

Summer transition work

BTEC Sport

This work contains all areas from unit 1 - Anatomy and physiology

You will need to read the knowledge organiser and then complete the worksheets that follow.

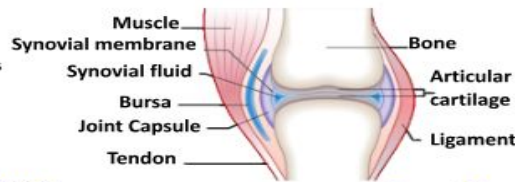
Please bring this in on your first day back after summer

Skeletal System

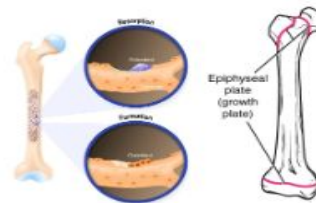
Functions

- Supporting framework
- Protection
- Attachment for muscles
- Blood cell production
- Storage of minerals
- Leverage
- Weight bearing
- Reducing friction at jo

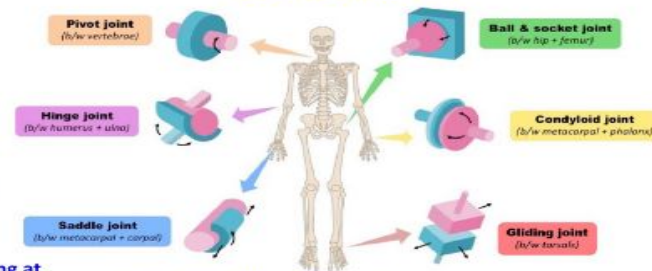
Structure of a joint



Bone Growth



6 Types of synovial joint



Types of Bone

	Long Bones	Leverage and red blood cell production	Femur, Humerus
	Short Bones	Weight bearing	Tarsals, Carpals
	Flat Bones	Protection	Cranium, sternum
	Irregular Bone	Individualised function	Pelvis
	Sesamoid Bones	Reducing friction across a joint, embedded in a tendon	Patella

Bones forming at specific joints

Shoulder
Scapula, Clavicle, Humerus
Joint Type: Ball & Socket
Elbow
Humerus, Radius, Ulna
Joint Type: Hinge
Wrist
Carpals, Radius, Ulna
Joint Type: Hinge
Hip
Ilium, Pubis, Ischium, Femur
Joint Type: Ball & Socket
Knee
Femur, Tibia, Fibula
Joint Type: Hinge
Ankle
Tibia, Fibula, Talus
Joint Type: Hinge

Short Term Effects of exercise

Increases of mineral uptake in bones due to weight bearing exercises.

Long Term Effects of exercise

- Increased bone strength
- Increased ligament strength

Kyphosis



Lordosis



Ranges of movement at synovial joints

Flexion



Extension



Hyperextension



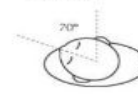
Abduction and adduction



Plantar/ dorsi flexion



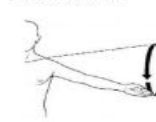
Rotation



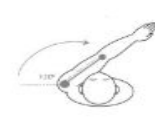
Lateral flexion



Circumduction



Horizontal flexion



Horizontal abduction



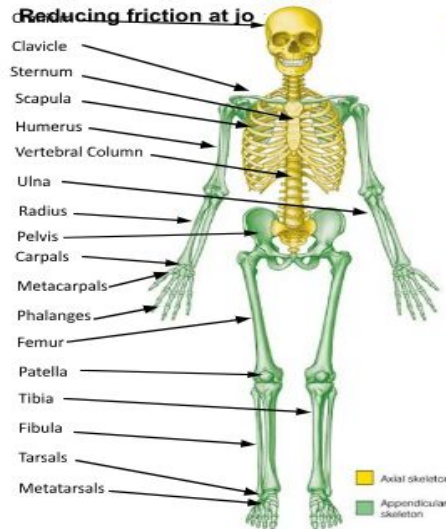
Horizontal Extension



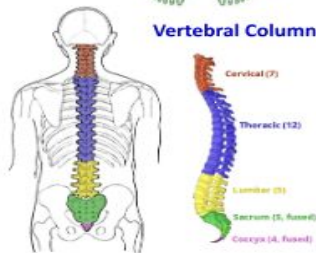
Horizontal adduction



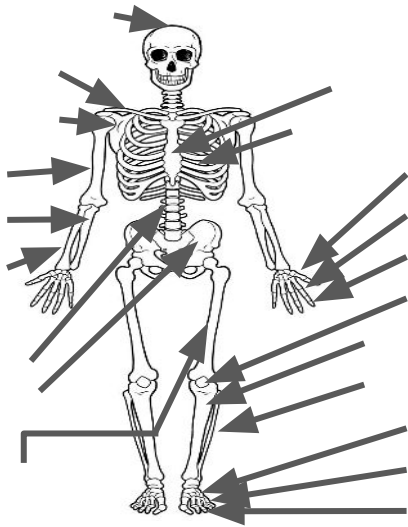
Bones



Vertebral Column



THE SKELETAL SYSTEM

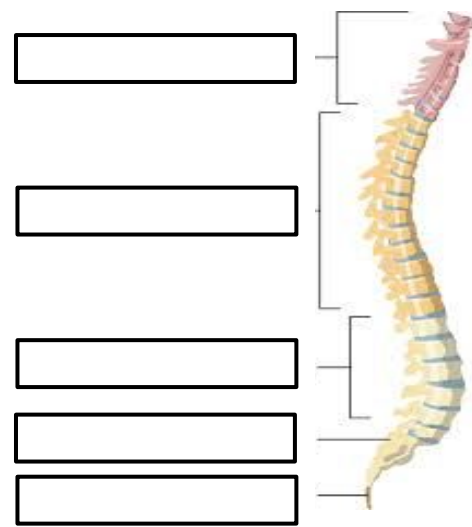


FUNCTION OF A SKELETON

Movement

PROCESS OF BONE GROWTH

All bones are formed from _____, except the clavicle (collarbone) and some parts of the cranium (skull). Bone growth begins in the centre of the bone so growth goes both upwards and downwards. Cartilage remains around the bone until growth is complete. The process from cartilage to bone is known as _____

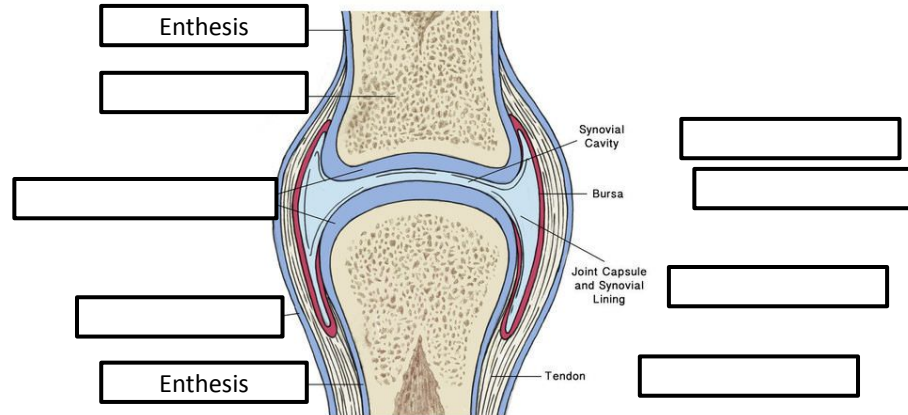


CLASSIFICATION OF BONES

	FUNCTION
SHORT	WEIGHT BEARING AND PROVIDE SUPPORT

AREAS OF THE SKELETON

	NO. OF BONES	LOCATION
AXIAL	80	SKULL, THORACIC CAGE, VERTEBRATE



TYPES OF JOINT MOVEMENTS

MOVEMENT	EXAMPLE IN SPORT
FLEXION	WHEN YOU BRING YOUR LEG BACKWARDS IN PREPARATION TO KICK A FOOTBALL

Explain one **adaptation** of the skeletal system stating why it would benefit a performer.

TYPES OF SYNOVIAL JOINTS

MOVEMENT	EXAMPLE IN SPORT
PIVOT	TURNING YOUR NECK TO LOOK UPWARDS OR SIDEWAYS WHEN PLAYING BADMINTON

Type	Meaning
	To the front or in front
	To the rear or behind
	Towards the midline or axis, an imaginary line down the centre of the body
	Away from the midline or axis
	Near to the root or origin (the proximal of the arm is towards the shoulder)
	Away from the root or origin (the distal of the arm is towards the hand)
	Above
	Below

Ligaments are tough elastic fibres that link _____

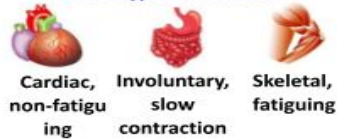
Tendons connect _____

Cartilage _____
bones rubbing together at joints.

State the three additional factors affecting the skeletal

The Muscular System

Three types of Muscles



Three types of Muscle Contraction

Isometric
Length of muscle does not change

Concentric
Muscle shortens

Eccentric



- Slow contraction
- Slow to fatigue
- Suited to aerobic activities
- Uses oxygen
- Rich blood supply

Muscle Fibre Types

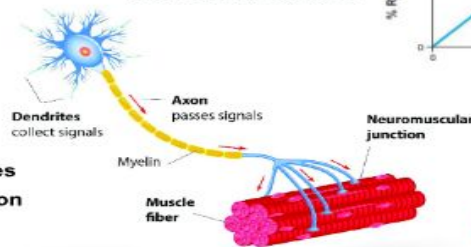


- Fast twitch fibres
- Fast contraction and powerful force
- Resistant to fatigue
- Need less oxygen
- Suited to speed, power and strength activities
- Fast twitch fibres
- Rapid contraction
- Large force produced
- Fatigue so better suited to anaerobic short events
- Stop-start sports

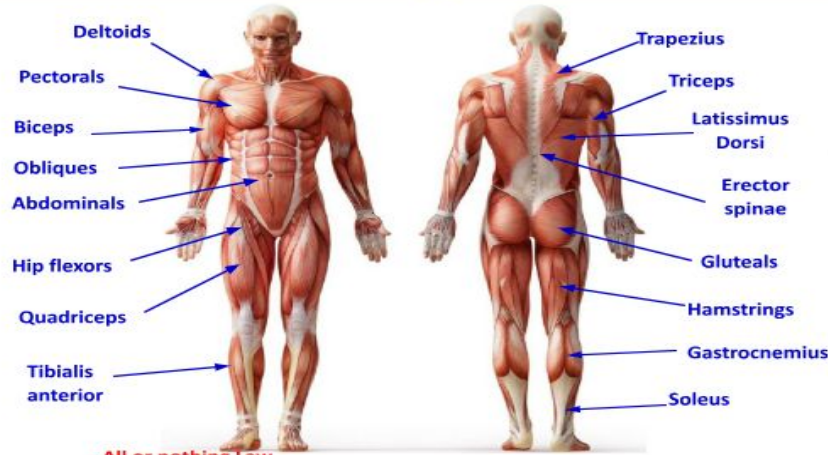
Nerve stimulation is needed for contraction
Motor units used which contain motor neurons.

When a motor unit is stimulated all the muscles attached will contract

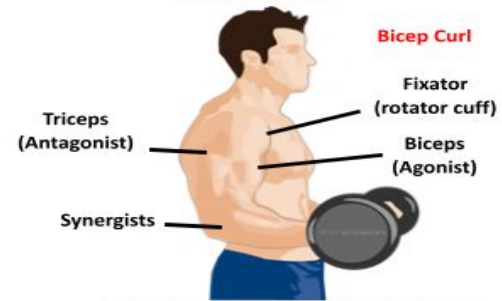
MOTOR NEURON



All or nothing Law



Antagonistic Pairs



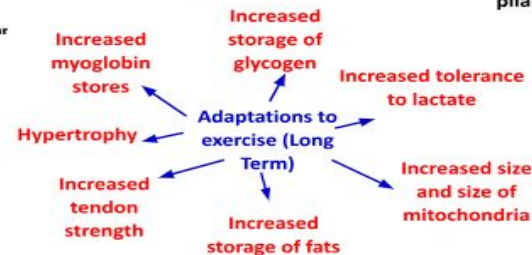
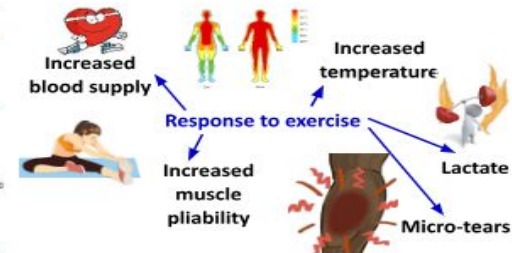
Antagonistic pairs = muscles that work together to produce movement (One muscle contracts whilst the other relaxes)

Agonist = muscle shortens to create movement

Antagonist = muscle relaxes during movement

Fixator = stops unwanted movement/stabilises

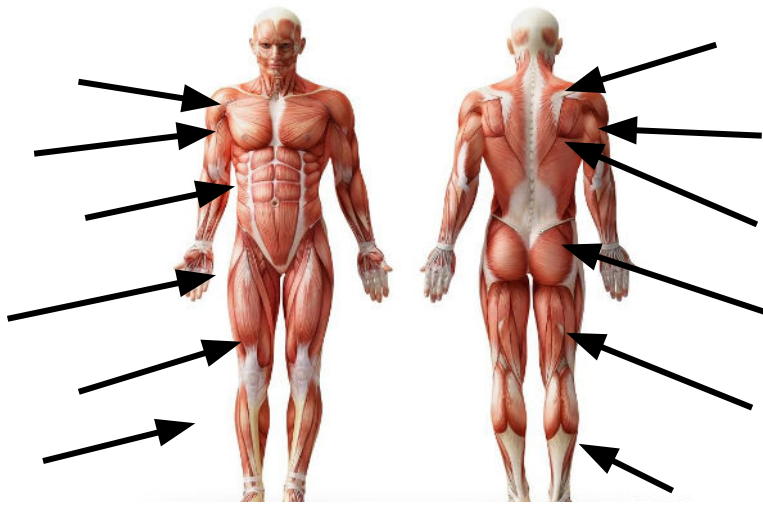
Synergists = Assists the agonist



Additional Factors

Age: Muscle atrophy

Cramp: involuntary contraction



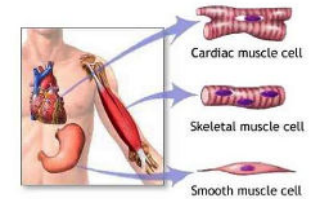
THE MUSCULAR SYSTEM

Muscle type	Characteristics and functions of each muscle type
Cardiac	
Skeletal / Voluntary	
Smooth / Involuntary	

Dennis is an athlete who swims regularly. What responses and adaptations will happen to Dennis' muscular system?

Responses

Adaptations

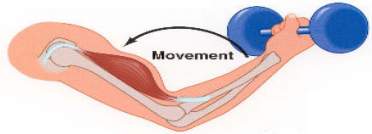


State the additional factors affecting the muscular system

Muscle	Function
Triceps	
Deltoids	
Pectorals	
Biceps	



During an _____ contraction the length of a muscle does not change and the joint angle does not alter. However, the muscle is actively engaged in holding a static position.



During an _____ contraction the muscle shortens as the muscle fibres contract.



An _____ contraction is when a muscle returns to its normal length after shortening against resistance.

ANTAGONISTIC PAIRS

Define these three terms: agonist, antagonist and antagonistic pairs.

Write down as many antagonistic pairs as you can think of.

TYPE 1

Slow twitch muscle fibres are designed to work _____ as they are excellent at using oxygen to help create energy.



LONG DISTANCE EVENTS

TYPE 2A

Fast twitch muscle fibres are designed to work _____.

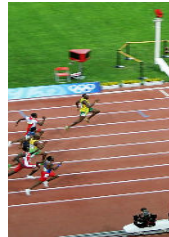
They contract quickly with high force, but can work for a relatively long time.



TYPE 2X INVASIVE GAMES PLAYER

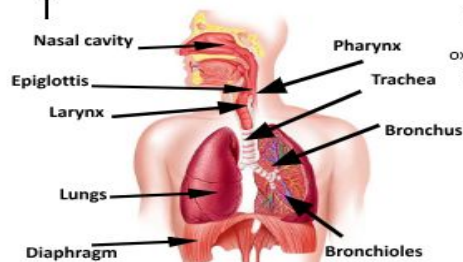
They are pure fast twitch muscle fibres, which work _____.

They contract very quickly with huge force, but they fatigue very quickly.



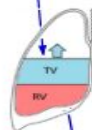
The Respiratory System

Structure of the Respiratory System



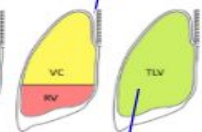
Lung Volumes

Tidal volume
(amount of oxygen breathed in normal per breath)



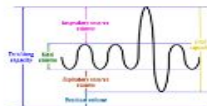
Residual Volume
(volume of air left in the lungs)

Vital capacity
(maximal amount of air breathed out after maximum inhalation)



Total Lung Volume (maximal amount of air breathed out after maximum inhalation)

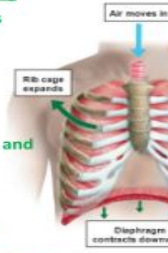
Pulmonary ventilation
(Total amount of air inhaled per minute)



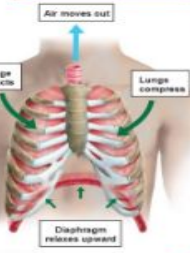
Mechanics of breathing

Inspiration (air in)

Intercostal muscles contract
Ribs lifted
Diaphragm contracts and flattens
Thoracic cavity pressure drops



Expiration (air out)



Intercostal muscles relax
Ribs lower
Diaphragm relaxes
Thoracic cavity pressure increased

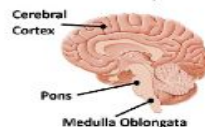
Air drawn in

Air drawn out

Control of ventilation

Neural Control of Ventilation

Voluntary ventilation
Breathing can be controlled voluntarily by the cerebral cortex (e.g. holding your breath)



Voluntary ventilation

Breathing is controlled by the respiratory control centre (Medulla Oblongata)

Chemical Control of Ventilation

Chemoreceptors

Located in the aorta and medulla oblongata

Detect changes in blood acidity (pH)

- Exercise will increase lactate production
- Breathing increases
- Lactic acid is broken down faster

Detect changes in blood CO₂ concentration

- Exercise will increase
- CO₂ removed more rapidly
- Breathing rate increases (dependent on exercise intensity)

Additional Factors

Asthma

Effects of altitude/partial pressure

Response to Exercise (short term)



Increased breathing rate

Increased tidal volume

Response to Training (Long term)



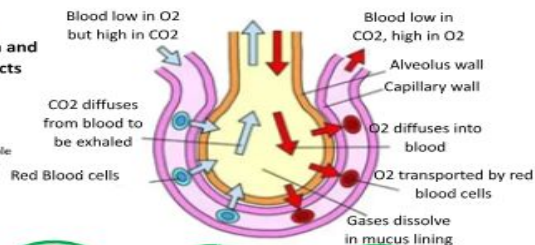
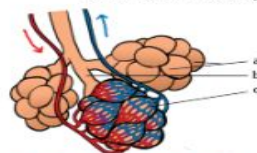
Increased vital capacity

Increased strength of respiratory muscles

Increased diffusion rates (O₂/CO₂)

Gaseous Exchange

Process of exchanging oxygen and nutrients with waste products



O₂ enters the alveoli

O₂ diffuses across alveoli membrane

Each alveolus has a network of capillaries

O₂ diffuses across into the blood stream

O₂ attaches to red blood cells

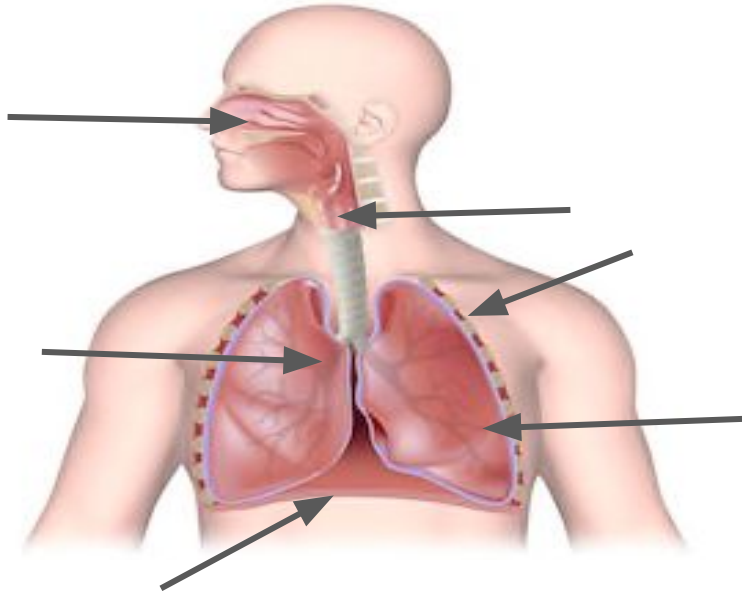
Exhaled from the lungs with water vapour

Diffuses across the alveoli membrane

Carried to the lungs

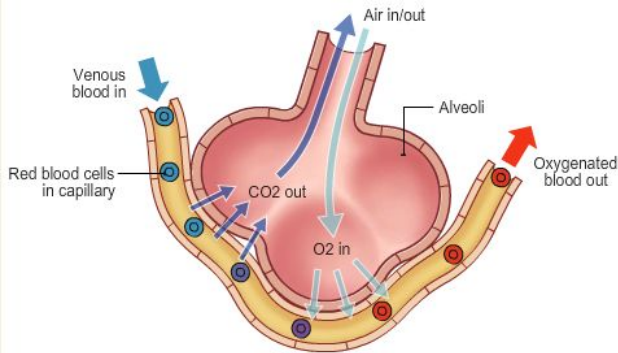
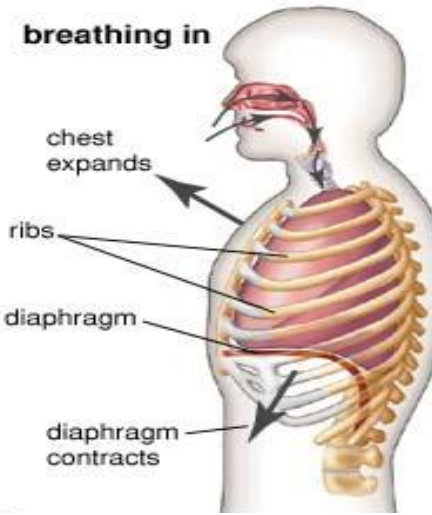
CO₂ diffuses into the blood stream

CO₂ created through respiration



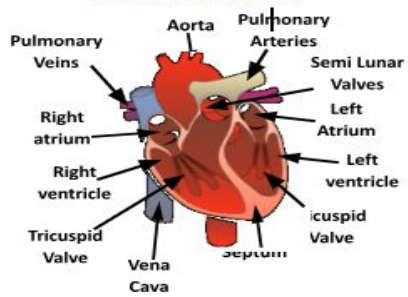
Describe the process of breathing in:

Breathing out:

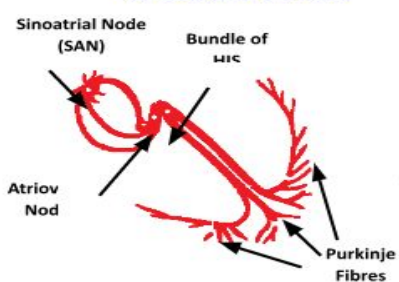


Describe the gaseous exchange in 3 bullet points

Structure of the Heart

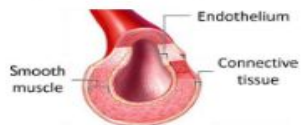


Conduction of the Heart



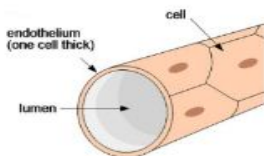
Structure of Blood Vessels

Artery / Arterioles



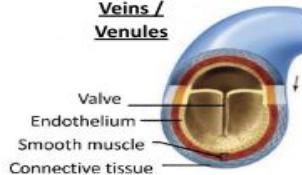
- Takes blood **A**way from the heart (exception the pulmonary artery)
- Oxygenated blood
- Thick elastic walls
- High pressure

Capillary



- One cell thick
- Diffusion
- Gaseous exchange (oxygen in CO₂ waste out)

Veins / Venules



- Blood back to the heart
- Deoxygenated blood
- Thin walls
- Large lumen
- Lower pressure
- Valves

Functions of the System

- Delivering oxygen and nutrients
- Removing waste products
- Thermoregulation
- Fighting infection
- Clot blood



Exercise (Short term)

- 1) Anticipatory rise
- 2) Increased heart rate
- 3) Increased Cardiac output
- 4) Increased blood pressure
- 5) redirection of blood

Training (Long Term)

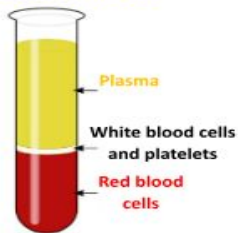
- 1) Cardiac hypertrophy
- 2) Decrease in resting heart rate
- 3) Decrease in resting stroke volume
- 4) Reduction in resting blood pressure
- 5) Decreased recovery time
- 6) Increased blood volume

YOU THERE
(YEAH, YOUUUUUUU!!!)

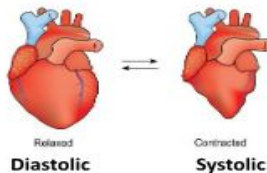
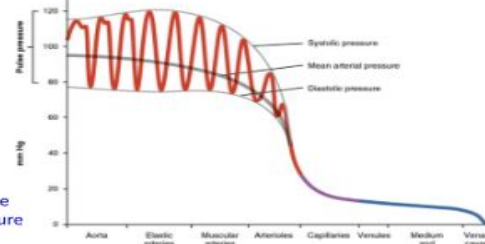


THERE'S A DIFFERENCE
BETWEEN EXERCISING
AND TRAINING. LEARN IT!!

Composition of blood



Blood pressure



N
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c
o
n
t
r
o
l
o
f
h
e
a
r
t
r
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e

Sympathetic nervous system



Excites – fight or flight

- 1) Secretes adrenaline
- 2) Increases heart rate
- 3) Increased blood pressure
- 4) Increases contractility of the heart
- 5) Stimulates vasoconstriction/vasodilation

Parasympathetic nervous system



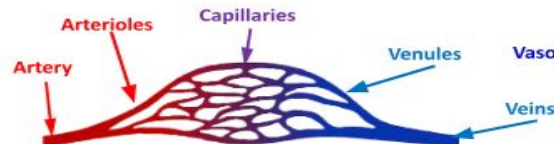
Calms/relaxes

- 1) Decrease heart rate
- 2) Decrease blood pressure
- 3) Decrease cardiac output (Q)

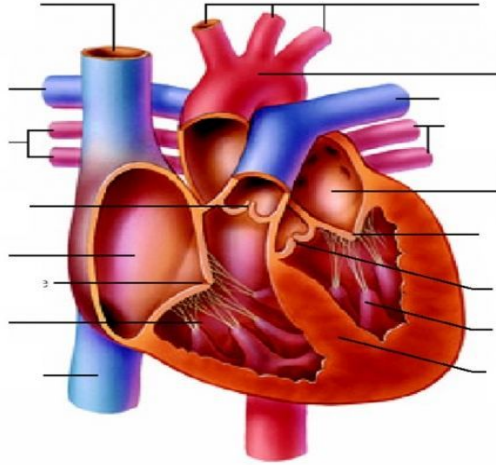
Vasodilation



Vasoconstriction



THE CARDIOVASCULAR SYSTEM



State the functions of the cardiovascular system?

Describe the pathway of blood

The blood is pumped from the right ventricle through the pulmonary valve into the pulmonary artery carrying deoxygenated blood to the lungs.



artery

Artery Function



vein

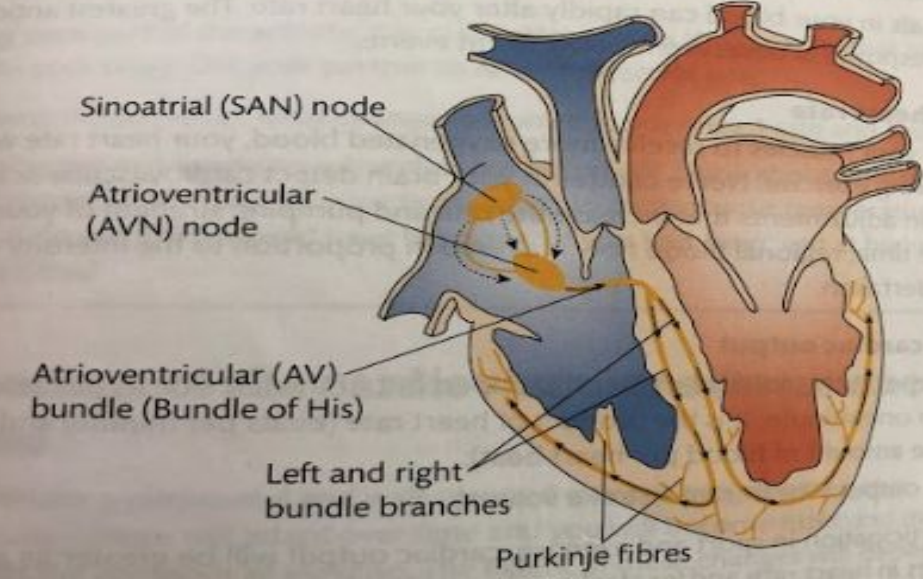
Vein Function



capillary

Capillary Function

Nervous control of the cardiac cycle.
What is the role of the labels (to your right)?



Red blood cells

White blood cells

Platelets

Plasma

State the responses of the CV system in a single sport or exercise session

State the adaptations of the CV system due to exercise

State the additional factors of the CV system

Energy Systems

Adenosine Triphosphate (ATP)

Type: to insert

The energy comes from breaking the bonds between each phosphate

- ATP is the only usable form of energy in the body.
- The body has a store of **3 seconds of ATP**.
- Then there are 3 systems that can resynthesise it

ATP-PC System

Type: Anaerobic

Fuel source : Phosphocreatine (PC)

Duration: 8-10 seconds

Used in : short explosive power

Recovery time : 3 minutes

ATPase

Energy

Adenosine diphosphate (ADP)

Let's Refuel using Creatine Phosphate

Creatine Kinase

Energy

Energy

Lactate System

Type: Anaerobic Glycolysis

Fuel source : Glycogen

Duration: 10 secs to 2 mins

Used in : stop start games/ court sports/400m

Recovery time : 1-2 hours

Glycogen phosphorylase

Phosphofructokinase

Lactate dehydrogenase

This Process is known as Anaerobic Glycolysis

Aerobic System

Type: Aerobic Glycolysis

Fuel source : Glycogen and fat

Duration: Longer than 2 mins

Used in : Long distance and endurance events

Recovery time : 24 - 48 hours

Glycolysis

Krebs

Electron Transport Chain

Fats

Beta Oxidation

CO₂

Hydrogen

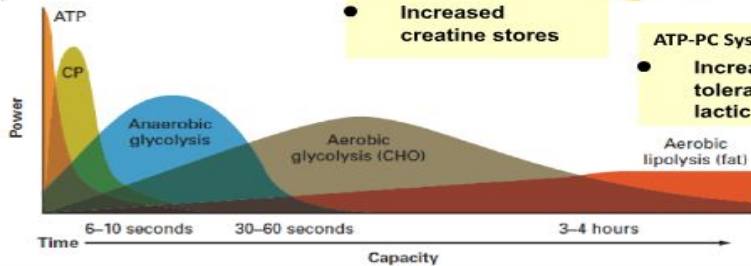
Ions

Electrons

Water

34 ATP

Total Yield: 38 ATP



ATP-PC System

- Increased creatine stores

Adaptations to Systems Long Term

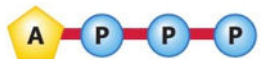
ATP-PC System

- Increased tolerance to lactic acid

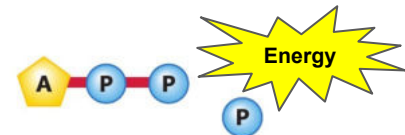
Aerobic System

- Increased use of fats
- Increased storage of glycogen

The role of ATP



What is ATP?

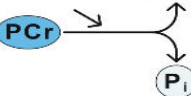


How does it release energy?

ATP-PC (Alactic System)

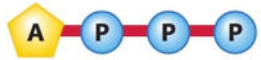


creatine

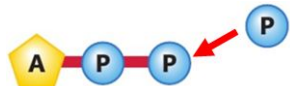


How long does ATP Last for?

What compound is broken, allowing the phosphate molecule to join an ADP molecule to create a new ATP molecule?



How long does the ATP-PC System last for?



THE ENERGY SYSTEM

Use these spaces to familiarise yourself with the energy system.

The Lactate System



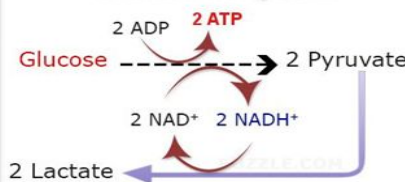
Where is glycogen stored?

When one molecule of glycogen is broken down, how many ATP is produced? What else is produced?

What happens to that new substance? What does it turn into?

How long does the Lactate system last for? How long does it take to recharge?

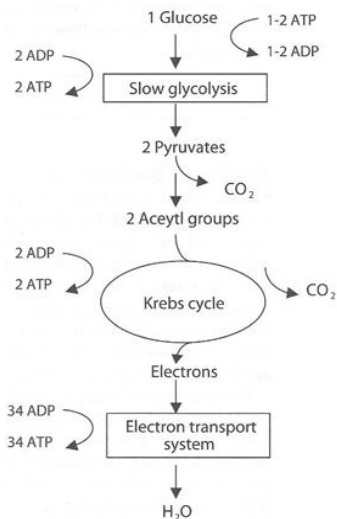
Lactic Acid System



Energy System	Aerobic or Anaerobic?	Energy Source	How long does it last?	Recover Time	Sporting Examples
ATP-PC System	Anaerobic			1:10	

Energy System	Aerobic or Anaerobic?	Energy Source	How long does it last?	Recover Time	Sporting Examples
Lactate System		Glucose Glycogen		8 minutes	

The Aerobic System



Stage 1 - anaerobic glycolysis

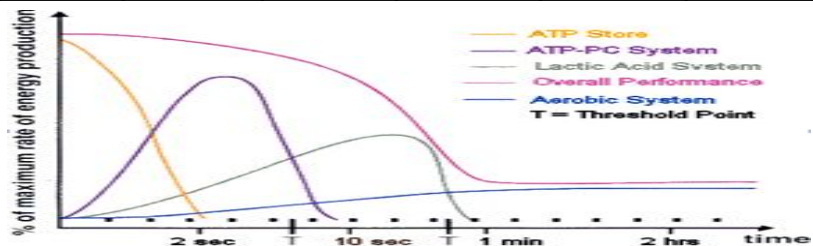
Stage 2 - Krebs Cycle

Stage 3 - The electron transport chain

Energy System	Aerobic or Anaerobic?	Energy Source	How long does it last?	Recover Time	Sporting Examples
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Aerobic

Few hours but can be up to 2-3 days



Adaptation

Explanation

Increase in creatine stores

Increase tolerance to lactic acid

Improved aerobic energy system

The use of fat as an energy source

Increase storage of glycogen

Increase in mitochondria

Additional factors - Diabetes, Hyperglycaemic and Hypoglycaemic attacks

Diabetes

Hyperglycaemic

Hypoglycaemic