

2

The Human Body: Skeletal System

We'll cover the following key points:

- The Skeletal System
- Functions of Bones
- Joints
- Muscles



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Learning Outcomes

By the end of this chapter, students will be able to:

- Understand the concept of the human skeletal system and its unique functions in the body.
- Identify and differentiate between the major bones in the human body and their roles, such as support, protection, and movement.
- Explore examples of how the skeletal system works with muscles to enable body movement and protect vital organs like the brain and heart.
- Learn the importance of maintaining bone health through proper nutrition (e.g., calcium, vitamin D) and regular physical activity.

Guidelines for Teachers

The teacher can start the chapter by introducing the skeletal system as the framework of the human body, encouraging students to touch their arms or legs to feel their bones. Discussions can focus on the key functions of the skeletal system, such as providing support, enabling movement, and protecting vital organs. The teacher can also emphasize the role of bones in working with muscles to allow movement and the importance of maintaining strong and healthy bones through a balanced diet and exercise.



Warm Up

Write 'S' for serious and 'J' for joking.

1. The shoulder and hip joints have ball and socket joints.
2. In our body, all the joints are movable.
3. Femur is the longest bone in our body.
4. The hip joint is a pivot joint.
5. The jaw enables us to talk and eat.

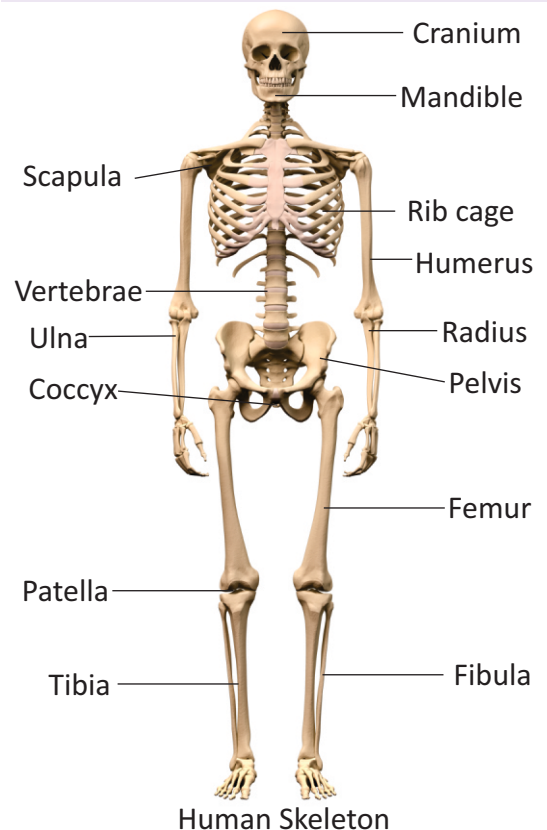
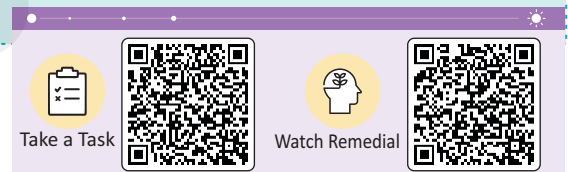
Fun Fact

Your skeleton is both strong and lightweight, with the human bone being five times stronger than steel of the same density! You're born with around 300 bones, but some fuse as you grow, leaving you with 206 bones in adulthood. The smallest bone, the stapes in the ear, is just 2-3mm long, while the femur in your thigh is the longest and strongest. Every 10 years, your skeleton essentially replaces itself as old bone tissue is replaced by new!

The Skeletal System

Can you imagine the shape of the human body if there was no supporting frame work? We would probably look like a huge mass of muscles. The human skeletal system is a framework of bones along with ligaments, tendons, cartilage and other tissues. This framework protects and supports the body tissues and internal organs while giving a proper shape and structure to our body. The framework of bones in our body is known as the **skeleton**.

About 70 percent of our bones are made up of hard minerals like Calcium and Phosphorous which give strength to our bones. **Joints** are where two bones meet. They make the skeleton flexible and help in movement. **Muscles** are also necessary for movement. They're the masses of tough, elastic tissue that pulls our bones when we move. Bones along with muscles form the **musculoskeletal** system.



Did you know ?

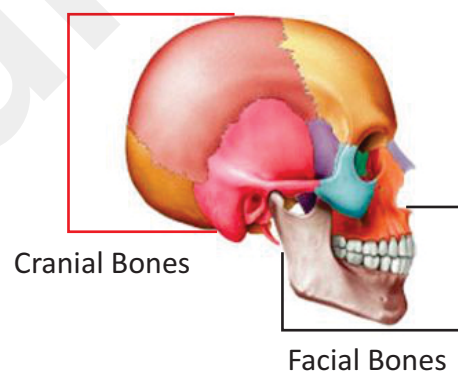
Bones are formed by the ossification of cartilage. What this really means is that all bones start off as cartilage (normally in the womb) and they gradually turn to hard bone (ossification) over a period of years. Calcium is needed for strong bone growth.

Parts of the Skeletal System

It is interesting to know that a new born baby has more bones than an adult. A baby has 300 bones which eventually join together to form 206 bones that an adult has. These bones make up the bulk of the skeletal system. The human skeleton can be split into two parts. The **axial skeleton** and **the appendicular skeleton**. The skull, the rib cage and the spine make up the axial skeleton. They mostly serve the protective functions. The skull protects the brain, the rib cage protects the lungs and heart and the spine protects the spinal cord. The appendicular skeleton on the other hand comprises bones of the arms and legs. These make walking, dancing and playing possible. Let's learn about them in detail.

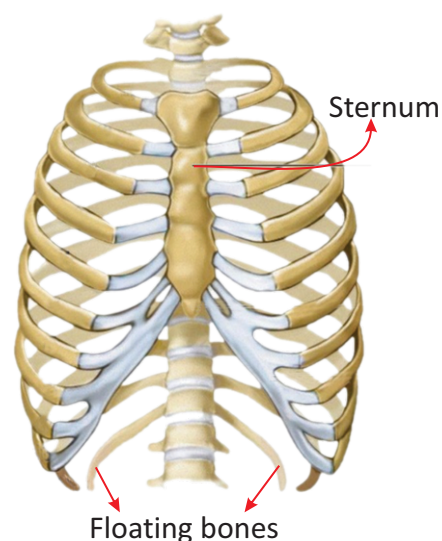
The Skull

The skull protects the most important part of our body, the brain. It is actually made up of different bones, some of which protect the brain while the others make up the structure of our face. The human skull contains 22 bones. 8 bones make up the cranium, a part of the top portion of the skull that protects the brain. The other 14 bones make up the lower part of the skull, which is known as the facial bones. It's interesting to know that the smallest bone in our body is also located in our head. The stirrup bone behind our eardrum is only 0.1 to 0.13 inches. The only movable bone in the skull is the lower jaw bone which helps us chew our food and also talk.



The Rib cage

The rib cage acts like a cage of bones around our chest region protecting the important organs such as the heart, the lungs and the liver. A typical human skeleton comprises 12 pairs of ribs (a total of 24). The upper 7 ribs on each side of the rib cage directly connects to the sternum which is a flat bone in the middle of the rib cage. The 8th, 9th and 10th pairs of ribs connects indirectly to the sternum whereas the 11th and 12th pairs do not connect to the sternum at all and are hence called the floating ribs.



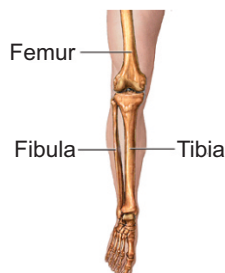


The Vertebral column or the Backbone

The vertebral column also known as the spine or the backbone is made up of a series of small bones, the vertebrae (33 in Number) that extends from neck to tail. The major function of the vertebral column is to protect the delicate spinal cord. In addition to that, it also holds the body upright.

Arms

The arm in humans is comprised of three bones. The upper part of the arm has a single bone called the **humerus** and the lower part of the arm is made up of two bones called **radius** and **ulna**. The upper and the lower arm join at the elbow.

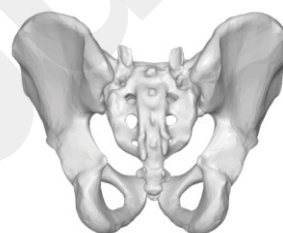


Legs

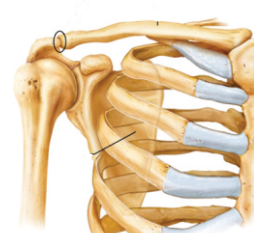
The bones of the legs need to be large and strong to be able to support the rest of the body. The upper part of the leg consists of the largest bone in our body called the **femur**. The lower part of the leg is made up of two bones namely **tibia** and **fibula**.

Girdles

Girdles are the ring like bony structures that connect the upper and lower limbs to the skull and the backbone. The human body consists of two girdles. They are the shoulder and the hip girdle. The shoulder or the **Pectoral** girdle supports the upper limbs and connects them to the body. The hip or the **Pelvic** girdle is an encircling bony structure supporting and connecting the lower limbs to the body.



Pelvic girdle



Pectoral girdle

Functions of Bones

The skeletal system serves several vital functions. Some of them are as follows:

- 1. Shape** – The presence of a firm bony skeleton gives the body its distinctive shape. All vertebrates have a vertebral column to support the central axis of their body.



Take a Task

Watch Remedial

Did you know ?

The smallest bone of the human body is in the ear.

Although our bones stop growing when we are around 20, they do constantly rebuild new bone cells.

Red bone marrow can produce around 5 billion red blood cells each day.

Very few man made substances can come close to the lightness and strength of bones.

If our body doesn't have enough calcium, it will take it from our bones making our bones weaker. So it is important to drink our milk so that there is a supply of calcium in our body!



Write 'T' for true and 'F' for false statements.

1. Skeleton is the framework of bones in our body. ☐
2. Muscles are the masses of tough, elastic tissue that pull our bones when we move. ☐
3. The most important part, the brain is protected by rib cage. ☐
4. Vertebral column protects the spinal cord. ☐
5. The lower part of the leg consists of the largest bone. ☐

2. Support – The skeleton provides support to the internal organs and keeps them in their proper place. The backbone, pelvis region and the legs provide support to the entire body, thus enabling us to stand upright.

3. Protection – The skeleton provides a protective framework around the soft internal organs. For example – the skull protects the brain, the rib cage protects the heart and the lungs, and the vertebral column protects the spinal cord.

4. Movement – The skeletal bones along with ligaments, tendons and muscles help in the movement of different body parts and also from one place to another. Muscles usually work in pairs. For example-muscles at the front of the arm (called biceps muscles) and those at the back of the arm (called triceps muscles) work together to lift and relax the arm. When the biceps muscle contract, the triceps relax and as a result the arm is lifted. When the triceps contracts, the biceps relax and the arm is straightened.


5. Blood Cell Production – Bones contain a spongy tissue called bone marrow inside them. Red blood cells are produced in the bone marrow.

Joints

Joints are the places where two or more bones meet. They make the skeleton flexible. Without them, movement would be impossible. Bones are joined to one another by tissues called **ligaments** that provide stability to the joints. They are elastic in nature. Apart from ligaments, a flexible connective tissue called **cartilage** is also found in joints. Cartilages serve as cushions between two bones and prevent bone damage due to constant rubbing. You can feel this soft, flexible connective tissue called cartilage at the tip of your nose and ears. Another connective tissue called **tendon** connects muscles to bones. The composition of tendons is much like, gelatin and not as elastic as ligaments.



Take a Task



Watch Remedial

Types of Joints

Joints are of two types. Immovable and movable joints.

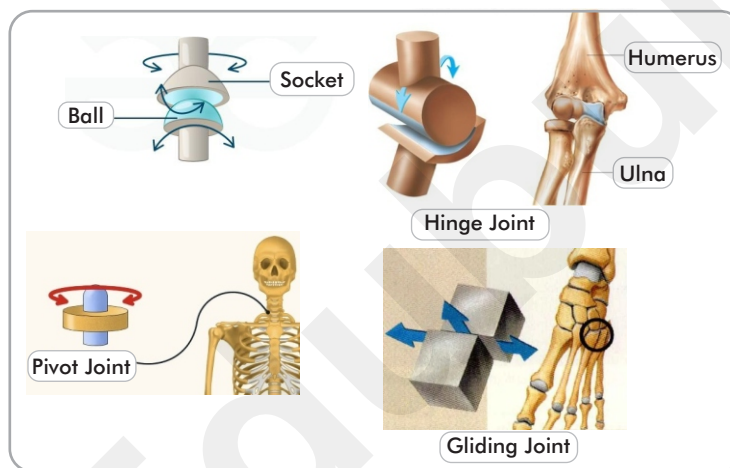
Immovable joints: The human skull consists of 22 bones. The joints between the bones of the skull are examples of immovable joints.



Movable joints: There are four types of movable joints in the human body. They are as follows:

Ball and socket joint: Here, the head of one bone (called a ball) fits into the bowl like portion (socket) of another one. This type of joint provides maximum movement in all directions. This type of joint is found in shoulder and hip joints.

Hinge joint: This joint is called so, as it resembles the hinges of a door. This type of joint provides movement in only one direction. This type of joint is found in elbows and knees.



Pivot joint: This type of joint is found between the head and the first vertebra of our backbone. Here one round bone rotates within a ring that is formed by another bone.

Gliding joint: These joints are found in our wrists and ankles. These joints allow the bones to glide past one another.

Did you know ?

Our body can heal broken bones all on its own. Doctors help it along, making sure that the bone heals straight and properly using a cast or sling. A broken bone heals in stages. When it first breaks there is blood around it and it forms a sort of scab over the broken portions. Next, tougher tissue will start to grow over the broken area called collagen. The collagen, together with cartilage, will bridge the gap between the two sides of the break which hardens and the bone is healed. It can often take months for bones to heal back to normal. While the bone is healing, it can't take the stress of a normal bone, which is why people use crutches and slings to take the pressure off the bone while it's healing.

Muscles

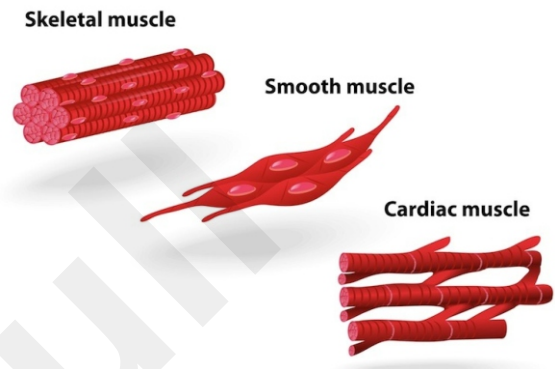
The muscular system is a very important system of the human body. There are roughly 650 different types of muscles in the human body. Muscles are either **voluntary** or **involuntary** which means that they can either be controlled or uncontrolled.

The muscles in the human body may be categorized under three heads:

Skeletal muscles: These muscles are attached to bones. Especially in the legs, arms, abdomen, chest, neck and face. Skeletal muscles are voluntary muscles as we can control them. These muscles tire easily and have to be given rest between workouts.

Smooth muscles: These muscles cannot be controlled by us and are controlled by our nervous system directly. Examples of smooth muscles are the walls of our stomach and intestine, the walls of our blood vessels, etc.

Cardiac muscles: These muscles are found in our heart. The walls of the heart's chambers are made up of muscles that are involuntary in nature. These muscles work nonstop pumping blood to all the different body parts without getting exhausted throughout our life.



CHECK 'N' MATE

Critical Thinking

Fill in the blanks with correct words.

1. _____ (Hinge/Gliding) joint resembles the hinges of a door.
2. The joint is found between the head and the first vertebra of our backbone is _____ (hinge/pivot) joint.
3. There are four types of _____ (movable/immovable) joints.
4. Skeleton gives _____ (protection/food) to soft internal organs.

Taking Care of Our Bones and Muscles

As we grow old, our bones become thin and lose their density. Therefore, it is important to take good care of our bones and muscles for the overall health and fitness of our body. Following are a few tips to take care of our bones and muscles.

1. **Eat Calcium rich food:** In addition to dairy products, choose fish with bones like salmons and sardines. Almonds, figs and soya milk are also calcium rich foods.
2. **Include protein in your diet:** Proteins help in the growth and repair of the body and also assist in muscle-building. That is why, young children need a more protein-rich diet. Foods rich in protein are meat, eggs, fish, milk, beans and pulses.

3. **Add vitamin D to your diet:** Vitamin D plays a very important role in our diet as it helps to absorb calcium. Fatty fish and egg yolk along with sunlight are some sources of vitamin D. However, sunlight, our natural source of vitamin D is not sufficient at times. In such a case, we must take vitamin D supplements.
4. **Eat a diet rich in vitamins, minerals and proteins:** These vitamins include calcium and Vitamin D primarily for your bones and protein and potassium for your muscles. Eggs, dairy products, and lean meat are all rich sources of such vitamins, and you can find one of the highest sources of potassium in sweet potatoes.
5. **Exercise regularly:** Some physical exercises that are good for building bones and muscles are running, jogging, aerobics, stair climbing, dancing, tennis, etc. Try to make these a part of your daily routine.



In a Nutshell

- ✦ The framework of bones in our body is known as the skeleton.
- ✦ Bones meet at joints. Bones along with muscles form the musculoskeletal system.
- ✦ The two parts of the skeleton are the axial skeleton and the appendicular skeleton.
- ✦ The axial skeleton consists of the skull, the rib cage and the spine.
- ✦ The appendicular skeleton consists of the limbs.
- ✦ The skeletal system serves several functions like shape, support, protection, movement and blood cell production.
- ✦ Immovable joints are the joints of the skull bones.
- ✦ Movable joints are the ball and socket joint, pivot joint, hinge joint and gliding joint.
- ✦ Muscles are of three types – skeletal, smooth and cardiac.
- ✦ It is necessary to take care of our bones and muscles by modifying our diet and through regular exercise.



Key Words

Joints	:	Meeting points of two bones
Rib cage	:	Protects the heart and the lungs
Skeleton	:	Entire collection of bones inside our body
Skull	:	A framework of bones that protects the brain

Improving Vocabulary



Time to Discuss

Are bones dead or alive? Discuss and give reasons for your answer.



EXERCISE

That turn curiosity into confidence—let's begin!



Gap Analyzer™
Take a Test

A. Objective Type Questions.

1. Our body gets its shape and support from:

a. Skin	<input type="checkbox"/>	b. Skeleton	<input type="checkbox"/>
c. Nerves	<input type="checkbox"/>	d. Muscles	<input type="checkbox"/>
2. Which of the following joints provide maximum movement?

a. Pivot joint	<input type="checkbox"/>	b. Gliding joint	<input type="checkbox"/>
c. Ball and socket joint	<input type="checkbox"/>	d. Hinge joint	<input type="checkbox"/>
3. Which of the following protects our bones?

a. Sternum	<input type="checkbox"/>	b. Rib cage	<input type="checkbox"/>
c. Cartilage	<input type="checkbox"/>	d. Muscles	<input type="checkbox"/>
4. The vertebral column is made up of _____ small bones.

a. 24	<input type="checkbox"/>	b. 33	<input type="checkbox"/>
c. 26	<input type="checkbox"/>	d. None of the above	<input type="checkbox"/>
5. The hollow space in the middle of the bones is filled with _____.

a. Air	<input type="checkbox"/>	b. Bone marrow	<input type="checkbox"/>
c. Blood	<input type="checkbox"/>	d. Bone cells	<input type="checkbox"/>
6. These join muscles to bones.

a. Ligaments	<input type="checkbox"/>	b. Joints	<input type="checkbox"/>
c. Tendons	<input type="checkbox"/>	d. Marrow	<input type="checkbox"/>
7. The bones in our spine are called _____.

a. Cartilage	<input type="checkbox"/>	b. Cranium	<input type="checkbox"/>
c. Vertebrae	<input type="checkbox"/>	d. Ribs	<input type="checkbox"/>

B. Fill in the blanks.

1. The _____ gives shape and support to our body.
2. Muscles of the legs and arms are examples of _____ muscles.
3. The three bones that make up our legs are _____ , _____ and _____ .
4. _____ is the only movable bone in the skull.
5. _____ joint is responsible for the movement of our head.
6. The major function of the backbone is to protect the delicate _____ .

C. Very Short Answer Questions.

Give one word answer.

1. Two parts of our body where smooth muscles are found _____.
2. Gliding joint is found in our _____.
3. The two parts into which the human skeleton can be divided _____.
4. Hinge joint is found in _____.
5. Tissue that joins bone to bone _____.



D. Short Answer Questions.

1. What do you understand by the skeletal system?
2. How many bones does a human skeleton have? What kind of joints can you find between the skull bones?
3. What are the muscles of our heart called? Why are they considered special?
4. Name a few physical activities that help in building bones and muscles.
5. What are voluntary muscles? Explain with a few examples.

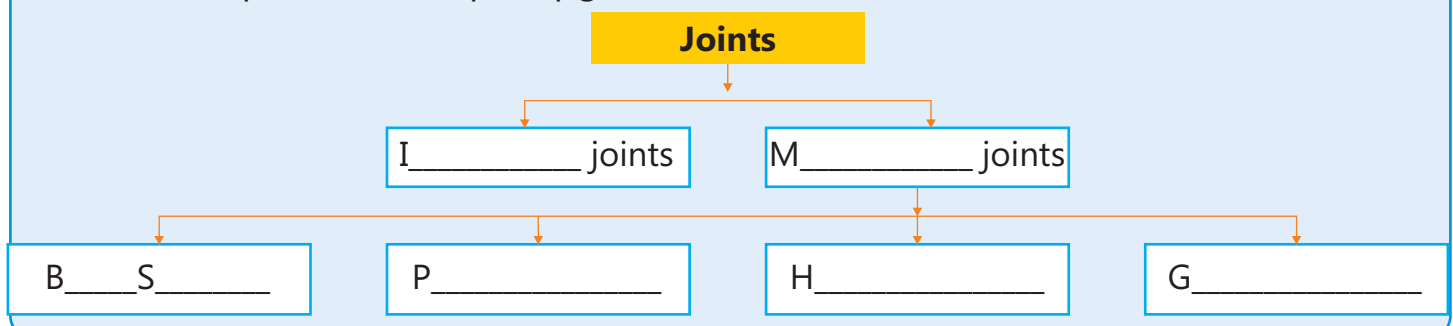
E. Long Answer Questions.

1. Describe in detail, the two parts into which the human skeleton can be divided.
2. Describe the rib cage and enlist its functions.
3. Explain in detail the functions of the skeletal system.
4. What are joints? Explain the various type of movable joints in our body giving one example of each.
5. What can we do to take good care of our bones and muscles? Explain.

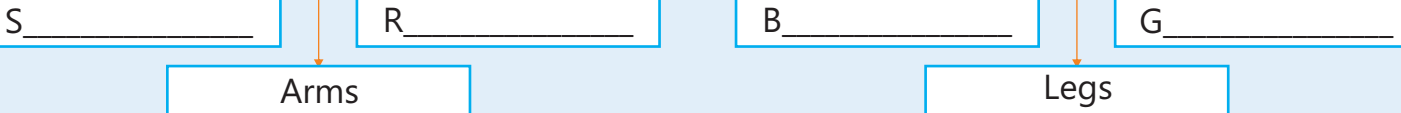
Time to Recall

Remembering and Analysing

Recall and complete the concept map given below.



Parts of the Skeletal System



Time to Apply

Applying and Creating

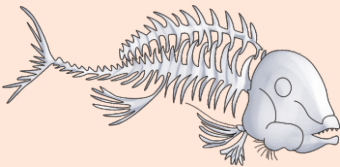
Do you play computer games? Find out the right posture to sit in front of a computer. Make a list of problems that you may face if you don't sit properly in front of a computer for a long time.

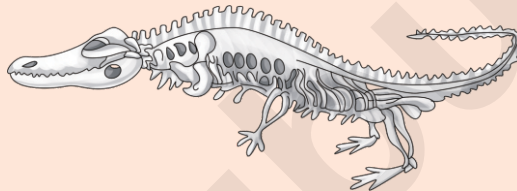


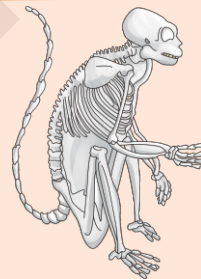
Time to Observe

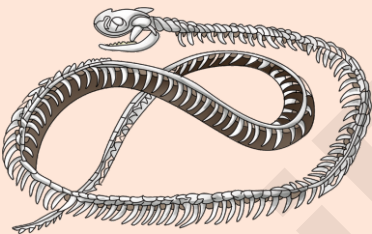
Observing, Critical Thinking, Analysing

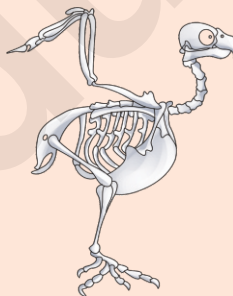
Identify the skeletons and write the name in the box.

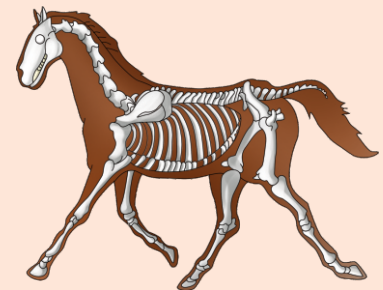














Time to Create

Creating and Collaborating

Make joints using plasticine or modeling clay. Collect pictures of all types of joints and two different colours of plasticine or modeling clay.

Divide the class into four groups. Look at the pictures of different types of joints. Study them carefully. Each group should try to make one type of joint. Try to move them according to their location. Have a class discussion on movement of the body.