When you have worked through this chapter, you will have developed knowledge and understanding of:

- the structure and function of the skeletal system
- the structure and function of the muscular system
- movement analysis
- the cardiovascular and respiratory systems
- the effects of exercise on the body systems.
The skeletal system is made up of many bones. While all bones have things in common, the shape of each bone will allow it to fulfil one or more of the functions of the skeleton.

**Support**
The skeletal system provides a framework to support your muscles and vital organs, keeping them in place so they can function properly. For example, during exercise your skeleton supports your heart, lungs and blood vessels. These work together to provide oxygen to your working muscles, especially during a long-distance activity.

**Movement**
Without the bones of the skeletal system, you would not be able to move. Bones provide a surface for muscles to attach to via tendons, and provide rigid structures that form levers. When muscles contract, they pull on the bones of the skeleton and movement is achieved. The ability to move is central to all physical activities. For example, the biceps muscle is attached to the radius and ulna by a tendon in the forearm, and when it contracts your elbow flexes.

**Posture**
The rigid nature of the bones in the skeletal system allows the body to maintain an upright position and hold the correct shape – the correct posture. For example, you can sit or stand upright because of the vertebral column running through the centre of your body. Many sporting actions require a person to be in an upright position. Good posture also enables you to move your arms and legs freely and, therefore, take part in sporting activities.

**Blood cell production**
Red blood cells, white blood cells, and platelets are produced in bone marrow contained within certain bones. Red blood cells are especially important in aerobic activities because they carry oxygen to working muscles. White blood cells fight off infections, and platelets help blood to clot following an injury.

**Storage of minerals**
Calcium and phosphorus, along with other minerals, are stored within the bones. These minerals are necessary for vital body functions. For example, calcium and phosphorus are both needed for strong teeth and bones, while calcium is also involved in muscular contractions.

**Protection**
Many bones act as a rigid shell. They protect vital organs and the central nervous system, which are soft and easily damaged. During physical activity, protection is crucial for both performance and long-term health. It reduces the chance of injury, which ensures players can continue to train and play. Examples include the cranium protecting the brain when heading a football, and the ribs protecting the heart and lungs during a rugby tackle.

**Study tip**
If you can remember ‘Bones Make People Perfectly Suit Sports’, then you have a memory aid to recall the functions of the skeleton: Blood cell production, Movement, Protection, Posture, Support, Storage of minerals. You could always make up your own memory aid.

**Functions of the skeleton**
- Support
- Posture
- Protection
- Movement
- Blood cell production
- Storage of minerals

**Activity**
1. Look at this photograph and discuss how the different functions of the skeleton are important in rugby.
2. In a group, write down ten sports or physical activities on separate scraps of paper and put them in a hat. Take it in turns to pick an activity out of the hat. Give specific examples of how each function of the skeleton is important in the activity you selected.
The skeletal system is made up of many bones of different shapes and sizes. Different bones can perform different functions in different circumstances. The majority of bones are articulating bones, which meet at a joint to allow movement.

**Key term**

Articulating bones: Bones that move relative to each other at a joint.

**Study tip**

Try to come up with ways of remembering the bones that may be challenging to recall. For example, in the lower arm, the ‘ulna is under’ the radius, while in the lower leg you can remember which bone is the fibula by using the expression, ‘tell a little fib’.

**Key term**

Synovial joint: An area where two or more bones meet within a joint capsule allowing a wide range of movement to occur.

**Study tip**

The different movements possible at joints are explained on pages 10–11.

### 1.1.2 The location of the major bones

The skeletal system is made up of many bones of different shapes and sizes. Most joints in the human body are freely movable or ‘synovial’ joints. Synovial joints share many common features, but they can be classified according to their structure and the range of movement they allow.

#### Hinge joints

The elbow and the knee are hinge joints. Their movement is limited to flexion and extension. They can only move towards and away from each other, increasing or decreasing the angle between the articulating bones, just like a door. They cannot move sideways or in circles.

#### Ball and socket joints

The shoulder and the hip are ball and socket joints. Their design means they can move in many different directions and provide a large range of movement.

**Study tip**

The articulating bones of the elbow joint and the knee joint.
1.2 Physical training

When you have worked through this chapter, you will have developed knowledge and understanding of:

- the components of fitness
- the principles of training
- how to optimise training
- how to prevent injury.

Practice questions

1. Which one of the following is an articulating bone at the shoulder joint? Put a tick (✓) in the box next to the correct answer.
   A Femur
   B Phalanges
   C Ulna
   D Humerus

2. Which one of the following is not a blood vessel attached to the heart? Put a tick (✓) in the box next to the correct answer.
   A Pulmonary vein
   B Ventricle
   C Vena cava
   D Aorta

3. Which one of the following is the best example of aerobic exercise? Put a tick (✓) in the box next to the correct answer.
   A Cycling 1000 m
   B Running a marathon
   C Throwing a discus
   D Playing a football match

4. Which one of the following statements is false? Put a tick (✓) in the box next to the correct answer.
   A A cartwheel takes place in the frontal plane.
   B A pirouette rotates around the longitudinal axis.
   C A tucked front somersault rotates around the frontal axis.
   D An axis is an imaginary line that a movement rotates around.

5. Explain the role of ligaments at a joint.

6. Explain two roles muscles can play during movement.

7. Compare the structure and function of an artery and a vein.

8. Figure 1 shows a diagram of the shoulder. Label bone A and muscle B.

9. Describe the potential long-term effects of exercise on the musculo-skeletal system. Why do different sports performers experience different long-term effects on the musculo-skeletal system?

10. Using practical examples, describe how different classes of lever are used in sporting performance. How are some levers more beneficial than others?