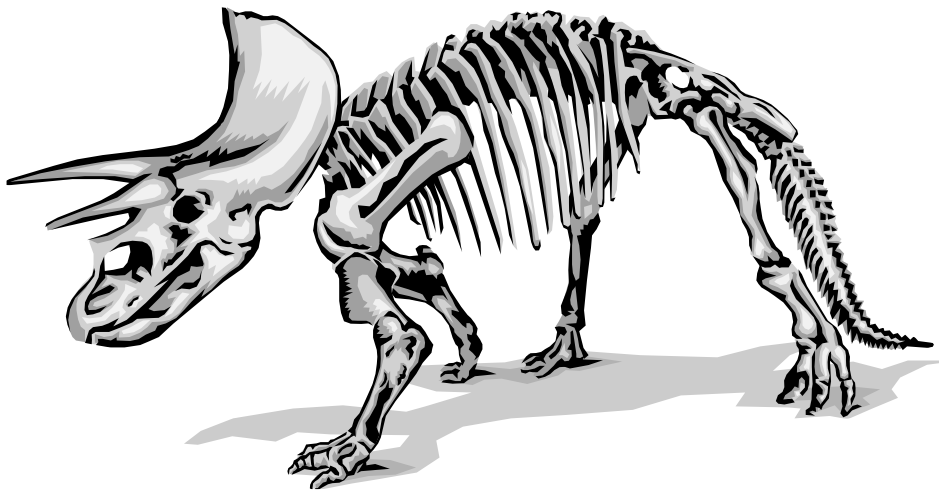
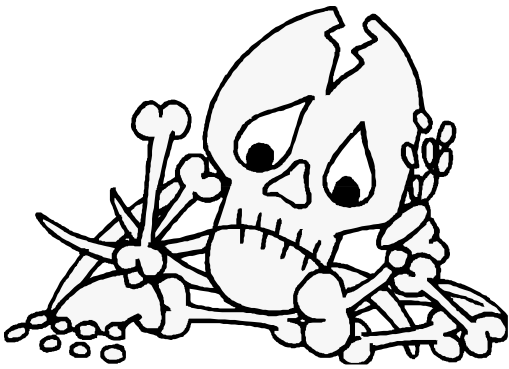
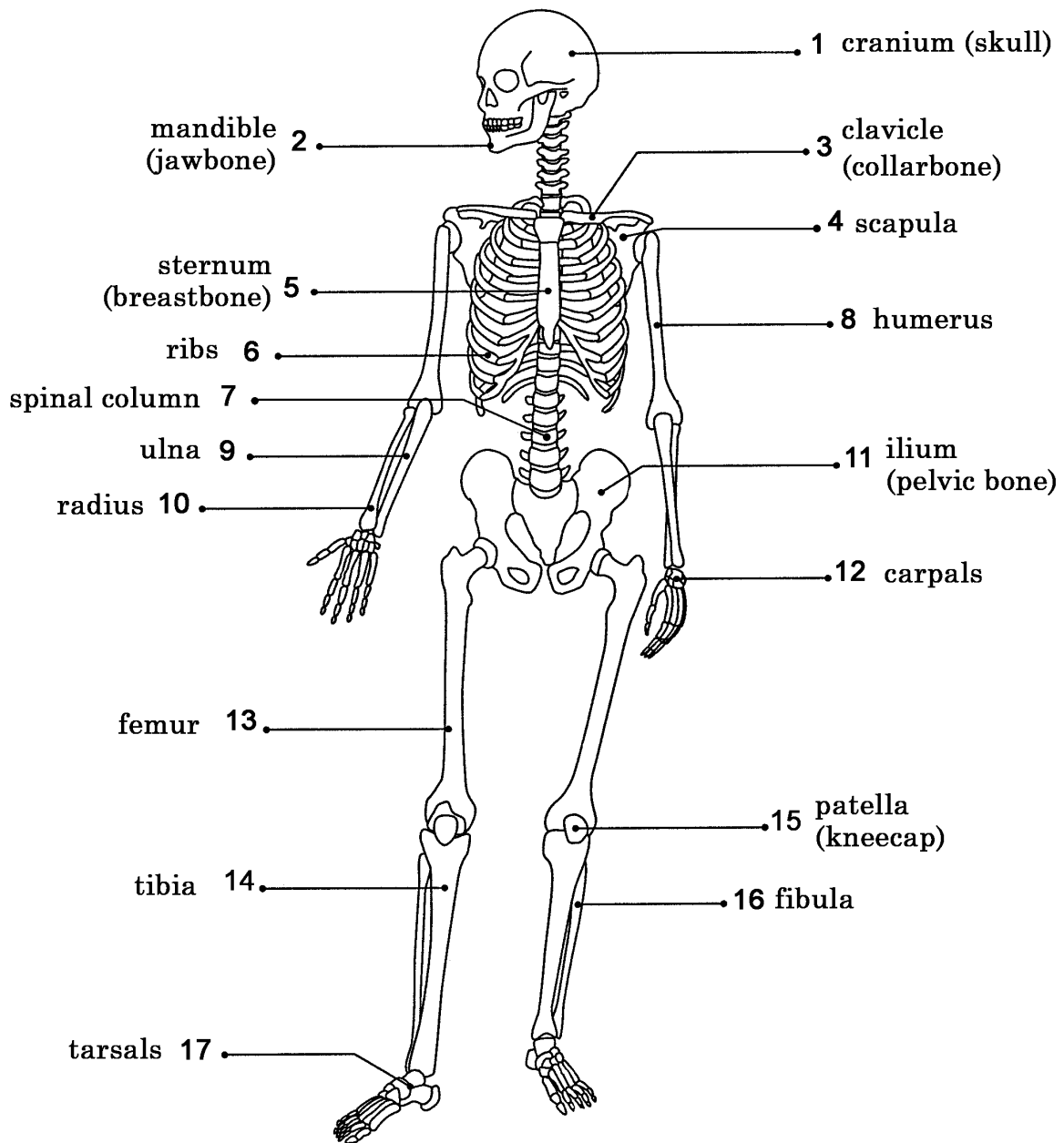


Skeleton



Name: _____

The Human Skeleton



Did you know that an adult human **skeleton** contains over 200 separate bones? There are 27 bones in each hand alone. The bones do three very important jobs.

The human skeleton has three main Functions.

- **Support.** The skeleton helps give your body its shape and helps you stand upright. The bones in your skeleton have the strength of mild steel, although they are much lighter. They can be compared with framework of a building.
- **Protection.** Soft organs of your body protected by your skeleton. For example, your skull protects your brain and your ribcage protects your heart and lungs.
- **Movement.** Muscles are attached to bones in the skeleton. Movement occurs at joints when these muscles apply forces to bones.

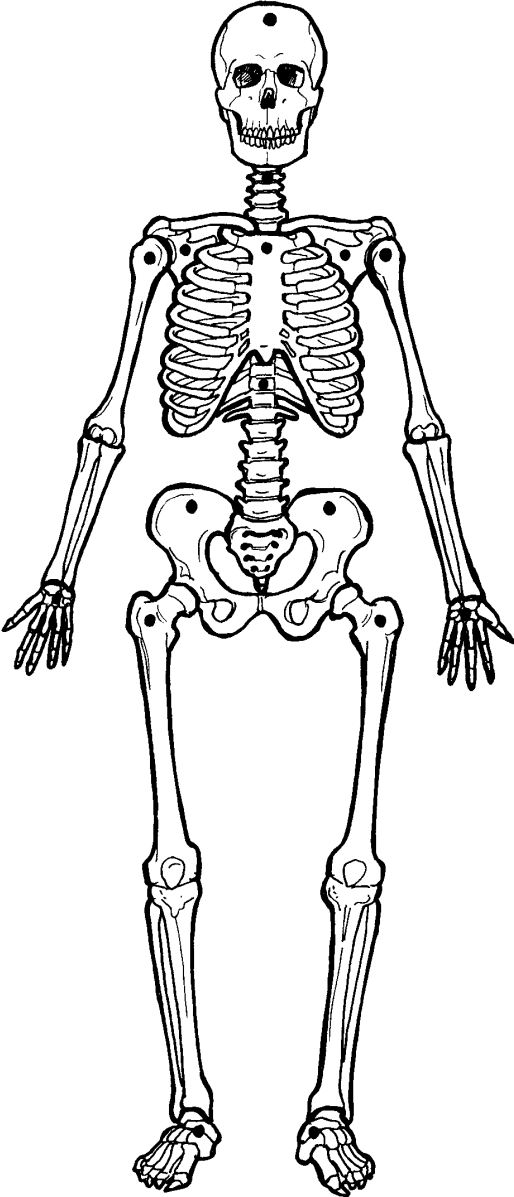


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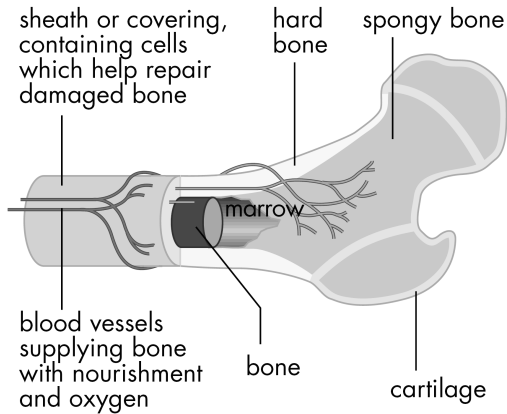
Sci Fact

The human skeleton consists of 206 bones. The largest bone is the femur or thighbone and the smallest bone, the stirrup, is one of the tiny bones ('ossicles') in the middle ear.

Your task is to construct a table of the bones that support and protect and the bones that allow movement. Use all the bones from page 2.

Human skeleton	Bones that support and protect
	<ul style="list-style-type: none">•
	<p data-bbox="794 1111 1295 1149">Bones that allow movement</p> <ul style="list-style-type: none">•

What's *in* a bone?



Bones have a strong and hard outer layer called **compact bone**.

It covers a compact spongy layer. The inside of the bone is hollow and contains a soft tissue called **bone marrow**. Within the bone marrow are special cells called stem cells which are unspecialised. They can develop into red blood cells, white blood cells or platelets.

Bone marrow transplants are an important medical technique for patients suffering from cancer. Cancer treatments such as chemotherapy and radiation destroy rapidly dividing cells like cancer cells. However, bone marrow cells are also rapidly dividing and may be destroyed too. Patients may have some of their own bone marrow removed before treatment and then have it injected back

afterwards. Patients suffering from leukaemia, a form of cancer where too many white blood cells are made in bone marrow, may receive donations of healthy bone marrow to replace their own.

Bones are alive. They contain living cells and need a blood supply to provide oxygen and other nutrients. If bones were not alive how would you grow taller? How would a broken arm and leg mend?

Your bones will not remain hard without an adequate supply of two important **minerals: calcium and phosphorus**. In fact, until you reach the age of about twenty, the soft **cartilage** that made up part of your skeleton when you were born is being gradually replaced. Cartilage is very soft and rubbery, not as hard and solid as bone.

The hardening of your bones as you get older is called **ossification**. After ossification the bone is made up of about 70 per cent non-living matter and 30 per cent living matter. As you get old your bones may get dry and brittle. That is why older people break their bones more easily.

Not all cartilage changes into bone. The ends of your bones remain covered in cartilage. Your trachea (windpipe), nose and ears are mostly made of cartilage.

The following experiment shows what could happen to your bones without a supply of important minerals.

Rubbery Bones Experiment

Materials

- 2 chicken or turkey bones
- 2 jars
- vinegar

Method

1. Clean the two chicken or turkey bones and leave them to dry overnight. Place one bone in a jar of vinegar and the other in a jar of water.
2. Allow the bones to soak for at least 3 days. Then remove the bones and observe any changes.
3. Return the bone to the jar of vinegar for another week, then remove and observe any further changes in the bone. Try to tie the bone in a knot.

Questions and conclusions

1. What changes occurred in each of the two bones? Vinegar is an acid and dissolves minerals such as calcium and phosphorus, removing them from the bone.

2. How did the bone change after more than a week in vinegar?

3. Why was the jar of water used in the first part of this experiment?

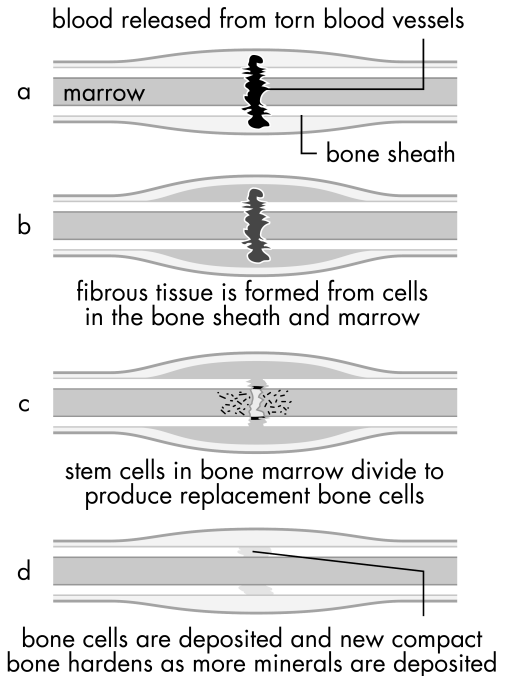
Broken bones

When a bone breaks, the ends of the bone need to be put back into place (set), so that they can grow together. If a bone is shattered into several pieces it is sometimes possible to use pins or wire to hold the pieces in place while the bone heals. A greenstick fracture occurs when the bone cracks but does not break. Greenstick fractures are common in children because the bones are more flexible.

A compound fracture occurs when the broken bone pierces the skin. It is a more serious injury because the wound may get infected.

Osteoporosis

Osteoporosis is a loss of bone mass that causes them to become lighter, more fragile and easily broken. It occurs in middle-aged or elderly men and women. In Australia, about 60 per cent of women and about 30 per cent of men are affected in some way by Osteoporosis. One cause is believed to be a lack of calcium in the diet. You can help protect yourself from getting Osteoporosis by exercising regularly and having a healthy diet. It should include dairy products such as milk, cheese and yoghurt and other foods high in calcium. Such a diet will help ensure that your bone mass is adequate as an adult.



EXERCISES

Completing the table.

Scientific name	Common name
vertebrae	
	skull
clavicle	
	breastbone
mandible	
	thigh bone
patella	
	shin bone

1. Which organs do the skull and ribcage protect?

2. Name the parts of the skeleton where cartilage is found?

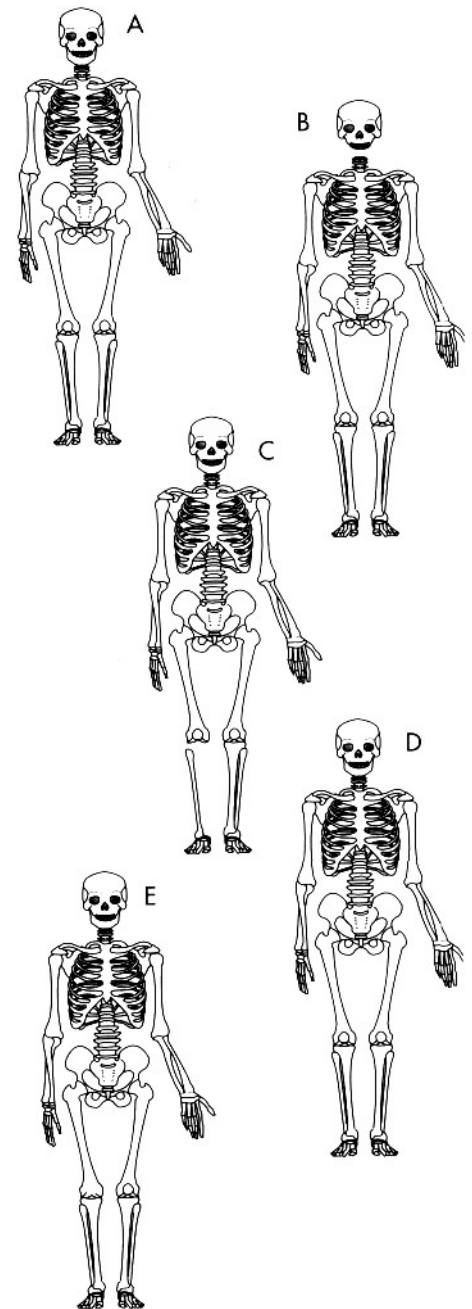
3. What material in bone is responsible for giving it hardness?

4. What material is responsible for bone being flexible?

5. Suggest how the age of a child could be determined by observing bones in the skeleton.

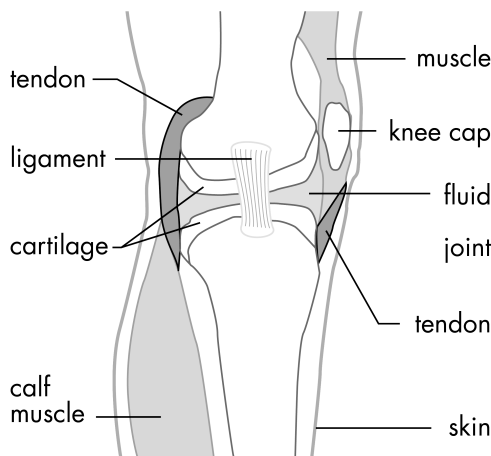
6. Look carefully at each of the skeletons on the right. Three of them are incomplete. Identify the incomplete skeletons and name the missing parts.

7. What is the function of bone marrow?



Bones on the move

The bones in your skeleton must be able to move so that your body can move. The bones are held together by bundles of strong fibres called **ligaments**. The ends of each bone are covered with cartilage. The cartilage is covered with a liquid called **synovial fluid**. Together, the cartilage and synovial fluid stop the bones from scraping against each other. The region where two or more bones meet is called a **joint**. Joints that you are probably already familiar with are the elbow and knee.



Some joints, such as those that join the plates of your skull, do not move. Such joints are called **immovable joints**. Immovable joints, while not allowing movement, provide a thin layer of soft tissue between bones. Their job is to absorb enough energy from a severe knock to prevent the bone

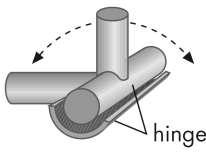
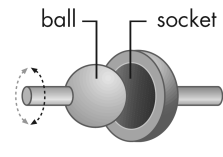
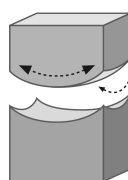
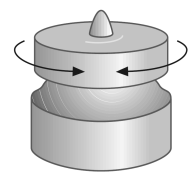
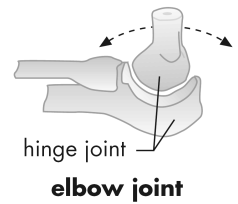
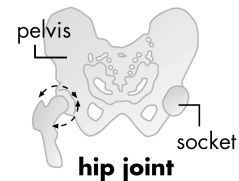
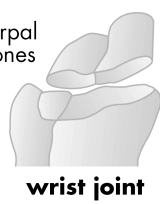

Joints

Most joints allow your bones to move. The amount and direction of movement allowed depends on the type of joint.

The knee and elbow are **hinge joints**, like those in a door. They allow movement in only one direction.

The hip and shoulder joints are **ball and socket joints**. They allow movement in many directions.

The joint between your skull and spine is a **pivot joint**. It allows a twisting type of movement.

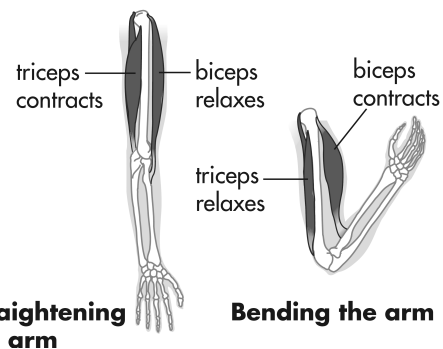
Joint	Hinge	Ball and socket	Condyloid	Pivot
Model				
Example	 hinge joint elbow joint	 pelvis socket hip joint	 carpal bones wrist joint	 atlas vertebra axis vertebra below skull at top of backbone
Movement	Back and forth movement in one dimension	Good rotation	Some rotation as well as back and forth movement	Turning from side to side

Some joints, such as those that join the plates of your skull, do not move. Such joints are called **immovable joints**. Immovable joints, while not allowing movement, provide a thin layer of soft tissue between bones. Their job is to absorb enough energy from a severe knock to prevent the bone from breaking.

Muscles

Bones are not able to move by themselves. They need **muscles** to pull them into different positions. Muscles are tough and elastic fibres. You have muscles to make your heart pump, muscles to help you digest food and muscles to help you breathe. Many muscles, however, are joined to bones. Muscles pull on bones by **contracting**, or shortening. Muscles never push. Muscles are not directly attached to bones. They are connected by bundles of tough fibres called **tendons**. Tendons do not contract and relax like muscles do.

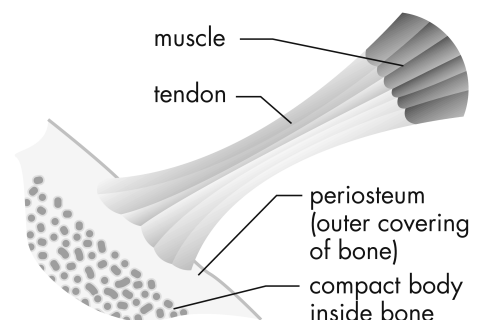
(See diagram on 6)



Sci Fact

During vigorous exercise, oxygen may not be supplied quickly enough to muscle tissue. The muscle goes into 'oxygen debt'. Another type of respiration takes place which is not as efficient ('anaerobic respiration'). It still supplies some energy to the muscle but it leaves a waste product called lactic acid. The build-up of lactic acid causes muscle pain.

Ligaments allow the bones to move at the joint but they also protect the joint by limiting that movement. Tendons provide a pulling force on a bone when a muscle contracts. Sprains occur when ligaments or tendons are stretched or torn. Sometimes an operation is needed to repair them.



Control of muscles

The movement of muscles is controlled by the brain, which sends signals through your nerves. Muscles such as those that make your heart pump and those that control your breathing are called **involuntary muscles**. They work without you having to think. The muscles that are connected to bones are called **voluntary muscles** because you have to think or choose to use them.

Create

Make a working model of an arm or leg to show how the muscles work. Use the illustration on page 6 as a guide. Materials you might use include icy pole sticks or stiff cardboard (for bones), split pins (for ligaments), string or rubber bands (for muscles), polystyrene foam (for cartilage) and glue. Draw a labelled diagram of your model. Explain how your model helps you to understand these ideas.

Some problems with joints and muscles

- Sprains occur when ligaments joining bones at a joint are torn or stretched. Sprains usually happen when you fall onto a joint, such as an elbow or an ankle, and twist it.
- **Arthritis** is a swelling of the joints that makes movement difficult (arthro means joint). Osteoarthritis occurs mainly in elderly people and is caused by wear and tear of the joints. The cartilage gradually breaks down, allowing bare bones to grate against each other instead of sliding or turning smoothly. Rheumatoid arthritis is a swelling of the tissue between the joints. The swelling causes the joints to slip out of place, which then causes great pain and deformities.
- Tennis elbow is caused when the lining of the elbow joint swells and produces too much synovial fluid. The joint becomes swollen and painful. This occurs when the joint is used a lot and is most common in tennis players.
- Torn hamstrings are a common sporting injury. The hamstring muscle joins the pelvis to the bottom of the knee joint, running along the back of the thigh. It controls the bending of the knee and straightening of the hips. A sudden start or turn in sport often stretches the hamstring muscle too far. It tears, causing great pain. Cold and unprepared muscles are more likely to tear. Proper warming up before strenuous sporting activity is one way of reducing the chances of tearing a muscle.

EXERCISES

1. Describe the job done by each of the following parts of a joint:

a. Ligament

b. Cartilage

c. Synovial fluid.

2. Some joints are referred to as immovable joints. What is the use of having joints that don't move?

3. Write down an example of each of the following types of joints:

a. Hinge:

b. ball and socket:

c. pivot:

d. immovable:

4. Describe the action of the biceps and triceps muscles as you bend your elbow to raise the forearm.

5. Ligaments and tendons are bundles of tough fibres. What is the major difference between a ligament and a tendon?
