

Unit 1: Introduction to body systems and principles of training in health and fitness

LO1: Understand the structure and function of body systems and how they apply to health and fitness

1.1 THE SKELETAL SYSTEM

FUNCTIONS OF THE SKELETAL SYSTEM

- Movement
- Protection
- Production
- Shape
- Support
- Storage

TYPES OF BONES

- Long
- Short
- Flat
- Irregular
- Sesamoid

TYPES OF JOINTS

- Fixed
- Cartilaginous
- Synovial

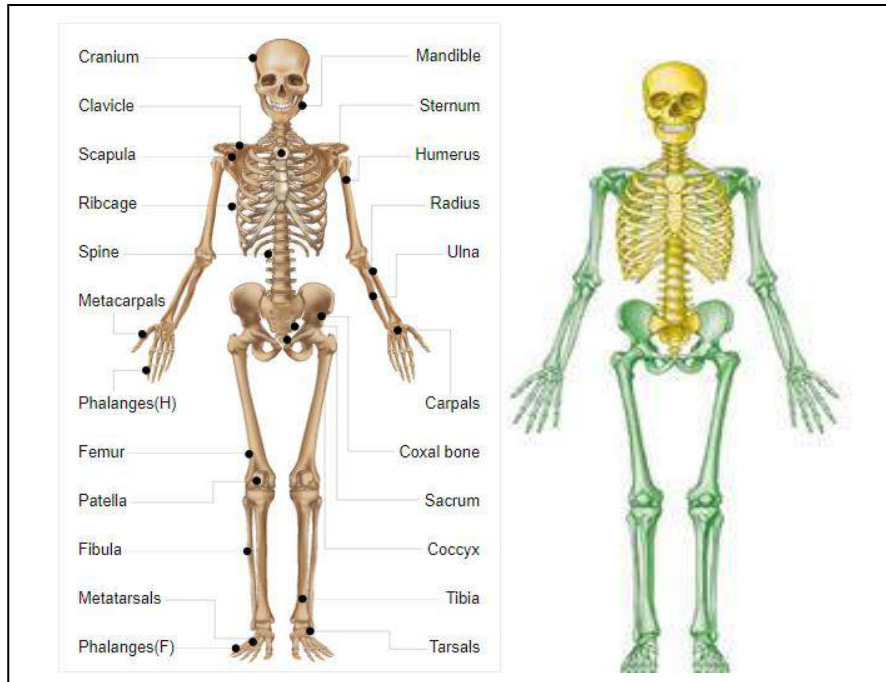
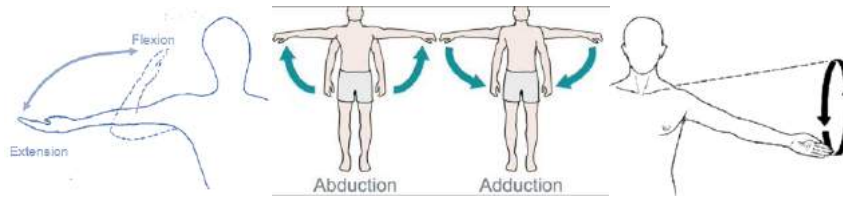
SYNOVIAL JOINTS

- Hinge
- Ball and socket
- Saddle
- Pivot
- Gliding
- Condyloid

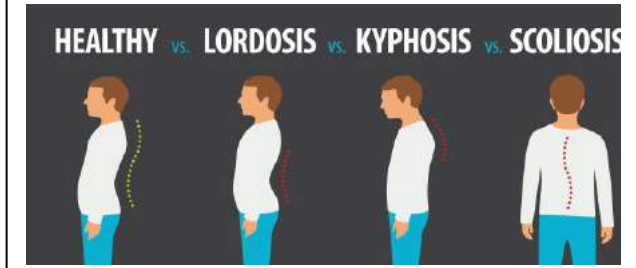
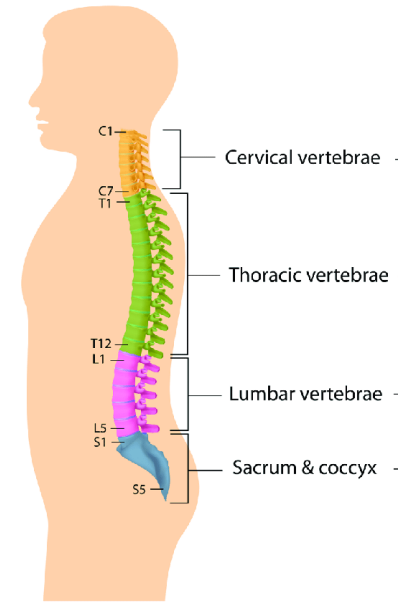
FUNCTIONS OF A SYNOVIAL JOINT

- Reduce friction
- Joint stability
- Shock absorption

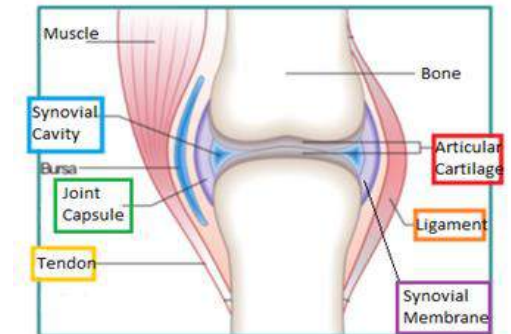
JOINT ACTIONS



THE SPINE



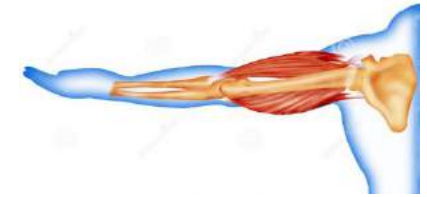
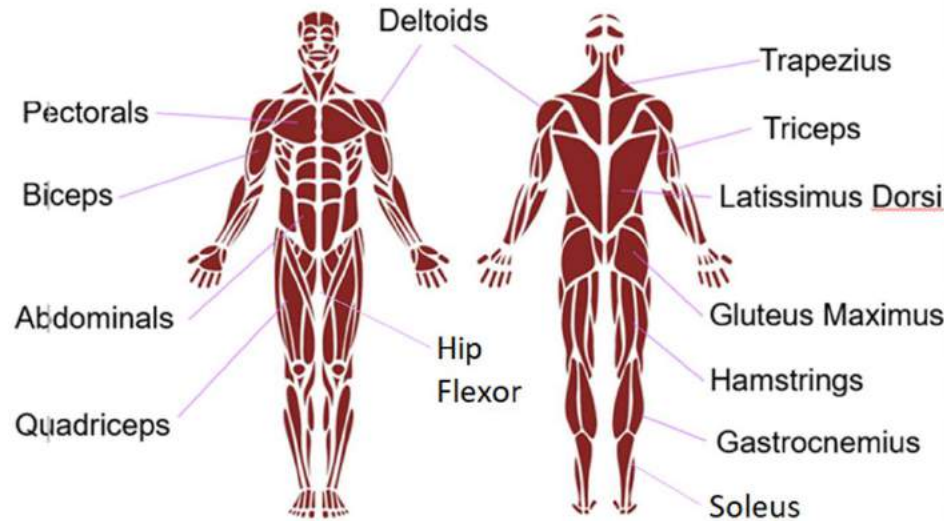
STRUCTURE OF A SYNOVIAL JOINT



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1.2 THE MUSCULAR SYSTEM



SLOW TWITCH FIBRES

Resistant to fatigue
Contract more slowly
Produce less force
Red in colour
Predominant in endurance sports

FAST TWITCH FIBRES

Fatigue easily
Contract fast
Produce great force
White in colour
Predominant in anaerobic power sports

Types of Muscle



Cardiac	Skeletal	Smooth
heart	Attach to bones	organs
unstriated	striated	striated
voluntary	involuntary	voluntary
oxygen	Can work with or without oxygen	No oxygen

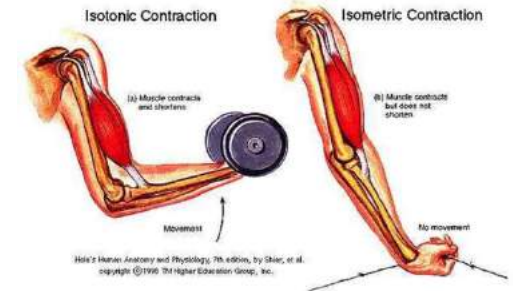
MUSCLE ACTIONS

Antagonistic muscle pairs

As one muscle contracts, another relaxes.

Agonist = contracting

Antagonist = relaxing



Isotonic contraction: Muscle action where the muscle changes length, causing movement.

Concentric contraction: Isotonic contraction where the muscle shortens.

Eccentric contraction: Isotonic contraction where the muscle lengthens, used to control downwards movements.

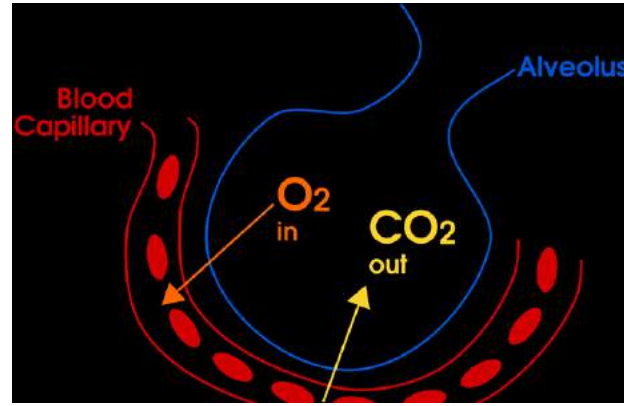
Isometric contraction: Muscle action where the muscle stays the same length, used in balances.

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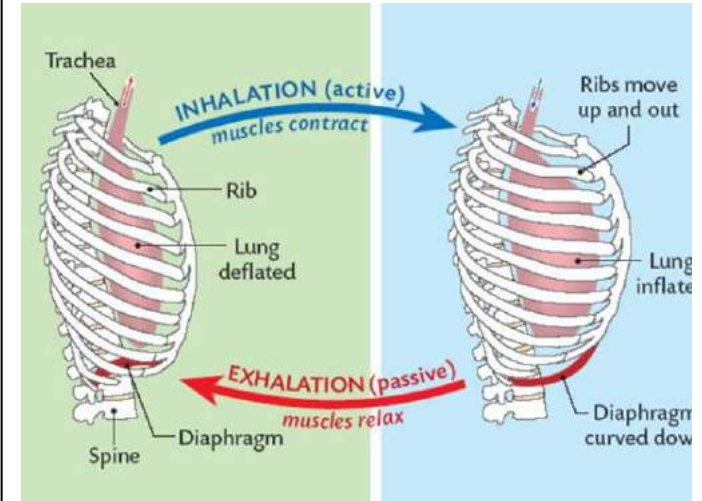
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1.3 THE RESPIRATORY SYSTEM

GASEOUS EXCHANGE

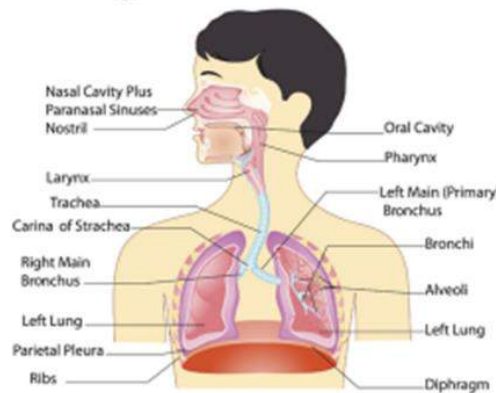


FUNCTIONS OF THE RESPIRATORY SYSTEM



Structure of the respiratory system

- Air enters the body through the nasal cavity and mouth
- Then it travels down the trachea (wind pipe)
- The trachea splits into 2 tubes, 1 to each lung, these are called bronchi
- Each bronchus further divides into smaller tubules called bronchiole
- Each bronchiole ends in a tiny air sac called an alveolus
- Gaseous Exchange occurs at the alveoli



LUNG VOLUMES

The **respiratory** or **lung volumes** are the *amount of air* inspired, exhaled and stored within the lungs at any given time.

Tidal volume: The amount of air which enters the lungs during normal inspiration at rest.

Residual volume: The amount of air left in the lungs following a maximal exhalation. There is always some air remaining to prevent the lungs from collapsing.

Vital capacity: The maximum amount of air you can exhale after taking the deepest inspiration you possibly can. It can be up to ten times more than you would normally exhale.

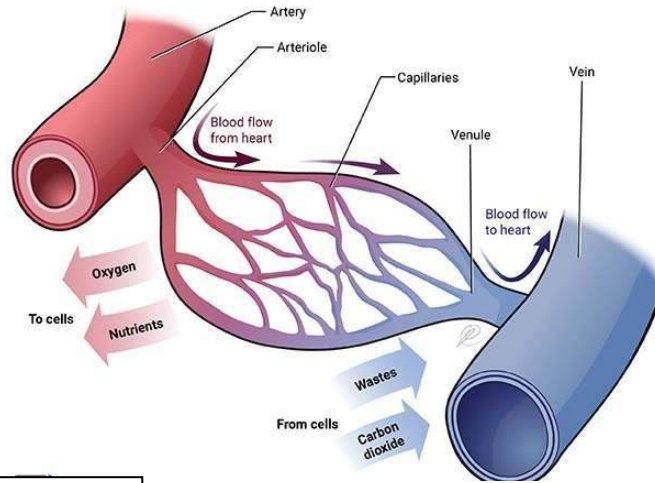


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1.4 THE CARDIOVASCULAR SYSTEM

STRUCTURE AND FUNCTION OF BLOOD VESSELS



Arteries: Carry blood away from the heart

Veins: Carry blood towards the heart

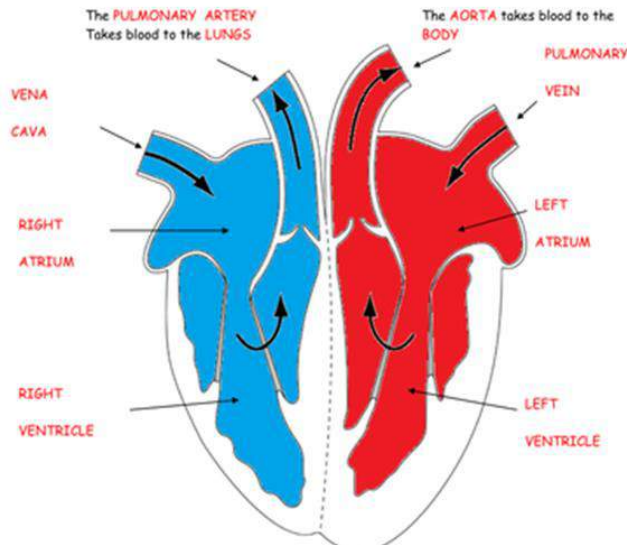
Capillaries: Very thin blood vessels that allow gaseous exchange to happen.

Vasoconstriction: Reducing the diameter of small arteries to reduce blood flow to issues.

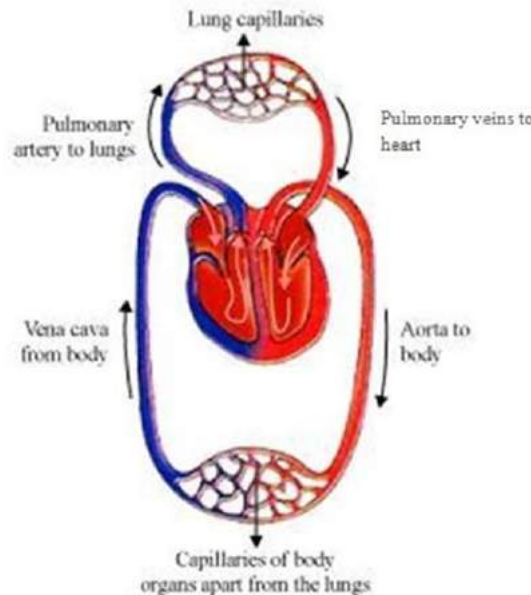
Vasodilation: Increasing the diameter

Vascular shunt: Mechanism that directs blood to where there is greater demand.

STRUCTURE OF THE HEART



THE CARDIAC CYCLE



CV MEASUREMENTS

Heart rate: The number of times the heart beats in a minute (BPM – beats per minute).

Maximum Heart Rate: 220- age

Cardiac output (CO) = Stroke Volume (SV) x Heart Rate (HR)

Cardiac output: The volume of blood that the heart is able to pump out (litres per minute). The cardiac output represents the volume of oxygenated blood delivered to the body.

Stroke Volume: The volume of blood that leaves the heart during each contraction.

Heart Rate: The number of times the hearts beats per minute (bpm).

Blood pressure

Systolic pressure: the higher blood-pressure measurement that occurs when the heart beats, pushing blood through the arteries.

Diastolic pressure: the lower blood-pressure measurement that occurs when the heart rest between beats.

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LO1: *Understand the structure and function of body systems and how they apply to health and fitness*

1.5 ENERGY SYSTEMS

An ENERGY supply is needed for muscle contractions.

Energy is usually supplied by the breakdown of glucose (sugar).

AEROBIC ENERGY SYSTEM

Glucose + oxygen → energy + carbon dioxide + water

The process uses oxygen to breakdown glucose to provide energy to working muscles.

- Low to moderate levels of exercise
- Extended periods of time

ANAEROBIC ENERGY SYSTEM

Glucose → energy + lactic acid

The process is used when the energy needed for exercise is provided without being dependant on oxygen.

- High-intensity
- Short period of time

LACTIC ACID

Lactic acid is a major cause of fatigue.

Without oxygen, waste products (co2) are not broken down fully. Lactic acid is created instead. This is why activities relying on the anaerobic energy system cannot last for more than a minute.

The build up of lactic acid in muscles causes fatigue and eventually pain. The exercise has to slow down, or stop.

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LO2: Understand the effects of health and fitness activities on the body

Short and long-term effects of health and fitness activities

SHORT-TERM EFFECTS OF HEALTH AND FITNESS ACTIVITIES

- Feeling hot and sweaty
- Body temperature increases
- Red skin as blood is shunted towards surface
- Breathing rate increases
- Heart rate increases
- Stroke volume increases
- Cardiac Output
- Blood pressure increases
- Hydration level increases
- Muscle fatigue occurs
- DOMS = delayed onset of muscle soreness

Performers will experience different short-term effects depending on the type of activity they take part in.

The intensity and duration will determine the immediate effects on the body.

LONG-TERM EFFECTS ON BODY SHAPE



Endomorph: Body shape characterized by large fat content.

Mesomorph: Body shape characterized by large muscular shoulder.

Ectomorph: Body shape characterized by lean, skinny, low muscle mass. Often tall.

LONG-TERM EFFECTS OF HEALTH AND FITNESS ACTIVITIES

- Body shape may change.
- Improvements in specific components of fitness.
- Increase in size of heart (hypertrophy).
- Lower blood pressure (hypertrophy allows more blood to be pumped per beat).
- Lower resting heart rate (bradycardia).
- Improved ability to use oxygen.
- More red blood cells made.

Performers experience different long-term effects on the body depending on the exercise they do.

After months/years of exercise, the body adapts to what it has been doing.

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LO3: Understand health and fitness and the components of fitness

LO4: Understand the principles of training.

Health is a 'state of complete physical, mental and social wellbeing and not merely the absence of disease or infirmity'.

The components of health:

Physical – All of the body's systems working well, free from illness and able to meet daily demands without fatigue.

Mental – Coping with the normal stress of life, working productively while being able to contribute to community. This includes being rational in different situations.

Social – Basic human needs are being met (food, clothing, shelter) while suffering little stress in social circumstances. An individual has friendship and support.

Fitness is a 'the ability to cope with daily demands without suffering undue fatigue'. Your body is fit enough to do what it needs to do.

HEALTH-RELATED COMPONENTS OF FITNESS	
Cardiovascular endurance	The ability of the heart and lungs to supply oxygen to the working muscles
Flexibility	The range of movement possible at a joint
Muscular Endurance	The ability of a muscle of muscle group to undergo repeated contractions avoiding fatigue.
Muscular strength	The ability to overcome a resistance. There are three types of strength: <ol style="list-style-type: none"> 1. Static – maximal strength that can be applied to an immovable object. 2. Dynamic –repeated contractions applied to a moving object. 3. Explosive – Power = A combination of strength and speed.
Body composition	A comparison of the percentage of bone, fat, water and muscle within the body.

SKILL-RELATED COMPONENTS OF FITNESS	
Agility	The ability to move and change direction quickly (at speed) while maintaining control.
Balance	The maintenance of the centre of mass over the base of support.
Co-ordination	The ability to use different (two or more) parts of the body together smoothly and efficiently.
Power	Explosive strength or anaerobic power is the product of strength x speed.
Reaction Time	The time taken to initiate a response to a stimulus
Speed	The maximum rate at which an individual is able to perform a movement or cover a distance in a period of time. It is also defined as putting the body parts in action as quickly as possible.

PRINCIPLES OF TRAINING (SPORT)	
Specificity	Training should be specific to the individual's needs and demands of the activity.
Progression	Gradually increasing the intensity of training as the body adapts to training
Overload	Working harder than normal so that the body can adapt to the stresses and improve. Overloading too far will cause injury.
Reversibility	Loss of fitness if you stop or reduce training. If an individual stops or reduces their training level, fitness and performance are likely to drop.
Tedium	Training needs to be varied to avoid boredom.

PRINCIPLES OF F.I.T.T	
Frequency	How often someone trains.
Intensity	How hard someone trains.
Time	How long someone trains for.
Type	The type of training used.