

# 1.1 The Structure and Functions of the Musculoskeletal System

Name \_\_\_\_\_

Class \_\_\_\_\_



Topic	Description from Specification	Pupil comments – How confident do you feel on this topic?
Bones	Identification of the bones at the following locations: head/neck – cranium and vertebrae, shoulder – scapula and humerus, chest – ribs and sternum, elbow – humerus, radius and ulna, hip – pelvis and femur, knee – femur and tibia (students should also know that the patella sits in front of the knee joint), ankle – tibia, fibula and talus.	
Structure of the skeleton	How the skeletal system provides a framework for movement (in conjunction with the muscular system): the skeletal system allows movement at a joint; the shape and type of the bones determine the amount of movement (short bones enable finer controlled movements/long bones enable gross movement); flat bones for protection of vital organs; the different joint types allow different types of movement; the skeleton provides a point of attachment for muscles – when muscles contract they pull the bone.	
Functions of the skeleton	Support, Protection of vital organs by flat bones, Movement, Structural shape and points for attachment, Mineral storage, Blood cell production. Functions should be applied to performance in physical activity.	
Muscles of the body	Identification of the following muscles within the body: latissimus dorsi, deltoid, rotator cuffs, pectorals, biceps, triceps, abdominals, hip flexors, gluteals, hamstring group (not individual names), quadriceps group (not individual names), gastrocnemius, tibialis anterior. Students should be taught the role of tendons (attaching muscle to bones).	
Structure of a synovial joint	Identification of the following structures of a synovial joint and how they help to prevent injury: synovial membrane, synovial fluid, joint capsule, bursae, cartilage, ligaments.	
Types of freely movable joints that allow movement	Identification of the types of joints with reference to the following: elbow, knee and ankle – hinge joint, hip and shoulder – ball and socket.	
How joints differ in design to allow certain types of movement at a joint	Understand that the following types of movement are linked to the appropriate joint type, which enables that movement to take place: flexion/extension at the shoulder, elbow, hip and knee, abduction/adduction at the shoulder, rotation of the shoulder, plantar flexion/dorsiflexion at the ankle. Application to specific sporting actions is in movement analysis.	
How muscle groups of the body work antagonistically to affect movement in physical activity	With reference to the shoulder, elbow, hip, knee and ankle joints: major muscle groups operating at these joints (see above), the action of prime movers (agonists)/ antagonists, bones located at the joint, how these muscle groups work isometrically and isotonicity (concentric/eccentric). The difference between concentric and eccentric (isotonic) contractions	



How do some of these functions help you in a sport that you take part in?

1.

---

---

2.

---

---

3.

---

---

4.

---

---

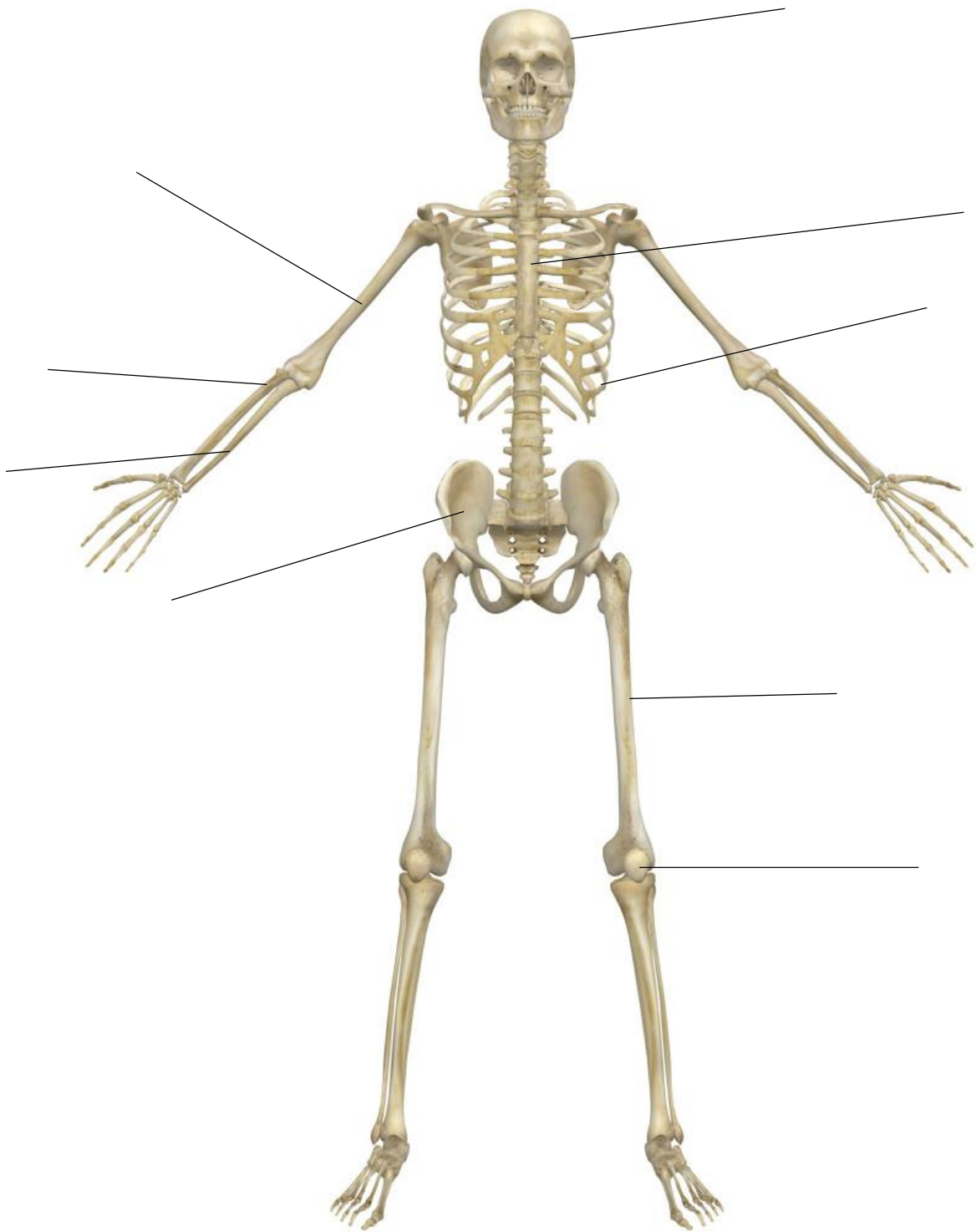
Which one of the five main functions of the skeleton are most important to you in your sport?

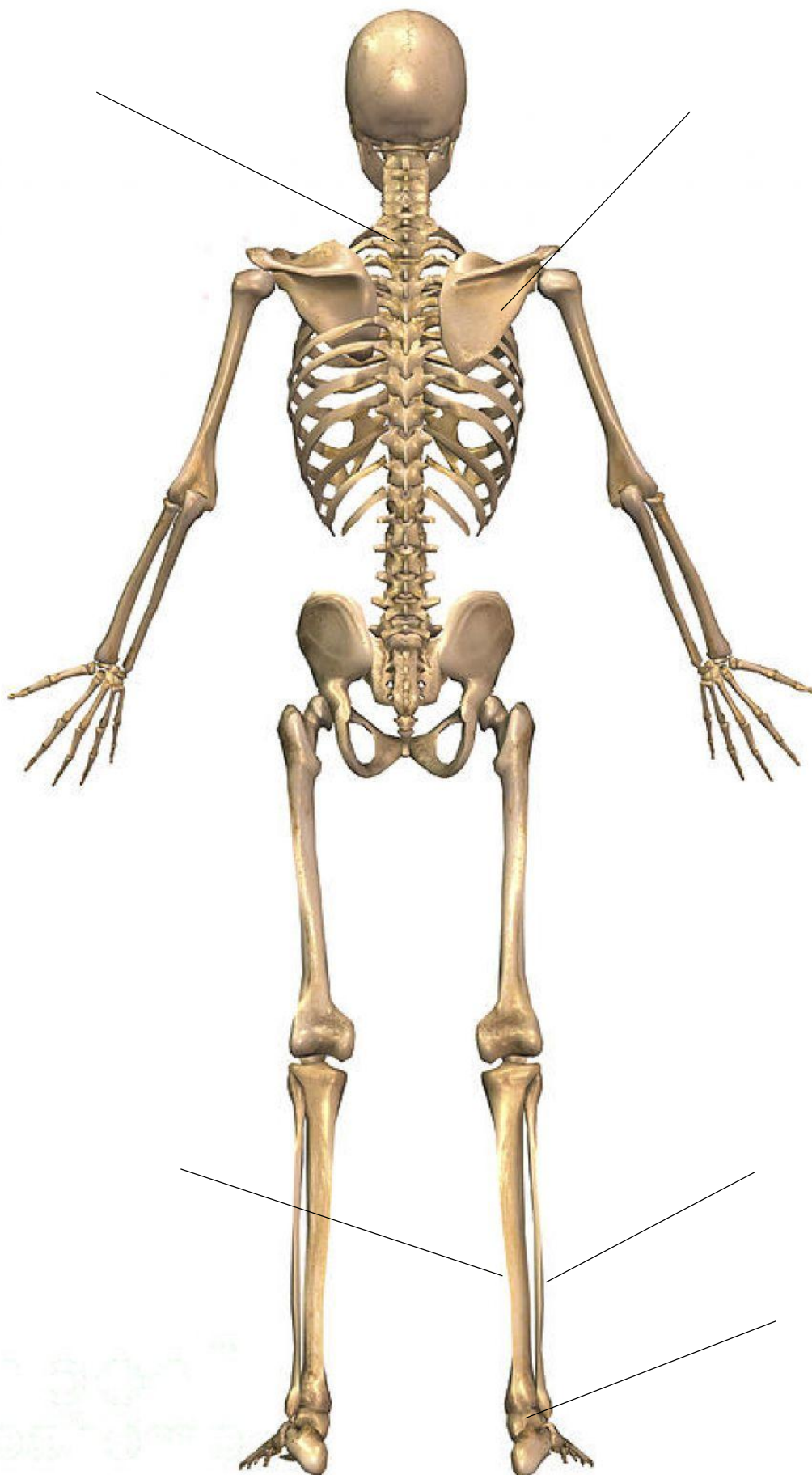
---

---

---

**The Structure of the Skeletal System**





### Classification of Bones

Type of Bone	Features
Long Bones	
Short Bones	
Flat Bones	
Irregular Bones	

Pick out the features below and place them with the correct type of bone.

'Roughly same size in length, width & thickness'

'Include the Talus'

'Protect vital organs' 'Longer than they are wide'

'Have odd shapes and perform a range of functions'

'Include patella, cranium, and sternum'

'Has a shaft plus two ends'

'Includes the vertebrae' 'Include fibula, femur and radius'

'Offer a good surface for muscles to attach to'

'Offer support during weight bearing activities'

Describe how a diver's flat bones can help protect their organs during a dive?

---



---



---



---



---



**Joints:**

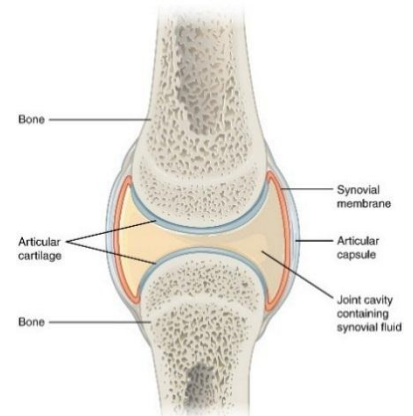
A synovial joint is a place where two or more bones meet. Joints are important for **movement** and **rotation**.

A synovial joint is made up of 6 parts which help with movement and preventing injury. Match the statements to below to the correct part of the joint.

Part of Joint	Description
Synovial Membrane	
Synovial Fluid	
Joint Capsule	
Bursae	
Cartilage	
Ligaments	

This image is of the knee joint. Can you name the bones being shown?

**Important Note - The functions of each part of a synovial joint help to prevent a performer from becoming injured.**





There are two types of synovial joints in the body that you need to know about.

**Hinge Joints** allow only backward and forward motion, just like the hinge on a door. There are three hinge joints; the knee, elbow and ankle.

Give an example of how a footballer might use a hinge joint?

---

---

**Ball and Socket Joints** are when a long bone fit into a cup shaped hole, allowing **circumduction**. The shoulder and hip joints are examples.

Name two sports whereby a ball and socket joint is important.

---

---

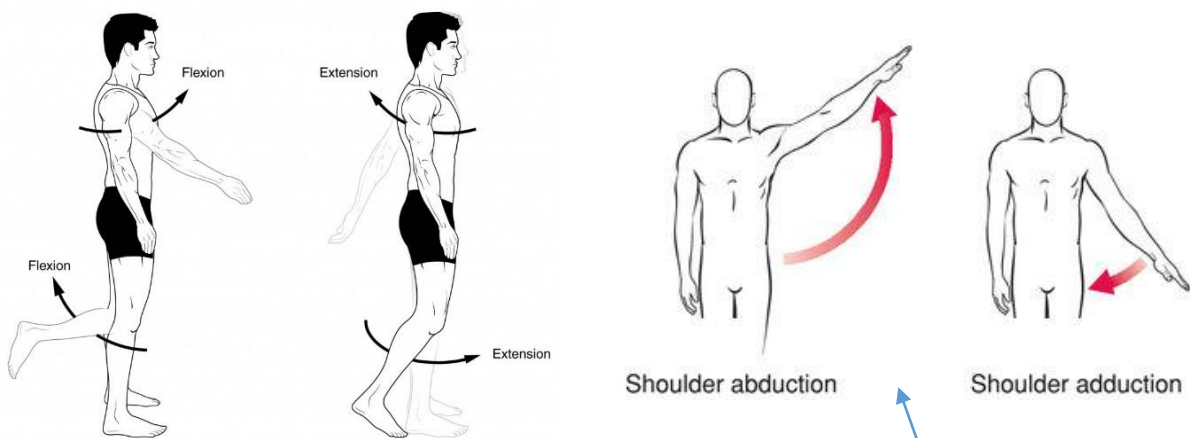
Which joints are key to creating movement for the sporting actions shown below?



## Joints and Movement:

Joints are what make it possible to move our body in certain ways. Each type of joint allows for a different type of movement.

1. Flexion: Movement decreasing the angle between body parts (**bending**).
2. Extension: Movement increasing the angle between body parts (**straightening**).
3. Dorsi-Flexion: Flexing the toes so that they move closer to the shin
4. Plantar-Flexion: Extending the toes down, away from the shin
5. Adduction: Movement of a body part toward the body's midline
6. Abduction: Movement of a body part away from the body's midline
7. Rotation: the action of rotating around an axis or centre.



Useful Hint:

**ADD**uction = add to the body

Abduction = Take Away

Useful Hint:

**PLANT**ar-Flexion = Plant your toes on the ground

Type of Joint	Examples of this joint in the body?	Types of movement available?

What type of movements result in the following sporting actions?

Kicking a ball in football \_\_\_\_\_

Serving in tennis \_\_\_\_\_

Hand Stand \_\_\_\_\_

Ten Pin Bowling \_\_\_\_\_

Bowling a cricket ball \_\_\_\_\_

Performing a bicep curl \_\_\_\_\_

'Pointe' in Ballet (standing on toes) \_\_\_\_\_

Performing a squat \_\_\_\_\_

Forehand shot in Table Tennis \_\_\_\_\_

Useful Hint:

**Think about different exercises that you can perform in the gym. What type of movement does each exercise require?**

The clean and jerk is a technique used in weightlifting. Explain the action of movement present at the knee joint at the start and finish of the lift.

---

---

---

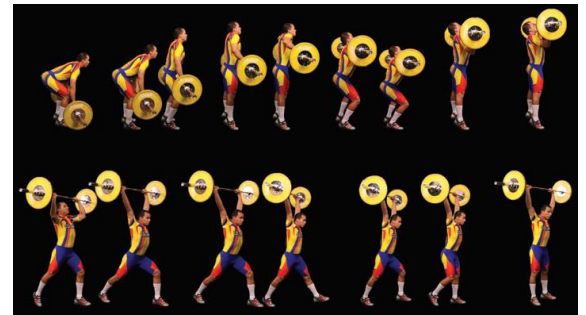
---

---

---

---

---



The images above show the stages involved in bowling a ball in cricket. Explain the action of movement present at the shoulder in order to bowl a cricket ball.

---

---

---

---

---

---

---

---



The image above shows a forehand shot in tennis. Explain the actions of movement present at the shoulder joint during the preparation and follow through of the shot.

---

---

---

---

---

---

---



The image above shows a person performing a calf raise exercise. Explain the action of movement present at the ankle joint in order to complete this exercise.

---

---

---

---

---

---

---



Muscle Types:

How many muscles can you name which you can voluntarily control?

Can you name any muscles which you cannot voluntarily control?

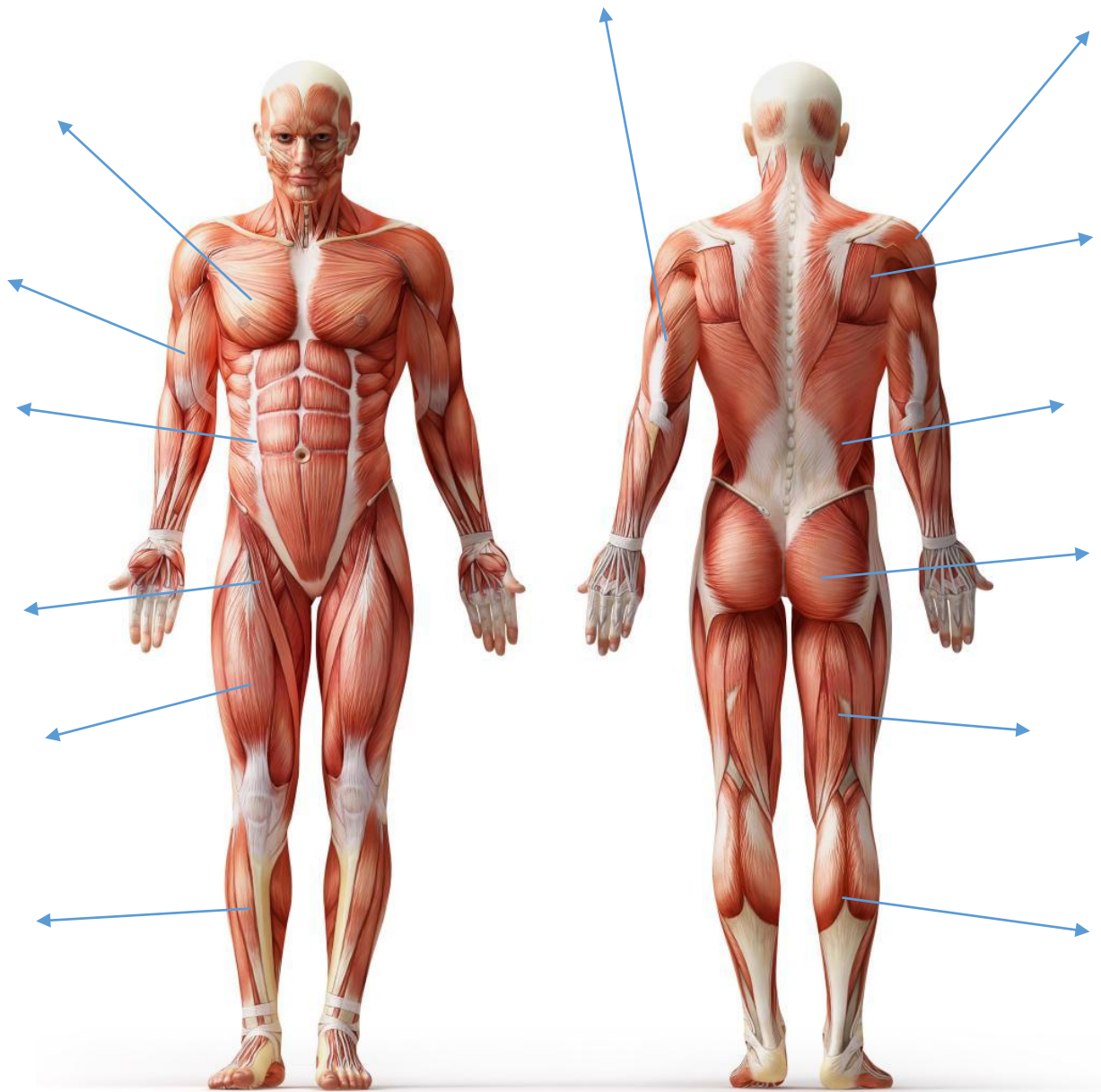
**Voluntary Muscles** – Muscles which are under your \_\_\_\_\_. You can choose when to **contract** or **relax** them. All of these muscles are attached to the skeleton by \_\_\_\_\_. They are therefore also known as \_\_\_\_\_ muscles

**Involuntary Muscles** – Are not under your \_\_\_\_\_. They \_\_\_\_\_ and \_\_\_\_\_ automatically. Involuntary muscles can be found in your \_\_\_\_\_, \_\_\_\_\_ and urinary systems. The involuntary muscles in your \_\_\_\_\_ help to digest food.

**Cardiac Muscle** – Is only found in the wall of the \_\_\_\_\_. Cardiac muscle is a type of \_\_\_\_\_ muscle as we cannot control when it contracts or relaxes. When you \_\_\_\_\_ the cardiac muscles in your heart help to \_\_\_\_\_ blood around the body faster.

Fill the following words into the gaps left above:			
Tendons	Pump	Relax	
Control	Skeletal	Heart	Involuntary
Digestive	Stomach	Circulatory	
Exercise	Control	Contract	

## Voluntary Muscles of the Body:



12 of the 13 muscles that you have labelled above, work as **antagonistic pairs**. Can you name these pairs?





## Antagonistic Pairs

A muscle is only capable of pulling during a contraction. Muscles cannot push. Therefore some muscles work in twos, known as **antagonistic pairs**. Whilst one muscle **contracts** (pulls), the other muscle in the pair will **relax**. The muscle contracting is known as the **agonist**, whereas the muscle relaxing is known as the **antagonist**.

Explain how an antagonistic pair of muscles work together to perform a press up.

---

---

---

---

Hint:  
Think about the  
arms

Explain how an antagonistic pair work together whilst performing a squat.

---

---

---

---

Hint:  
Think about the  
legs

Explain how an antagonistic pair work together during a hurdles race?

---

---

---

Hint:  
Think about the  
feet



**Isometric v Isotonic Contractions:**

An **isometric contraction** is where a muscle contracts but the length of the muscle does not change (therefore it doesn't move). Sporting examples could include

\_\_\_\_\_ or \_\_\_\_\_.

An **isotonic contraction** is where a muscle contracts and also lengthens. There are two types of isotonic muscular contraction:

**Eccentric contractions** occur when the muscle lengthen due to a greater opposing force.

**Concentric contractions** occur when the muscle shortens, therefore generating force.

At which stage of a bicep curl is an eccentric muscle contraction experienced? At which stage is a concentric contraction experienced?

---

---

---

---

**Which one of the following causes flexion at the elbow? (1 mark)**

- A Tricep
- B Bicep
- C Deltoid
- D Pectorals

Sample Exam Questions

**Which bones are found at the knee joint? (1 mark)**

- A Femur and Tibia
- B Pelvis and Femur
- C Tibia and Talus
- D Fibula and Ulna

Using an example from a sport of your choice, identify the two types of movement that can occur at a hinge joint (4 marks)

1. \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

2. \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

One of the functions of the skeleton is to provide support.

Name two other functions of the skeleton and explain how they can aid the performance of a marathon runner. (4 marks)

1. \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

2. \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Explain how the muscles and bones work together to produce the movement at the knee joint when a footballer takes a shot. (3 marks)

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_



Key Terms:

**Articulating Bones** – Where two or more bones meet to allow movement at a joint

**Tendons** – Fibrous tissues that join bone to muscle

**Ligaments** – Strong, flexible fibre that connects bones to other bones

**Flexion:** Movement decreasing the angle between body parts (**bending**)

**Extension:** Movement increasing the angle between body parts (**straightening**)

**Dorsi-Flexion:** Flexing the toes so that they move closer to the shin

**Plantar-Flexion:** Extending the toes down, away from the shin

**Adduction:** Movement of a body part toward the body's midline

**Abduction:** Movement of a body part away from the body's midline

**Rotation:** The action of rotating around an axis or centre

**Voluntary Muscle:** A muscle which is controlled by an individual

**Involuntary Muscle:** A muscle which is not under an individual's control

**Cardiac Muscle:** An involuntary muscle found in the wall of the heart

**Antagonistic Pair:** Two muscles working together. One contracts while the other relaxes.

**Agonist:** Muscle or group responsible for the movement.

**Antagonist:** Acts to produce the opposite action of the agonist.

**Isometric Contraction:** Where a muscle contracts but the length of the muscle does not change (therefore it doesn't move)

**Eccentric Contraction:** Occurs when the muscle lengthens due to a greater opposing force.

**Concentric Contraction:** Occurs when the muscle shortens, therefore generating force.