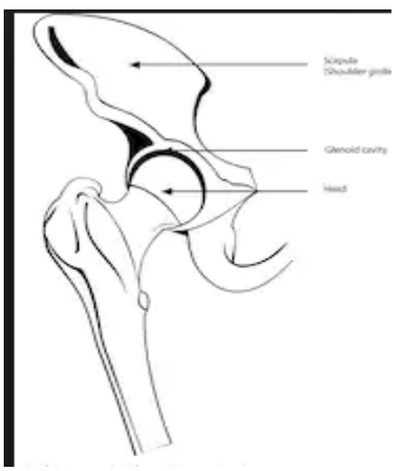
- Articular cartilage
- Articular capsule
- Joint cavity
- Reinforcing ligament



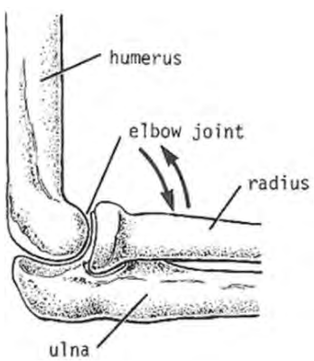
Types of synovial joints:

Synovial joints are classified according to the shape of the articulating surface. As you know, they can further be subdivided into the following categories.

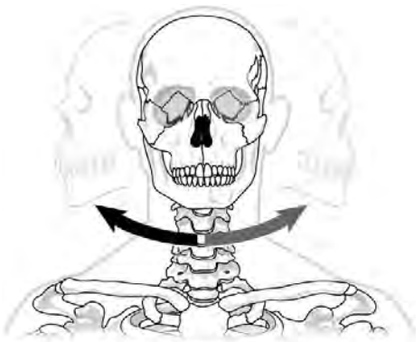
i. **Ball and socket joint:** The ball and socket joint is a type of synovial joint. It is formed when the ball-shaped head of one bone fits into the cup-like socket or depression of another bone. The ball and socket joint allows the greatest range of movement. These multiaxial joints permit movement in all axes including rotation. e.g.,hipjoint and shoulder joint. This joint allows movement like an overhead clear in badminton or bowling in cricket.



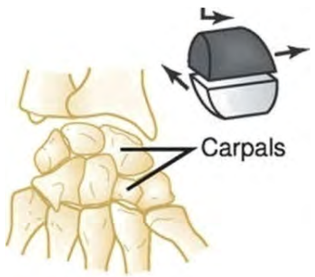
ii. **Hinge joint:**The cylindrical end of one bone fits into at rough shaped surface of another bone. Angular movement is possible in just one plane there by restricting the movement of the bone to only bending and straightening. e.g. elbow, knee. The extension and flexion movement is essential for building biceps, triceps and quadricep smuscles.



iii. Pivot joint:- Pivot jointalso called rotary joint, is a freely moveable joint that allows only rotary movement around a single axis. The moving bone rotates within a ring that is formed from a second bone and adjoining ligament. e.g., the joint between the first and the second cervical vertebrae which allows the turning of the head from side toside.

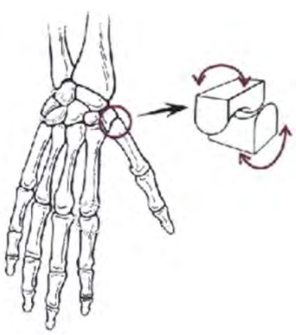


iv. Plane or Gliding joint: A gliding joint, also known as a plane joint, is a type of synovial joint that is formed between bones that meet at flat or nearly flat articular surfaces. Gliding joints allow the bones to glide past on another in any direction along the plane of the joint — up and down, left and right, and diagonally. The movement in this joint is nonaxial which indicates that gliding does not allow rotation around any axis. e.g., inter carpals or joints of the wrist.

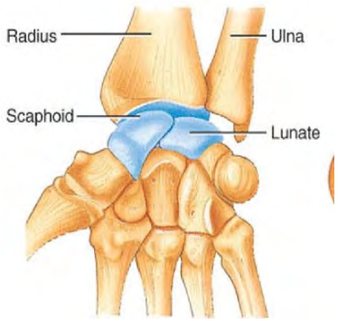


Plane joint

v. Saddle joint: In the saddle joint, the articulatings urface is shaped like a saddle, having both convex and concave areas. The bones in a saddle joint can rock back and forth and from side to side, but they have limite drotation.These biaxial joint sallow very limited movement like the condyloid joints. e. g., thumb joint. Example of as addle joint used in sport is in a thumb war. The thumb moves side to side and back and for thin a thumb war.

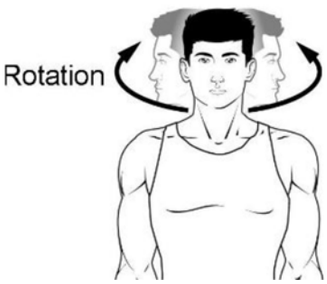


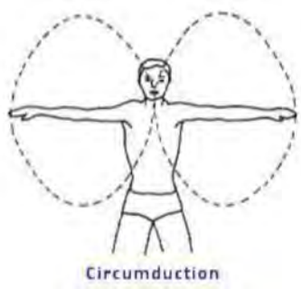
vi. **Condyloid joint:** Condyloid joints are a type of synovial joint where the egg-shaped articular surface of one bone fits into an oval cavity in another. This joint allows the moving bone to travel from side to side, back and forth butit does not allow it to rotate. Movement occurs only around two axes so they may be also called biaxial. e.g.,wrist joint, meta carpal, phalangeal joint. This joint is useful the players use their wrist when dribbling with the ball in basketball.

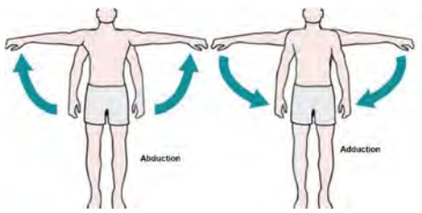


Extension Activity

Practise the following movements. Can you identify the joint used?







I. Tick the correct option.

1. The short bones are generally
   - i. flat
   - ii. cube-shaped
   - iii. curved
   - iv. thin

2. One of the functions of the skeletal system includes haematopoiesis which refers to
   - i. provision of support to the body
   - ii. formation of blood cells

iii. production of minerals

iv. protection of delicate organs

3. A child has____bones.

i. 206

ii. 213

iii. 225

iv. 270

4. Bones serves as a store house for

i. potassium

ii. phosphorus

iii. calcium

iv. nitrogen

5. According to the functional classification of joint which focuses on the amount of the movement of the joint, synarthroses are also known as:

i. immovable joints

ii. slightly movable joints

iii. freely movable joints

iv. combination of immovable and slightly movable joints

6. The sutures of the skull are the best examples of:

i. cartilaginous joints

ii. synovial joints

iii. fibrous joints

iv. freely movable joints

7. The synovial joints in which angular movement is allowed in just one plane is called

i. hinge joint

ii. saddle joint

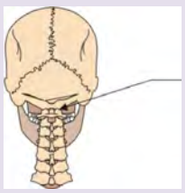
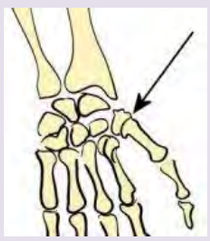
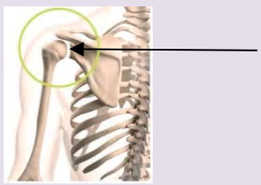
iii. plane joint

iv. pivotjoint

II. Answer the following questions briefly.

1. Name the longest and the shortest bones in the body.
2. List at least two functions of the skeletal system.
3. Name the four main classification of bones.
4. What are the two basic classifications of a joint?
5. What is the major difference between a fibrous joint and a cartilaginous joint?
6. Name two ball and socket joints of the body.

III. Identify the bones given below and mention the type of Joint that is formed by them. Also mention its function.

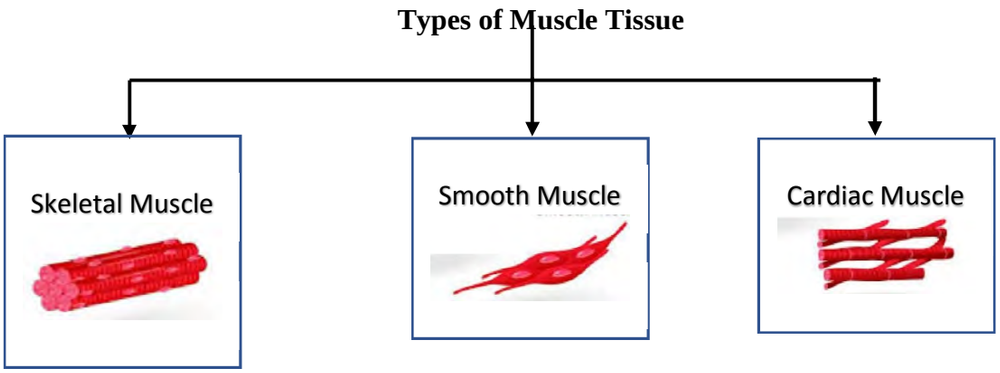
Bones	Type of Joint	Functions
		
		
		
		

IV. Answer the following questions in 150-200 words.

1. Elaborate the functions of the skeletal system.
2. Describe the types of bones found in the human body and discuss their functions.
3. Write about the types of synovial joints in details with suitable examples

8.3.1 PROPERTIES AND FUNCTIONS OF MUSCLES

Every movement from heartbeat to completing a marathon takes place due to contraction of the muscles. There are basically three types of muscle tissue.



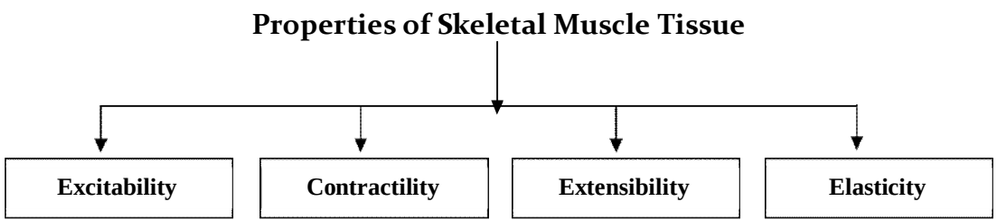
1. **Skeletal Muscles**–Skeletal muscles comprise 40% of the body weight. They are named so because they are attached to the skeletal system. They are also called striated muscles as their striations can be seen when observed under the microscope. These muscles are responsible for locomotion, facial expressions, posture, and other body movements. They are also known as voluntary muscles as they are under conscious control of the brain. They can contract very rapidly and forcefully but they also tire very easily and require rest after short periods of activity.

2. **Smooth Muscles** – Smooth muscles are small and spindle shape. They are called smooth muscles as their cells are not striated. They are also called involuntary muscles as their expansion or contraction is not under our control. These muscles contract much more slowly as compared to skeletal muscles. They are found mostly in hollow organs such as stomach, urinary bladder and respiratory passages.Smooth muscles are also present in the eyes, where their function is to change the size of the iris and alter the shape of the lens; and in the skin where they cause hair to stand erect in response to cold temperature or fear.

3. **Cardiac Muscles**–Cardiac muscles are found in the heart where they form the walls of the heart. They are long and striated but not as clearly striated as skeletal muscles. The rate of contraction of cardiac muscles is intermediated between smooth and skeletal muscles. Cardiac muscles are in voluntary as their expansion and contraction is not underour control.

8.3.2 PROPERTIES OF SKELETAL MUSCLES

Skeletal muscles have four major functional properties:



Excitability is the ability to respond to as timulus, which may be delivered from a motorneuron or ahormone.

Contractility is the ability of muscle cells to forcefully shorten or the ability for self-contraction.

Extensibility is the ability of a muscle to stretch or the capacity to lengthen.

Elasticity is the ability to recoil or bounce back to the muscle's original length after being stretched.

8.3.3 FUNCTIONS OF MUSCLES

1. **Movement**: Muscles give rigidity to our body. Skeletal muscles can yank and pull on the bones in the skeleton, resulting in body movements such as walking, chewing, running, lifting and manipulating objects with ourhands.
2. **Maintenance of posture**: Muscles generate a constant contractile force that allows us to maintain an erect position or posture, without much consciouscontrol.
3. **Heat generation**: Contraction of muscle tissue generates heat, which is essential for maintenance of temperatureor homeostasis.
4. **Respiration**: Ourmuscular system automatically drives movement of air into and out of our body.
5. **Constriction of organs and blood vessels**: Nutrients move through our digestive tract, urine is passed out of the body, and secretions are propelled out of glands by contraction of smoothmuscles.
6. **Pumping blood**: Blood moves through the blood vessels because our heart tirelessly receives blood and delivers it to all body tissue and organs.

Do You Know?

*The **gluteus maximus** is the largest muscle in the human body as it has the job of keeping the trunk of the body in an erect posture.*

I. Tick the correct answer.

1. How many types of muscle tissue are there?
   - i. 1
   - ii. 2
   - iii. 3
   - iv. 4
2. Locomotion and facial expression are one of the important responsibilities of
   - i. Cardiac muscles
   - ii. Skeletal muscle

iii. Smooth muscle

iv. cardiac and skeletal muscles

3. The ability of a muscle to shorten forcefully is known as

i. extensibility

ii. contractility

iii. elasticity

iv. excitability

II. Answer the following questions briefly.

1. What is a muscle? List the major types of muscles.
2. Enlist the four major functional characteristics of the skeletal muscles.
3. Write down the properties of cardiac muscle
4. How are smooth muscles different from cardiac muscles?
5. Where are smooth muscles found?
6. How do cardiac muscles differ from skeletal muscles?

III. Answer the following questions in 150-200 words.

1. What do you understand by the muscular system? Explain the structural classification of muscles.
2. Write down the functions of muscles in detail.

8.4.1 STRUCTURE AND FUNCTIONS OF THE RESPIRATORY SYSTEM

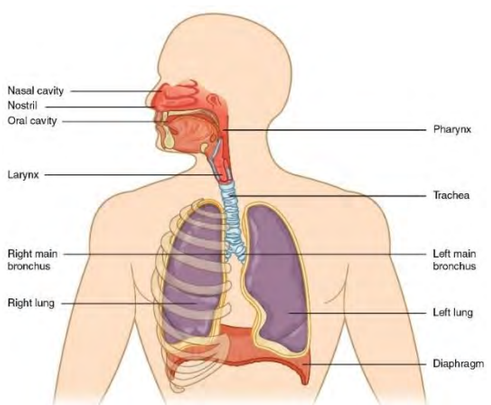
Respiration is made up of two phases called inspiration and expiration: You inhale (breathe in) oxygen during inspiration. You exhale (breathe out) carbon dioxide during expiration. Respiration includes the following processes

- Ventilation, the movement of air into and out of the lungs
- Gas exchange between the air in the lungs and blood, sometimes called external respiration
- Transport of oxygen and carbon dioxide in the blood.
- Gas exchange between the blood and the tissues, sometimes called internal inspiration.

Structure of Respiratory System:

The respiratory system consists of

- The nose
- The nasal cavity
- The pharynx
- Thelarynx
- The trachea
- Bronchi



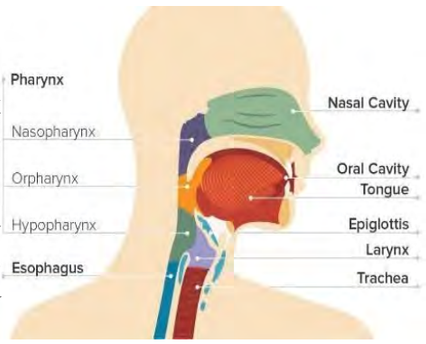
- Thelungs
- Bronchioles
- Alveoli
- Diaphragm

The Nose: The term nose usually refers to the visible structure that forms a prominent feature of the face and also refers to the internal nasal cavity.

The Nasal Cavity: It extends from the external opening in the nose to the pharynx, and it is divided by the nasal septum into right and left side.

Pharynx: The pharynx is the common passageway of both the digestive and respiratory systems.

The pharynx can be divided into three regions



The nasopharynx: It is the superior part of pharynx and extends from the internal nares of nasal cavity to the level of uvula.

The oropharynx: The oropharynx is a passage way for both air and food. It extends from the uvulato the epiglott is. Theoropharynx is bordered superiorly by the nasopharynx and anteriorly by the oral cavity.

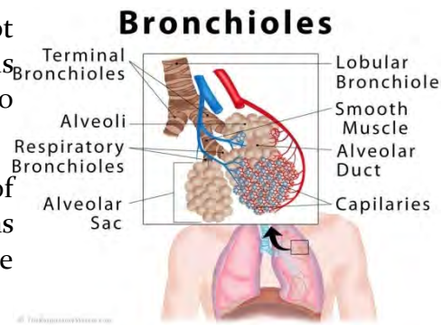
The laryngopharynx: The laryngopharynx extends from the epiglottis to the lower margin of the larynx. It continues the route for ingested material and air until its inferior end, where the digestive and respiratory systems diverge.

Larynx: The larynx consists of an outer casting of nine cartilages that are connected to each other by muscles and ligaments. It is also known as Voice box.

Trachea: The trachea, also known as the windpipe, is a membranous tube that consists of connective tissues and smooth muscles.

Bronchi: The trachea divides into the left and right primary bronchi. The main function of the bronchi, like other conducting zone structures, is to provide a passageway for air to move into and out of each lung. In addition, the mucous membrane traps debris and pathogens.

Bronchioles: Bronchioles, which are about ımmindia meter, further branch until they become the tiny terminal bronchioles, which lead to the structures of gasex change. There are more than ıooo terminal bronchioles in each lung.



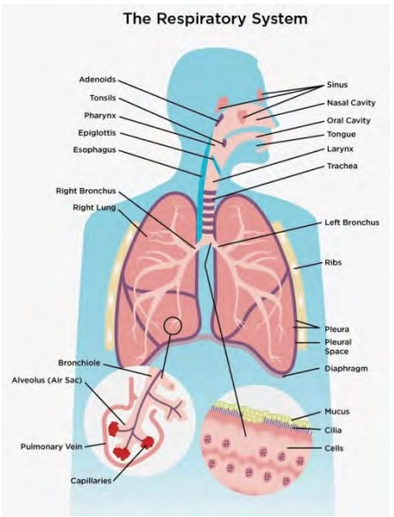
The muscular walls of the bronchiolesdo not contain cartilage like those of the bronchi. This muscular wall can change the size of the tubing to increase or decrease airflow through thetube.

Alveoli: An **alveolar duct** is a tube composed of smooth muscle and connective tissue, which opens into a cluster of alveoli. An **alveolus** is one of the

many small, grape-like sacs that are attached to the alveolar ducts.

Lungs: The lungs are the principal organs of respiration. These spongy, pinkish organs look like two upside-down cones in your chest. Lungs are divided into two parts

1. **Right lung:** The right lung is made up of three lobes
2. **Left lung:** The left lung has only two lobes to make room for your heart.



Diaphragm: The diaphragm is a thin skeletal muscle that separates the abdomen from the chest. It contracts and flattens when you inhale. This creates a vacuum effect that pulls air into the lungs. When you exhale, the diaphragm relaxes and the air is pushed out of lungs.

8.4.2 CIRCULATORY SYSTEM

The **circulatory system** is a network consisting of blood, blood vessels, and the heart. This network supplies the tissues in the body with oxygen and other nutrients, transports hormones, and removes unnecessary waste products.

Do you know?

Arteries *- blood vessels that carry oxygenated blood from the hear*

Arterioles *- a small branch of an artery leading into capillaries.*

Capillaries *- any of the fine branching blood vessels that form a network between the arterioles and venules.*

Venules *- a very small vein, especially one collecting blood from the capillaries.*

Veins *- blood vessels that carry deoxygenated blood back to the heart*

The Heart

The **heart** is made of specialized cardiac muscle tissue that allows it to act as a pump within the circulatory system.

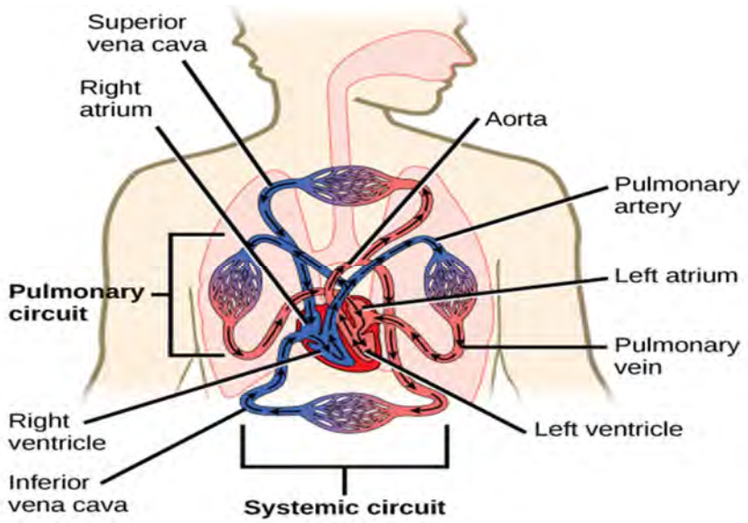
The human heart is divided into four chambers. The two sides of the heart are separated by a thick muscular wall called the septum.

There are two chambers – one atrium and one ventricle – on each side of the heart.

The atria receive blood and the ventricles pump blood.

The human circulatory system consists of several circuits:

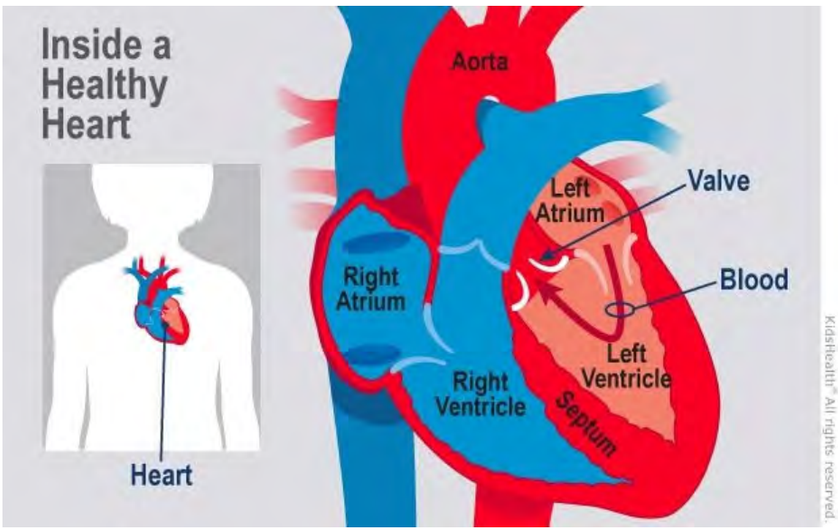
- The pulmonary circuit pumps blood to the lungs and back to the heart.
- The systemic circuit pumps blood to the body and back to the heart.
- The coronary circuit pumps blood to the heart.



Blood and Blood Vessels

Blood from the heart is pumped throughout the body using blood vessels. Arteries carry blood away from the heart to the body using smaller arterioles and capillaries. They provide oxygen (and other nutrients) to tissue and cells.

Once blood is de-oxygenated, it travels back to the right chambers of the heart through a network of veins. From the heart, blood is pumped into the lungs where it is re-oxygenatedand returned to the heart.



I. Tick the correct answer.

1. Trachea is also knownas
   a. Windpipe
   b. Voicebox
   c. Pharynx
   d. Nose
2. The movement of air into and out of the lungs
   a. External respiration
   b. Ventilation
   c. Internal respiration
   d. Respiration
3. The principal organ of respirationis
   a. Nose
   b. Larynx
   c. Trachea
   d. Lungs
4. The heart is made up of
   a. Connective tissue
   b. Epithelialtissue
   c. Cardiactissue
   d. Muscletissue
5. Thehearthas___chambers
   a. Three

b. Four
c. Five
d. Six

II. Answer the following questions briefly.

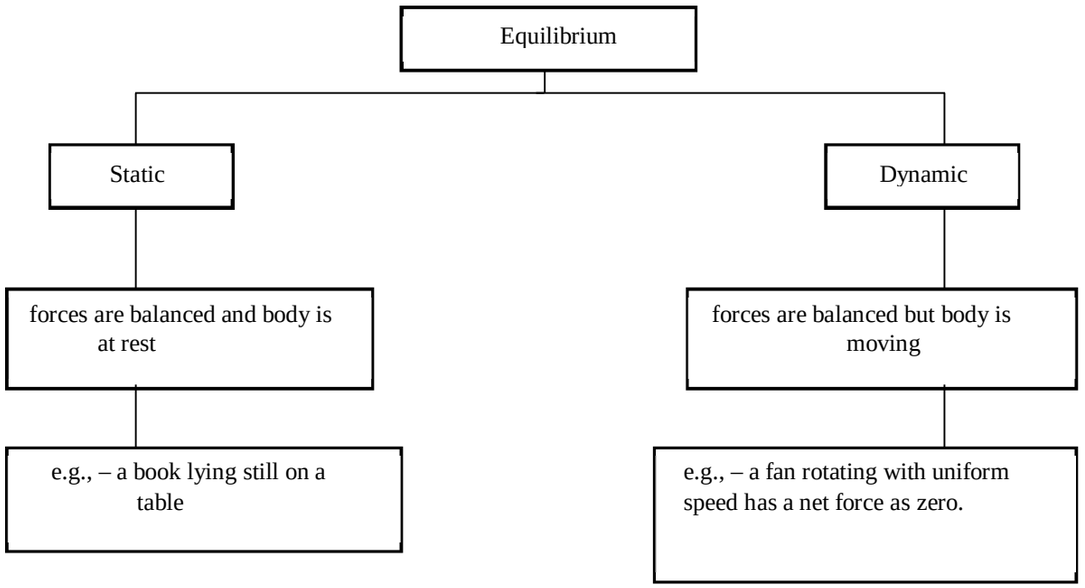
1. Define respiration.
2. Write a short note onpharynx.
3. Explain the function of the diaphragm in breathing.
4. Define circulatory system
5. Write a brief note on the heart.
6. What is the difference between Arteries and Veins?

III. Answer the following questions in 150-200 words.

1. What are the functions of respiratory system?
2. What are the functions of the heart?
3. Describe the circulatory system.

8.5.1 EQUILIBRIUM

- Equilibrium refers to the state of any object when all forces acting upon it result in zero change of motion for the object.
- In other words, when the sum of all forces is zero, the object is in a state ofequilibrium.
- In all activities whether stationary or moving, balance is an important factor.
- All activities demand stability and sometimes, instability depends on its purpose.



Static Equilibrium	Dynamic Equilibrium
1. When the sum of forces acting upon the object and sum of the movement acting upon the body is both equal to zero, then the body is said to be in static equilibrium.	1.When all the forces acting on an object are balanced, and the body is in motion, then the body is said to be in dynamic equilibrium.
2. In other words, Static balance is maintaining equilibrium when stationary. e.g., Yoga	2. In other words, dynamic balance is maintaining equilibrium when moving. eg. jump shot in basketball.
3. e.g., A gymnast performing 'T' position on the balancing beam, because the gymnast is not making any movement.	3 e.g., A cycle is moving with uniform velocity.

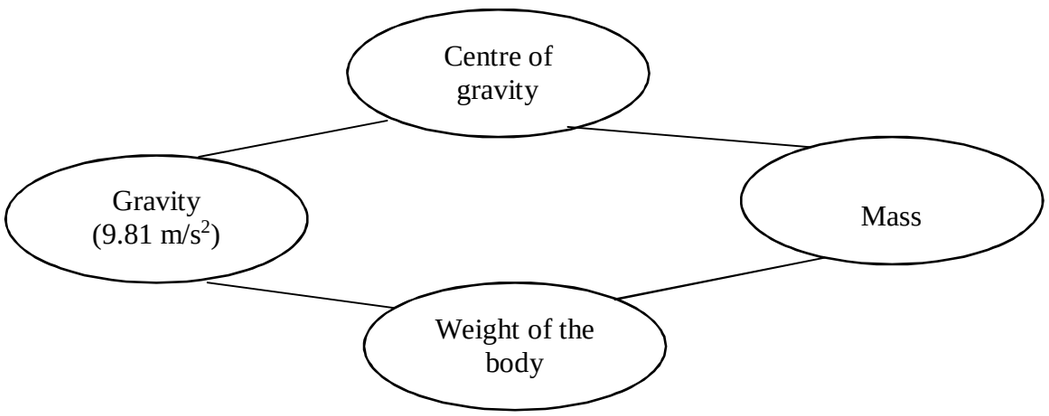
8.5.2 APPLICATION OF EQUILIBRIUM IN SPORT

1. Two people balancing on a see-saw.

2. In every sport, the athletes maintain stability by lowering the centre of gravity by bending their knees.
3. Boxers can lose balance if they shift their weight on heels because the centre of gravity must fall within the line of base of support for greater stability.
4. Dynamic equilibrium is required by a tennis player to change her/his position after hitting a shot.

8.5.3 CENTER OF GRAVITY

1. Centre of gravity is a point at which a body balances or the point at which the weight of body is equally distributed.
2. It is a point in the body or system around which its weight is evenly distributed or balanced and through which the force of gravity acts.
3. Centre of gravity is the intersection point of all the three planes and axis.
4. The centre of gravity is the average location of the weight of anobject.
5. The position of centre of gravity changes depending up on the position of the body or object.



Application in Sports

1. An athlete who bends legs will lower his/her centre of gravity which will result in greater stability for the athlete.
2. Centre of gravity needs to be lowered for greater stability in sports like wrestling.
3. A jumper's centre of gravity must lie on the base of support for greater stability while take-off.

I. Tick the correct answer.

1. When the sum of force acting upon the object and sum of the movement acting upon the body is both equal to zero then the body is said to bein
   i. equilibrium
   ii. static equilibrium
   iii. dynamic equilibrium
   iv. zero force

2. The position of centre of gravity changes depending uponthe
   i. position of force
   ii. position of the body
   iii. position of intersection of force
   iv. position of stability
3. Centre of gravity is the average location of the____of an object
   i. weight
   ii. force
   iii. balance
   iv. velocity

II. Answer the following questions briefly.

1. What do you understand by equilibrium? What are the types of equilibrium?
2. Give suitable examples of type of equilibrium applied to sports /games.
3. Define centre of gravity.

III. Answer the following questions in 150-200 words.

1. Writed own the factors on which the centre of gravity depends with suitable examples.

Suggested Readings :

- Dhananjay Shaw (2000), Mechanical Basis of Biomechanics, Sports Publication, Delhi,
- Lutlegen, & Nancy, H. (1997). Kinesiology: Scientific Basis of Human Motion. Mc Graw Hill.
- *Physical Education and Yog (373)*. (n.d.). Retrieved 11 25, 2020, from National School of Open Learning: https://www.nios.ac.in/online-course-material/sr-secondarycourses/physical-education-and-yog-(373).aspx
- Thompson, & Floyd. (2017). *Manual of Structural Kinesiology*. Mc Graw Hil.