



# BODY MOVEMENTS



## Concepts Covered

- The human body and its movements.
- Joints and their types.
- Skeleton of the human body and its function.
- Functions of locomotion, and movement of muscles in humans.

## Introduction

Living organisms can move from one place to another place through the movement of their body parts. While doing physical exercise we move parts of our body in different ways. We can also rotate some parts of our bodies. We lift and bend legs, hands, and other parts of our body while playing a game, running by using legs, jumping by using hands, etc.

## Movement

- The term movement is related to living organisms for their displacement from one place to another by using their body parts.
- The body has a system of functioning, where the main control and processing is regulated by the brain to perform any activity.



**Dracula ant, *Mystrium camillae* can snap its mandibles at speeds of up to 90 meters per second (more than 200 mph), making it the fastest animal movement on record.**



## The human body and its movement

All the movements are done with the help of certain parts of our body.

The human body movements get polished as we grow in age. The movement starts from crawling and with the increase in age the person starts walking leading to the movement of the whole organism.

These movements are possible because of joints. Different joints help our body carry out different activities and movements

## Extended Learning

### Five different types of movement-

- Adduction is the moving of a body part toward the midline of the body.
- Abduction is moving a body part away from the body.
- Flexion, Extension
- Rotation involves moving a body part around an axis.

## Joints

- The point where two bones meet is called a joint.
- Joints help us to bend, turn, move, and do all the activities.
- Joints are divided into two types-

## (1) Movable Joints

- Movable joints are the joints that are capable of moving in a variety of directions (allow mobility).
- The joint surfaces are smooth, covered with cartilage, and gathered in a so-called joint capsule.
- The joint capsule is a fibrous connective tissue that ensures that the joint is secure.
- Examples include the knee joints, elbow joints, wrist joints, shoulder joints, hip joints, and ankle joints.

### Types of movable joints

(A) Ball-and-socket joints (ex: shoulder and hip joints)

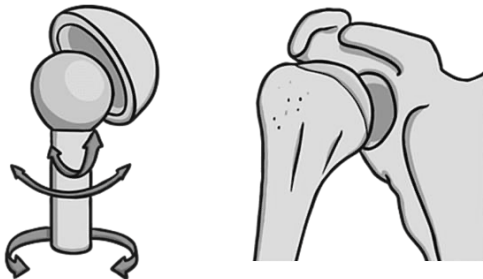
(B) Hinge joints (ex: knee, elbow, and finger joints)

(C) Gliding joints (ex: base of the thumb)

(D) Pivot joints (ex: the first and second vertebrae of the neck that allows the head to move back and forth)

#### (A) Ball and Socket joint

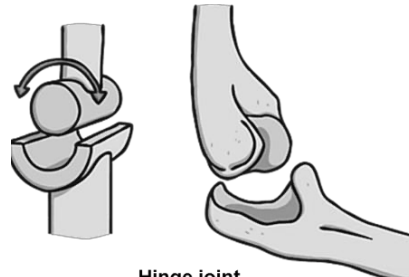
- Ball and socket joint is a movable joint in which a bone with a round head fits into the hollow space of another bone.
- This makes the bone rotate freely.
- For example, bones of the hip and shoulder can move in all directions due to ball and socket joints.
- If we stand up and move our leg around at the hip, we will find that we can move it forward and backward, and from side to side, and we can also rotate it. This is because the hip joint is a ball and socket joint.



Ball and socket joint

#### (B) Hinge joint

- A hinge joint allows the movement of bones in only one direction i.e. forward and backward.
- Elbow and knee joints are examples of hinge joints.
- We can bend our arms only in one direction i.e. forward and backward.
- The lower end of the upper arm bone is in the shape of a **knob** and the upper end of the lower arm is in the shape of a **cup**.
- The knob of the upper arm bone fits into the cup of the lower arm bones to form a hinge joint at the elbow.
- The ligaments hold the upper arm bone and lower arm bone together at the elbow joint.



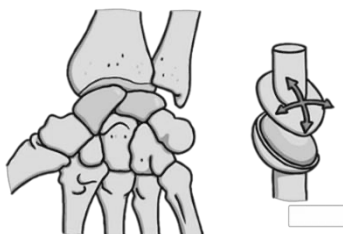
Hinge joint



**Ligament tear-** A ligament tear is an injury caused by an extreme motion, like a forceful twisting of a joint.

#### (C) Gliding joint

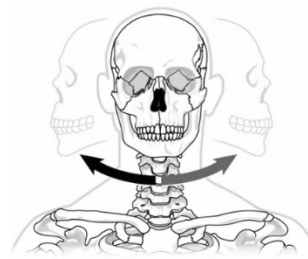
- The gliding joint is a joint built between two bones that meet on flat articular surfaces allowing sliding or gliding motion.
- These types of joints provide little movement in all directions.
- These are the joints present at the ankles, wrist, and between vertebrae.
- There is tender and flexible cartilage between the vertebrae of the backbone.
- Due to the cartilage, vertebrae slide over each other. So, the backbone can move in any direction.



Gliding joint

#### (D) Pivot joint

- Pivot joint is a freely moveable joint that allows only rotary movement around a single axis.
- The joint that joins the skull to the backbone is called the pivot joint or neck joint.
- A pivot joint between our skull and neck allows our heads to bend up and down from side to side.
- The pivot joint occurs in the forearm near the elbow.
- The forearm has two bones, the radius, and ulna.
- In the forearm, the pivot joint makes the radius and ulna bones twist around each other.



Pivot joint

## (2) Immovable or Fixed Joint

- The joints in which bones cannot move or bend are called immovable or fixed joints. Examples include skull bones, teeth in sockets of jaw, etc.
- The function of fixed joints is to provide strength and support to the body.
- The plate-type bones of our skull are held together by fixed joints and cannot move at all.
- The hard and strong skull protects a delicate organ of our body called the brain.
- If we open our mouth wide, we will find that we can move our lower jaw but the upper jaw does not move at all.
- We cannot move the upper jaw because it is connected to the skull by a fixed joint.



### Check Your Concept - 1

- (1) The joint in our elbow is an example of  
(A) Hinge Joint (B) Ball And Socket Joint  
(C) Pivot Joint (D) Gliding Joint
- (2) Fixed joints are found in  
(A) Lower Jaw (B) Skull  
(C) Hands (D) Hip Bone
- (3) What are Joints?
- (4) Give some examples of pivot joint.



The most commonly affected joint in human body is Knee Joint. The wearing and tearing of cartilage is extensively high here than any other body part, and the process is usually accelerated due to obesity and overweight.

## Bones

- Bones are made of connective tissue reinforced with calcium and specialized bone cells.
- Most bones also contain bone marrow, where blood cells are made.
- Bones work with muscles and joints to hold our body together and support freedom of movement.
- Bones provide a definite shape to our bodies.
- One way to know the shape of our bones is through X-ray images.

### Extended Learning

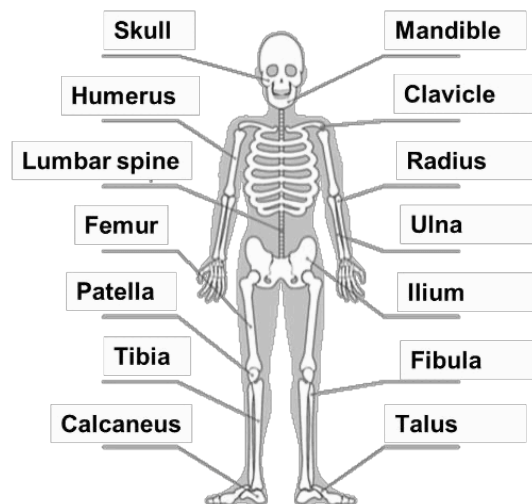
**X-RAYS:** X-rays are a type of radiation called electromagnetic waves. X-ray imaging creates pictures of the inside of our body. The images show the parts of our body in different shades of black and white. This is because different tissues absorb different amounts of radiation.

## Human Skeleton

- The different bones of the different parts of the body are combined to form a single structure. This structure is called Skeleton.
- It is made up of bones, cartilage, and joints.
- The skeleton of a normal adult human being is made up of bones.
- Apart from bones, cartilage, and joints; muscles, ligaments, and tendons also form a part of the Skeletal System.

### Functions of the Skeleton

- It forms the framework of our body, provides shape and support, and holds us upright.
- It helps in the movement of various parts of our body.
- It protects internal organs. The brain and heart and lungs are protected by the skull and ribs respectively

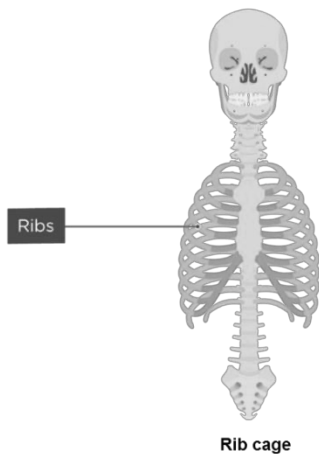


There are just a few differences between human male and female skeletons. The female skeleton is generally slightly smaller and the pelvis bones differ in shape, size and angle in order to assist with child birth.

## Structure of the Skeleton

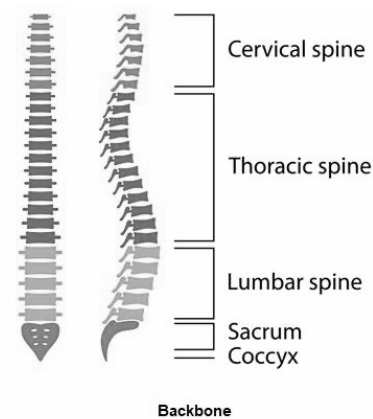
### Rib Cage

- Ribs are curved bones in our chest.
- There are 12 pairs of ribs in the chest of our body.
- Ten of the rib pairs are connected to the breastbone known as the sternum. The last two pairs of ribs are known as "floating ribs"
- One end of all ribs is joined to the backbone and the other end is joined to the breast bone.
- The hollow, bony structure formed by the ribs is called a rib cage.
- The rib cage protects delicate internal organs like the heart, liver, and lungs.
- The rib cage also takes part in our breathing movement.



### Backbone

- The backbone is a line of bones that runs through the center of our back.
- It is made up of many small bones called vertebrae.
- There are 33 vertebrae.
- The rib cage is joined to these bones.
- Between the various vertebrae of the backbone are the discs of cartilage i.e. soft bones.
- The spinal cord runs through the center of these vertebrae.



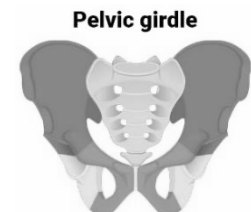
### Pectoral Girdle

- A pectoral girdle is a group of two bones that connect the arm on both sides.
- The pectoral girdle is composed of the clavicles (collarbones) and the scapulae (shoulder blades).
- The scapula, also known as the shoulder blade, is present posteriorly in the shoulder. It helps in articulation with the collarbone and humerus bone.
- The clavicle, also known as the collarbone, is present anteriorly to the shoulder. it functions as a strut to support the shoulder.



### Pelvic girdle

- The pelvic girdle is a ring-like bony structure located in the lower part of the trunk. It connects the axial skeleton to the lower limbs.
- The pelvic bones include the hip bones, sacrum, and coccyx.
- It transfers weight from the upper axial skeleton to the lower appendicular components of the skeleton, especially during movement.



### Skull

- The bony part of our head is called the skull.
- The skull is made of 22 bony plates joined together.
- The bones of the skull form the strong case around the brain.
- The skull protects the brain.



### Jaw Bones

- See in the mirror and just up and down your jaw.
- Notice the joint in the bones near your ear.
- This is the place where lower jaw bones are joined to our skull.
- The upper part is the maxilla. It doesn't move.
- The moveable lower part is called the mandible.
- The left and right halves of the lower jaw, or mandible, begin originally as two distinct bones.
- The horizontal central part on each side is the body of the mandible.

## Limbs

Limbs are arms and legs in the human body.

Each limb is made up of 30 bones.

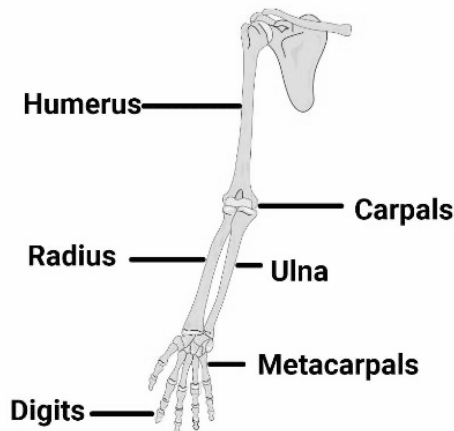
The bones present in the forelimbs are — scapula, humerus, radius, ulna, carpals (8), metacarpals (5), and phalanges (14). The bones present in hind limbs are — femur, patella, tibia, fibula, digits, tarsals, and metatarsals.

### (a) Forelimbs:

Forelimb is located between the wrist and elbow.

- The humerus is the long bone in the upper arm.
- The lower arm has two bones called the radius and ulna.

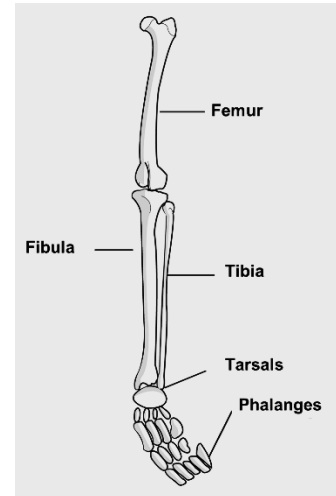
The humerus is joined to the vertebral column by the collar bone and shoulder blade.



### (b) Hindlimbs

- Hind limbs are those that are found in the back part of the body i.e legs.
- The longest bone in our body is the thigh bone or the femur.
- The lower leg consists of two bones- the tibia and the fibula.

The pelvis or hip bone is attached to the lower end of the backbone.



## Flexible Bones- Cartilage

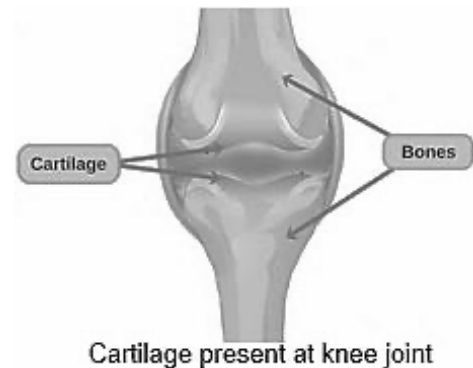
Cartilage is defined as a type of connective tissue that provides structural support and protection for the body's joints. Cartilage is found in many areas of the body including joints between bones e.g. the elbows, knees, and ankles.

It's made from specialized cells called chondrocytes that produce a combination of collagen, proteoglycans, and other non-collagenous proteins.

### Major Functions of Cartilage

There are many roles that cartilage plays in the human body. For instance:

- Cartilage helps to keep the joints from rubbing against each other.
- Cartilage helps to provide structure and protection for many of the body's organs, such as the ear and nose.
- Cartilage protects the spinal cord and keeps the bones from rubbing together.
- Cartilage provides cushioning for the skeletal system and holds articular joints together.
- It also acts as an elastic framework that allows bones to adjust their position relative to one another.



### Check Your Concept - 2

- What are the different types of bones in human skeleton
- How many bony plates are joined to make skull?
- Fixed joints are found in  
(A) Lower Jaw (B) Skull (C) Hands (D) Hip Bone
- The bone that protects the spinal nerve cord is  
(A) Skull (B) Backbone (C) Breast Bone (D) Chest Bone
- Both clavicle and scapula constitutes the  
(A) Shoulder Bone (B) Chest Bones (C) Hand Bone (D) Backbone

## Muscles

Muscles are tissues that can contract, and therefore they help in the movement of the other body parts.

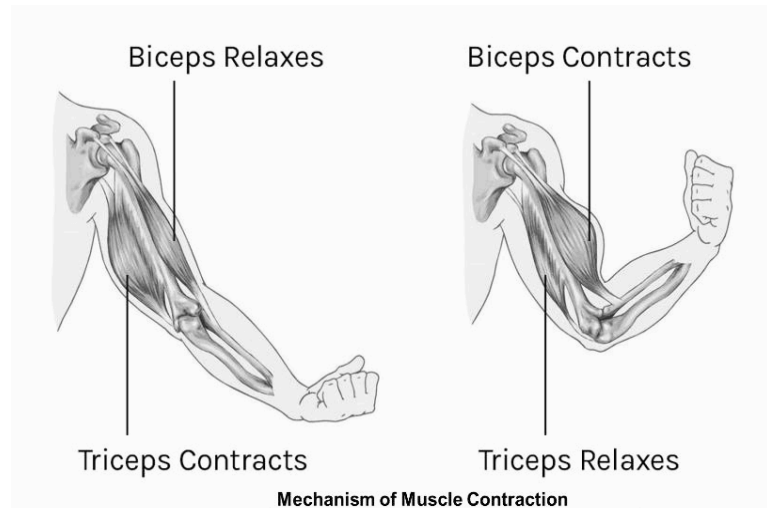
- Muscles can pull bones, but they can't push them back to their original position.
- So, they work in pairs of flexors and extensors.



**There are more than 650 muscles in our body. The biggest muscle is Gluteus-Maximus and the smallest muscle is Stapedius.**

## Mechanism of Muscle Contraction

- Among the pairs of muscles, when one of the muscles contracts, the other relaxes.
- The bone is moved in the direction in which the muscle contracts.
- To move the bone in the opposite direction, the muscle under relaxation contracts to pull the bone towards its original position. During this, the other muscle relaxes.
- In muscles contraction, different factors come in place as in
  - Calcium ions stimulate muscle movement.
  - Actin and myosin together contract and relax.
- Some muscles are directly connected to bones.
- Muscles have round, white, and rope-like fibers at their ends that connect to the bone.



## Extended Learning

### Tendon and Ligament

**A tendon** is a fibrous connective tissue that attaches muscle to bone. A tendon serves to move the bone or structure. **A ligament** is a fibrous connective tissue that attaches bone to bone, and usually serves to hold structures together and keep them stable.



### Check Your Concept - 3

- What is movement?
- What are the two components of muscles?
- How do muscles move?
- The fibers which join the muscles to the bones
 

(A) Tendon	(B) Ligament
(C) Cartilage	(D) none
- Skeleton of human body is made up of
 

(A) Bones	(B) Cartilage
(C) Both Bones And Cartilage	(D) None Of These



## Solved Examples

### Level – 1

(1) **List the two types of movable joints.**

**Answer:** 1. Hinge Joint.  
2. Ball socket Joint.

(2) **What are the examples of Hinge joints?**

**Answer:** Knee, elbow, and finger point.

(3) **Where are the gliding joints present?**

**Answer:** These are the joints present in the ankle, wrist, and between the vertebrae.

(4) **What is the function of a fixed joint?**

**Answer:** The function of fixed joints is to provide strength and support to the body.

(5) **How is locomotion different from movement?**

**Answer:** Locomotion is the displacement of a body from one place to another. On the contrary, movement is the displacement of a body or a part of the body from its original position.

(6) **Name the bones which protect the heart from all sides.**

**Answer:** The breastbone from the front and the backbone at the back make a type of box, a Rib cage, to protect the heart.

(7) **What is the significance of locomotion in animals?**

**Answer:** In animals, locomotion plays an important role in helping them to move from one place to another. Animals move for many reasons to support their living. Therefore they walk, run, jump, fly, swim, and escape from their predators.

(8) **What is movement? How do humans move?**

**Answer:** Movement is when the living organism moves a body part or parts to bring without a change in the position of the organism. In Humans, movement is achieved by a complex and highly coordinated mechanical interaction between bones, muscles, ligaments, and joints within the musculoskeletal system under the control of the nervous system.

(9) **Why flexibility at all joints is not desirable?**

**Answer:** This is because it has the most elastic tissue and because ligaments and tendons (since they have less elastic tissue) are not intended to be stretched very much at all. Overstretching them may weaken the joint's integrity and cause destabilization (which increases the risk of injury).

(10) **What would happen if there were no ribs in our body?**

**Answer:** Ribs provide a framework for our main internal organs like the heart and lungs. If ribs were absent in our body all these internal organs would become vulnerable to any kind of injury or shock.

### Level – 2 (HOTS)

(1) **Ritu fractured her leg while playing. The doctor plastered her leg and advised her to take calcium tablets and milk regularly. He also asked her to get plenty of sunlight. Ritu followed the doctor's advice.**

(a) **What is a fracture?**

(b) **Why did the doctor advice Ritu to take calcium tablets?**

(c) **Why did the doctor ask Ritu to get plenty of sunlight?**

(d) **What value of Ritu is shown here?**

**Answer:** (a) A fracture is a broken bone that ranges from a thin crack to a complete break.  
(b) Calcium tablets will help in the quick healing of bones.  
(c) Sunlight is the source of Vitamin D which is good to make our bones strong.  
(d) Sia is an obedient girl.

(2) **Collect information regarding joint pains from an orthopedic.**

**Answer:** Joint pain can be discomfort, pain, or inflammation arising from any part of a joint — including cartilage, bone, ligaments, tendons, or muscles. Most commonly, however, joint pain refers to arthritis or arthralgia, which is inflammation or pain from within the joint itself.

- Non-steroidal anti-inflammatory drugs called NSAIDs help relieve joint swelling, stiffness, and arid pain — and are among the most commonly used pain killers for people with any type of arthritis.

- Following can provide natural relief from Arthritis pain

(i) Weight Control

(ii) Exercise

(iii) Acupuncture

- (iv) Meditation
- (v) Turmeric
- (vi) Massage.

(3) **Collect X-ray films and identify which body part they represent and write a note on them.**

**Answer:**

- **Gliding joint:** A gliding joint is a joint which allows only gliding movement. The gliding joint allows one bone to slide over the other. The gliding joint in your wrist allows you to flex your wrist. It also allows you to make very small side-to-side motions. There are also gliding joints in your ankles and backbone.



- **Rib cage:** Ribs are bent which joins the chest bone and the backbone together to form a box. This is called the rib cage.



- **Pivot joint:** Only allows rotating movement. The joint that joins the skull to the backbone is called the pivot or neck joint.



- **Ball-and-socket joint:** The ball-shaped surface of one bone fits into the cup-like shape of another. Examples of a ball-and-socket joint include the hip and the shoulder.



- **Hinge joint:** The ends of the bones are shaped in a way that allows motion in two directions, forward and backward. Examples of hinge joints are the knees and elbows.



(4) **List out the activities that you performed at your home and which joints were involved in each activity.**

**Answer:** We cannot perform any movement without the involvement of joints. They have a key role in our daily activities.

**ACTIVITIES**

1. Walking
2. Running
3. Bowling
4. Playing
5. Dancing
6. Painting
7. Driving

**INVOLVED JOINTS**

- Hinge and gliding joints
- Hinge and gliding joints
- Ball and socket joint
- Ball and socket, hinge, gliding, and pivot joints
- Ball and socket, hinge, gliding, and pivot joints
- Gliding joint
- Hinge, gliding joints



## Exercise

### FILL IN THE BLANKS

- (1) Joints of the bones help in the \_\_\_\_ of the body.
- (2) A combination of bones and cartilage forms \_\_\_\_ of the body.
- (3) A bone of elbow has \_\_\_\_ joints.
- (4) A contraction of \_\_\_\_ pulls the bones during movement.
- (5) The \_\_\_\_ are fibrous cords that attach muscles to bone.
- (6) Actin and myosin are components of \_\_\_\_.
- (7) The X-rays show the shapes of the \_\_\_\_ in our bodies.
- (8) \_\_\_\_ is the smallest bone present inside the ear.
- (9) There are \_\_\_\_ pairs of ribs in our body.
- (10) Bones are fastened to other bones by long, fibrous straps called \_\_\_\_.
- (11) \_\_\_\_ is a flexible, rubbery substance in our joints.
- (12) The pelvic girdle is a \_\_\_\_ like bony structure.
- (13) The joint where the slides move each other is called the \_\_\_\_ joint.
- (14) The bones are held so tightly together that they cannot move at all such joints are called \_\_\_\_.
- (15) The body of the fish is slimmer than the middle portion, it is called tapered ends and this shape is called \_\_\_\_ body.

### TRUE OR FALSE

- (1) The movement and locomotion of all animals are the same.
- (2) Cartilages are harder than bones.
- (3) Finger bones do not have joints.
- (4) The forearm has two bones.
- (5) Ball and socket joint is a movable joint.
- (6) The joint that joins the skull to the backbone is called the pivot joint or neck joint.
- (7) The lower end of the upper arm bone is in the shape of a knob and the upper end of the lower arm is in the shape of a cup.
- (8) Cartilage is present in the pinnae (Inner parts) of the ears.
- (9) The hard and strong skull protects a delicate organ of our body called the brain.
- (10) All objects have similar shapes and sizes.
- (11) The joint surfaces are smooth, covered with cartilage, and gathered in a so-called joint capsule.
- (12) The ligaments hold the upper leg bone and lower leg bones together at the knee joint.
- (13) The point where two bones meet is called muscles.
- (14) They have hollow bones that are light in weight. Hence their bones are known as pneumatic bones.
- (15) The function of fixed joints is to provide strength and support to the body.

### OBJECTIVE TYPE QUESTIONS

- (1) The \_\_\_\_ is the only movable part of the skull.  
(A) Nasal Conchae (B) Mandible  
(C) Vomer (D) Maxilla
- (2) Which is a part of the pectoral girdle?  
(A) Acetabulum (B) Ilium  
(C) Sternum (D) Glenoid cavity
- (3) A skeletal muscle that decreases the angle between two bones and bends a joint is?  
(A) Abductor (B) Flexor  
(C) Extensor (D) Adductor
- (4) Largest bone in the human body is  
(A) Femur (B) Tibia  
(C) Thigh (D) All of these
- (5) Components of muscles are  
(A) Actin (B) Myosin.  
(C) A&B. (D) tubulin

- (6) The main types of joints in the human being  
(A) Fixed joint (B) Ball and socket joint  
(C) Hinge joint (D) All of these
- (7) \_\_\_\_\_ connect the ends of bones together.  
(A) Ligaments (B) Tendon  
(C) Muscles (D) Cartilage

- (8) Match the following:

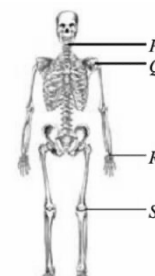
Column A	Column B
(i) Hinge Joint	(1) Carpals
(ii) Saddle Joint	(2) Knee
(iii) Pivot Joint	(3) Thumb
(iv) Gliding Joint	(4) Vertebra

- (A) i-4, ii-3, iii-1, iv-2 (B) i-3, iv-1, iii-2, iv-4  
(C) i-2, ii-3, iii-4, iv-1 (D) i-3, ii-1, iii-4, iv-2
- (9) Backbone is a composition of  
(A) Vertebrae (B) Muscles  
(C) Blood (D) Metals
- (10) The ribs joining the chest bone to the backbone form a box called as  
(A) rib cage (B) Cartilage  
(C) Ligament (D) Knee
- (11) Movement of the upper arm is  
(A) Rotate completely (B) One direction  
(C) Round (D) Two direction
- (12) Parts where the smooth bone is located  
(A) Skull (B) Nose tip  
(C) Clavicle (D) Femur
- (13) Movement in humans is due to  
(A) Muscles (B) Ligaments  
(C) Cartilage (D) All the above
- (14) How many joints are there in our body  
(A) 12 (B) 22  
(C) 33 (D) 28
- (15) Muscles are attached to bones by  
(A) Cartilage (B) Tendon  
(C) myosin (D) Actin
- (16) Which of the following joints is present between the thigh bone and shin bone? [NSO 2014, Set A]  
(A) Hinge joint (B) Pivot joint  
(C) Fixed joint (D) Ball and socket joint
- (17) Rohit's father experienced a heart attack. Doctor told him that his blood vessels have become narrower. What could be the reason for this? [NSO 2014, Set B]  
(A) His diet has an excess of roughage and water.  
(B) His diet lacks proper amount of vitamins and minerals.  
(C) His diet has an excess of fats and carbohydrates.  
(D) His diet lacks proper amount of proteins and carbohydrates.
- (18) Which of the following statements are incorrect regarding the given figure? [NSO 2015, Set A]  
(i) The parts labelled P and Q show ball and socket joint and hinge joint, respectively.  
(ii) The part labelled R is radius bone.  
(iii) The parts labelled T and U are called metacarpals and carpals respectively.  
(iv) The part labelled S is ulna bone.  
(A) (ii) and (iii) only (B) (ii) and (iv) only  
(C) (i) only (D) (iii) only



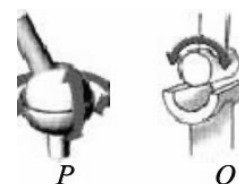
(19) Identify the joints labelled as P, Q, R, and S in the given figure, and select the correct option.

	Gliding joint	Ball and socket joint	Hinge joint	Pivot joint
(A)	S	P	Q	R
(B)	R	Q	P	S
(C)	R	Q	S	P
(D)	S	P	Q	R



(20) Refer to the given figures P and Q which represent different joints in our body. Identify these joints and select the correct option. [NSO 2017, Set A]

- (A) Joint P allows  $360^\circ$  of movement whereas joint Q allows only  $90^\circ$  of movement.  
 (B) Both joints P and Q allow movement in one plane only.  
 (C) Joint P is present in our shoulders and hips whereas joint Q is present between our neck and skull.  
 (D) Joint P is ball and socket joint whereas joint Q is hinge joint.



## Answer Key

### CHECK YOUR CONCEPT

- |                         |                            |                       |
|-------------------------|----------------------------|-----------------------|
| (1) (i) (A) hinge joint | (ii) (B) skull             |                       |
| (2) (iii) (B) skull     | (iv) (B) backbone          | (v) (A) shoulder bone |
| (3) (iv) (A) tendon     | (v) (C) bone and cartilage |                       |

### FILL IN THE BLANKS

- |              |                |                    |
|--------------|----------------|--------------------|
| (1) Movement | (6) Muscles    | (11) Cartilage     |
| (2) Skeleton | (7) Bone       | (12) Ring          |
| (3) Hinge    | (8) Stapes     | (13) Sliding       |
| (4) Muscles  | (9) 12         | (14) fixed joints. |
| (5) Tendons  | (10) Ligaments | (15) Streamlined   |

### TRUE OR FALSE

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|-----------|------------|------------|
| (1) False | (6) True   | (11) True  |
| (2) False | (7) True   | (12) True  |
| (3) False | (8) False  | (13) False |
| (4) True  | (9) True   | (14) True  |
| (5) True  | (10) False | (15) True  |

### OBJECTIVE TYPE QUESTIONS

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|---------|----------|----------|----------|
| (1) (B) | (6) (D)  | (11) (A) | (16) (B) |
| (2) (D) | (7) (A)  | (12) (B) | (17) (A) |
| (3) (B) | (8) (C)  | (13) (A) | (18) (C) |
| (4) (A) | (9) (A)  | (14) (A) | (19) (A) |
| (5) (C) | (10) (A) | (15) (B) | (20) (C) |