

FITEDUHUB

Knowledge in Motion

CLASS XI • PHYSICAL EDUCATION (048)

UNIT 7

FUNDAMENTALS OF ANATOMY AND PHYSIOLOGY IN SPORTS

CBSE 2026-27 | ILLUSTRATED STUDY EDITION



Current CBSE Alignment & Unit Overview

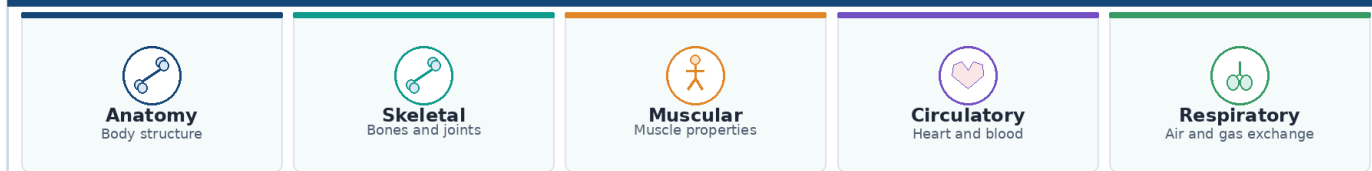
Unit 7 is part of the CBSE Class XI Physical Education (048) curriculum for the 2026–27 academic session. The unit carries 08 marks in the current syllabus. The scope below follows the current CBSE topic list; supporting explanations and examples are added to make the prescribed concepts teachable and exam-ready.

CBSE Prescribed Area	Coverage in this Master
Definition and importance of Anatomy and Physiology in exercise and sports	Detailed explanation + sports application + visual support + exam practice
Functions of the Skeletal System, Classification of Bones, and Types of Joints	Detailed explanation + sports application + visual support + exam practice
Properties and Functions of Muscles	Detailed explanation + sports application + visual support + exam practice
Structure and Functions of the Circulatory System and Heart	Detailed explanation + sports application + visual support + exam practice
Structure and Functions of the Respiratory System	Detailed explanation + sports application + visual support + exam practice

Learning Objectives

- Define anatomy and physiology and explain their relevance to exercise and sports.
- Describe major functions of the skeletal system and classify bones using shape-based categories.
- Identify major joint types and relate joint movement to sports actions.
- Explain important properties and functions of skeletal muscles in movement and exercise.
- Describe the basic structure and pathway of the circulatory system and explain the role of the heart in exercise.
- Describe the basic structure and pathway of the respiratory system and explain gas exchange and its importance in exercise.
- Connect anatomical and physiological concepts with safe, efficient sports performance.

Unit Map • Anatomy & Physiology



1. Anatomy and Physiology in Exercise and Sports

1.1 Meaning of Anatomy

Anatomy is the study of the structure of the body and the relationships among its parts. In physical education and sport, anatomical knowledge helps students understand which bones, joints, muscles and organs are involved in movement and how body structures are arranged.

1.2 Meaning of Physiology

Physiology is the study of how the body and its systems function. Exercise physiology applies physiological ideas to the responses and adaptations that occur when a person performs physical activity.

1.3 Why They Matter in Sports

- Anatomy helps identify the structures involved in a movement.

- Physiology helps explain what those structures and systems do during exercise.
- Together, they help teachers and coaches select appropriate activities, explain technique, monitor responses and plan progression.
- They support safer movement by improving understanding of body position, joint action and exercise demands.

Anatomy vs Physiology



Anatomy

Structure • bones, joints



Physiology

Function • body systems



In sport

Movement and response

Exam focus

Remember: Anatomy = structure; Physiology = function. In sport, both are used together to understand movement and exercise responses.

2. Skeletal System

2.1 Major Functions of the Skeletal System

- Support: provides the body with a firm framework and helps maintain posture.
- Protection: bones protect important organs, such as the skull protecting the brain and the rib cage protecting the heart and lungs.
- Movement: bones provide levers and attachment sites for muscles; joints allow controlled movement.
- Mineral storage: bone tissue stores minerals such as calcium and phosphorus.
- Blood-cell formation: red bone marrow is a site of blood-cell production.

Human Skeletal System



Skull

Protects the brain



Spine

Support and posture



Rib cage

Protects chest organs



Pelvis

Transfers load



Limbs

Movement and leverage

2.2 Classification of Bones

Category	General form / role	Examples
Long bones	Longer than they are wide; act effectively as levers	Femur, humerus, tibia
Short bones	Compact, roughly cube-shaped bones that provide stability and controlled movement	Carpals, tarsals
Flat bones	Thin or flattened bones often associated with protection or broad muscle attachment	Scapula, ribs, sternum, skull bones
Irregular bones	Complex shapes that do not fit neatly into the other major groups	Vertebrae

Category	General form / role	Examples
Sesamoid bones	Small bones embedded within certain tendons; reduce friction and alter leverage	Patella

Classification of Bones

 Long Femur	 Short Carpals	 Flat Ribs / sternum	 Irregular Vertebra	 Sesamoid Patella example
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2.3 Types of Joints

A joint is a place where two or more bones meet. Joints provide stability and/or movement depending on their structure. For school-level study, joints can be grouped as fibrous, cartilaginous and synovial joints. Synovial joints are especially important in sports because they permit a wide range of controlled movements.

Joint group	General characteristic	Examples / sports link
Fibrous	Bones are closely joined with little or no movement	Skull sutures; stability is more important than movement
Cartilaginous	Bones are joined by cartilage and allow limited movement	Intervertebral connections; shock absorption and flexibility
Synovial	Joint cavity and structures allow relatively free movement	Knee, elbow, shoulder, hip

Common synovial type	Main movement characteristic	Example
Hinge	Primarily flexion and extension	Elbow, knee
Ball-and-socket	Movement in multiple directions and rotation	Shoulder, hip
Pivot	Rotation around a single axis	Upper neck region; forearm-related pivot at proximal radioulnar joint
Gliding / plane	Small sliding movements between relatively flat surfaces	Wrist/ankle regions in selected joints

Types of Joints

 Fibrous Little / no movement	 Cartilaginous Limited movement	 Hinge Elbow / knee	 Ball & socket Shoulder / hip	 Pivot / gliding Rotation / sliding
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3. Muscular System

3.1 Properties of Skeletal Muscle

Property	Meaning
Excitability / responsiveness	Ability to respond to stimulation.
Contractility	Ability to develop tension and shorten or otherwise produce force.
Extensibility	Ability to be lengthened within physiological limits.
Elasticity	Ability to return toward resting length after stretching.

3.2 Functions of Muscles in Sports

- Produce force and create movement.
- Maintain posture and joint stability.
- Control and decelerate movement as well as initiate it.
- Help maintain body position during skill execution.
- Generate heat as a by-product of muscular activity.



3.3 Muscle Roles During Movement

In many movements, muscles work in coordinated groups. A prime mover (agonist) is a muscle or muscle group that contributes strongly to a particular action. An antagonist produces an opposing action and can help control movement. Synergists assist the main action. The exact role of a muscle can change with the task and joint position.



4. Circulatory System and Heart

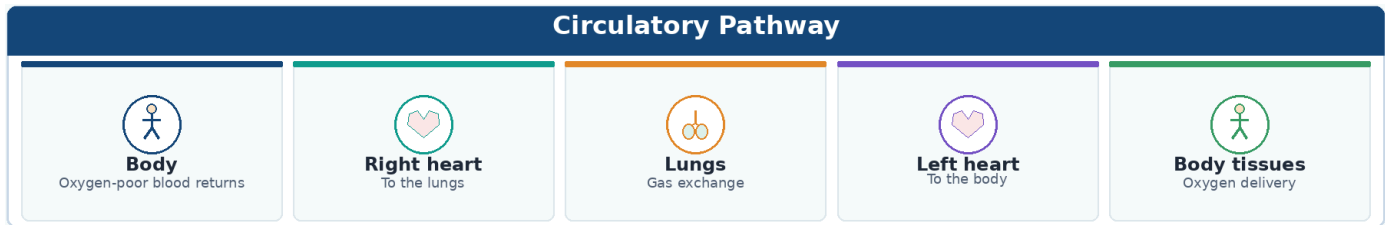
4.1 Main Functions of the Circulatory System

- Transports oxygen from the lungs to tissues.
- Carries carbon dioxide from tissues toward the lungs.
- Delivers nutrients and hormones and carries metabolic wastes.
- Helps distribute heat and supports internal balance.

- Supports the increased demands of active muscles during exercise.

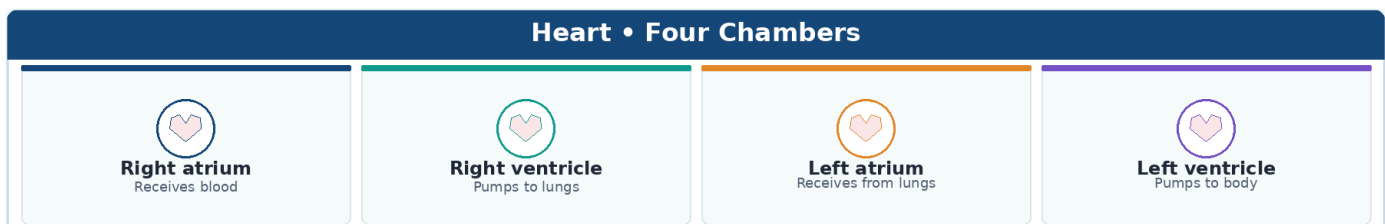
4.2 Main Parts

The circulatory system includes the heart, blood and blood vessels. Arteries generally carry blood away from the heart, veins generally return blood to the heart, and capillaries provide sites for exchange between blood and tissues.



4.3 Basic Structure of the Heart

Structure	Basic role
Right atrium	Receives deoxygenated blood returning from the body.
Right ventricle	Pumps deoxygenated blood toward the lungs.
Left atrium	Receives oxygenated blood returning from the lungs.
Left ventricle	Pumps oxygenated blood into systemic circulation.
Valves	Help keep blood moving in the intended direction.
Major vessels	Connect the heart with pulmonary and systemic circulation.



4.4 Pulmonary and Systemic Circulation

Pulmonary circulation carries blood between the heart and lungs for gas exchange. Systemic circulation carries oxygenated blood from the heart to the body and returns deoxygenated blood toward the heart. This division helps maintain continuous oxygen supply to tissues while carbon dioxide is transported to the lungs for removal.

4.5 Exercise Response

- Heart rate generally increases as exercise intensity and oxygen demand increase.
- Cardiac output rises so more blood can be delivered to working tissues.
- Blood flow is redistributed according to the demands of exercise and the body's regulatory mechanisms.

Body Response During Exercise



Heart rate
Usually increases



Breathing
Rate and depth rise



Blood flow
Working muscles need more



Recovery
Responses settle gradually

5. Respiratory System

5.1 Structure and Air Pathway

The respiratory system brings air into the body and provides the surfaces where oxygen and carbon dioxide are exchanged. The main pathway can be simplified as nose or mouth → pharynx → larynx → trachea → bronchi → smaller airways → alveoli.

Air Pathway & Gas Exchange



Nose / mouth
Air entry



Trachea
Air passage



Bronchi
Enter the lungs



Bronchioles
Smaller airways



Alveoli
Gas exchange

5.2 Main Functions

- Ventilation: moving air into and out of the lungs.
- Gas exchange: oxygen moves into the blood and carbon dioxide moves out at the alveoli-capillary interface.
- Supporting acid-base regulation through carbon-dioxide removal.
- Supplying oxygen needed for aerobic energy production.

5.3 Breathing During Exercise

When physical activity increases, working muscles generally require more oxygen and produce more carbon dioxide. The respiratory system responds by adjusting the depth and rate of breathing so ventilation can meet changing demands. Breathing response varies with exercise intensity, fitness, environment and individual factors.

Important distinction

Respiratory system = air movement and gas exchange. Circulatory system = transport of blood, oxygen and other materials. They work together but are not the same system.

Assessment Practice

MCQs

1. Which term mainly describes the study of body structure?

- A. Physiology
- B. Anatomy
- C. Psychology
- D. Kinesiology

2. Which is a major function of the skeletal system?

- A. Gas exchange
- B. Support and protection
- C. Digestion
- D. Hormone production only

3. A long bone is typically found in the:

- A. Vertebra
- B. Patella
- C. Scapula
- D. Femur

4. A hinge joint permits movement mainly in a:

- A. Single plane around one axis
- B. Fixed position
- C. Multiple axes only
- D. Gliding-only pattern

5. The property of muscle that allows it to shorten forcibly is:

- A. Contractility
- B. Extensibility
- C. Elasticity
- D. Plasticity

6. The heart chamber that pumps oxygenated blood into systemic circulation is the:

- A. Left atrium
- B. Right ventricle
- C. Right atrium
- D. Left ventricle

7. Gas exchange mainly occurs in the:

- A. Larynx
- B. Bronchi
- C. Alveoli
- D. Trachea

8. The pulmonary circuit carries blood between the heart and the:

- A. Digestive tract
- B. Brain only
- C. Lungs
- D. Skeletal muscles only

9. Which system directly transports oxygen and nutrients around the body?

- A. Skeletal system
- B. Circulatory system
- C. Integumentary system
- D. Digestive tract only

10. Which structure protects the spinal cord?

- A. Pelvic girdle only
- B. Vertebral column
- C. Rib cage
- D. Scapula

11. A ball-and-socket joint allows movement at the:

- A. Elbow
- B. Interphalangeal joint

C. Suture

D. Hip

12. During exercise, the demand for oxygen by working muscles generally:

A. Falls to zero

B. Always stays identical

C. Increases

D. Becomes unrelated to breathing

13. The respiratory pathway begins with air entering mainly through the:

A. Alveoli

B. Nose or mouth

C. Bronchioles

D. Diaphragm

14. Which muscle property means it can return toward its resting length after being stretched?

A. Excitability

B. Contractility

C. Elasticity

D. Conductivity

15. Anatomy is most directly concerned with:

A. Doping

B. Training load

C. Team cohesion

D. Structure

Assertion–Reason

1. Assertion: Anatomy is concerned with body structure.

Reason: It examines the arrangement and relationships of body parts such as bones, joints and muscles.

Answer: Both true and Reason explains Assertion.

2. Assertion: The skeletal system contributes to movement.

Reason: Bones provide levers and attachment sites that work with muscles and joints.

Answer: Both true and Reason explains Assertion.

3. Assertion: Contractility is a property of skeletal muscle.

Reason: Contractility refers to the ability of muscle to develop tension and shorten when appropriately activated.

Answer: Both true and Reason explains Assertion.

4. Assertion: The left ventricle pumps oxygenated blood into systemic circulation.

Reason: It ejects blood into the aorta for distribution to the body tissues.

Answer: Both true and Reason explains Assertion.

5. Assertion: Gas exchange mainly occurs in the alveoli.

Reason: Their thin walls and close relationship with capillaries support diffusion of gases.

Answer: Both true and Reason explains Assertion.

6. Assertion: Exercise can increase heart rate and breathing rate.

Reason: Working muscles generally have greater demands for oxygen delivery and carbon-dioxide removal during exercise.

Answer: Both true and Reason explains Assertion.

Match the Following

Column A	Column B
1. Femur	A. Pumps oxygenated blood into systemic circulation
2. Hinge joint	B. Long bone
3. Alveoli	C. Gas exchange

Column A	Column B
4. Left ventricle	D. Protects spinal cord
5. Vertebral column	E. Elbow

Fill in the Blanks

- The study of body structure is called _____.
- The study of body function is called _____.
- The femur is a _____ bone.
- The lungs contain microscopic air sacs called _____.
- The heart has _____ main chambers.
- The vertebral column helps protect the _____ cord.
- The ability of muscle to shorten forcibly is called _____.
- Blood returning from the body enters the _____ atrium.

2-Mark Questions

- Define anatomy and physiology.
- State two functions of the skeletal system.
- Name two types of joints.
- List two properties of skeletal muscle.
- Name the four chambers of the heart.
- What is the main function of alveoli?
- State two functions of the respiratory system.
- Differentiate arteries and veins.
- State two functions of the circulatory system.
- What is the role of the vertebral column?

3-Mark Questions

- Explain three functions of bones.
- Differentiate anatomy and physiology.
- Explain the pathway of blood through the heart.
- Explain the main functions of the respiratory system.
- Describe three muscle properties.
- Explain the role of joints in movement.
- Differentiate pulmonary and systemic circulation.
- Explain how muscles and bones work together.

4-Mark Questions

- Explain classification of bones with examples.
- Explain major types of joints with sports examples.
- Describe the structure and function of the heart.
- Explain pulmonary and systemic circulation.
- Explain the properties and functions of skeletal muscles.
- Describe the structure and functions of the respiratory system.
- Explain the role of the skeletal system in movement and protection.

8. Explain how circulatory and respiratory systems cooperate during exercise.

5-Mark Questions

1. Discuss the integrated role of skeletal, muscular, circulatory and respiratory systems in exercise.
2. Explain how anatomy and physiology knowledge can support safe and efficient sports participation.
3. Describe the complete pathway of oxygen from inhaled air to working muscles.
4. Discuss the importance of joint structure and muscle action for sports movement.
5. Explain how the circulatory and respiratory systems respond to increased exercise demand.
6. Discuss why students should understand body systems before planning demanding physical activity.
7. Explain the interdependence of bones, joints and muscles in sports performance.

Case-Based / Competency Questions

Case 1

A basketball player lands awkwardly and the teacher asks students to identify the joint involved and the body system that provides support. Explain how anatomy helps analyse the situation.

Answer guidance: Expected points: identify relevant joint(s), skeletal support/protection, movement role, and need for safe assessment rather than diagnosis.

Case 2

During repeated shuttle runs, a learner notices faster breathing and an increased heart rate. Explain the physiological purpose of these responses.

Answer guidance: Expected points: increased oxygen delivery, carbon-dioxide removal, circulation, energy demand, and exercise adaptation concepts.

Case 3

A student is asked to trace the path of oxygen from the air to a working muscle. Write the main pathway in order.

Answer guidance: Expected: airways to alveoli, gas exchange, pulmonary circulation to heart, systemic circulation to tissues.

Case 4

A coach compares two movements that use different joints. Explain why understanding joint structure is useful for technique and safe practice.

Answer guidance: Expected points: range/direction of movement, joint type, muscle action, technique, load and injury-prevention awareness.

Case 5

A learner says that the heart and lungs are the same system because they work together. Correct the statement and explain their relationship.

Answer guidance: Expected: they are distinct systems (circulatory and respiratory) that cooperate for gas exchange and oxygen transport.

Case 6

A sprinter asks why the skeleton is important even though muscles create movement. Explain the complementary roles of bones, joints and muscles.

Answer guidance: Expected: bones as levers/support, joints as movement interfaces, muscles generate force; coordinated movement.

Visual / Concept-Based Practice**Visual Question 1 • Identify Structures****A**
Skull**B**
Rib cage**C**
Knee joint**D**
Long bone**Visual Question 2 • Trace Circulation****A**
Heart**B**
Lungs**C**
Body**Visual Question 3 • Muscle Action****1**
Muscle contracts**2**
Joint moves**3**
Sport action**Quick Revision**

Concept	Quick recall
Anatomy	Study of body structure.
Physiology	Study of body function.
Skeleton	Support, protection, movement leverage, mineral storage and blood-cell formation.
Joints	Connections between bones that permit or control movement.
Muscles	Excitable tissues that contract to create and control movement.
Circulation	Heart and blood vessels transport oxygen, nutrients and wastes.
Respiration	Air movement and gas exchange support oxygen supply and carbon-dioxide removal.