# 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.

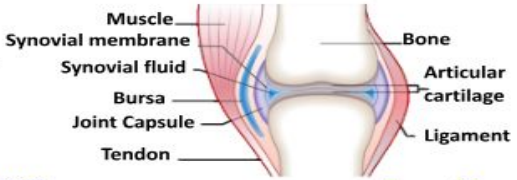
Please bring this in on your first day back after summer

# Skeletal System

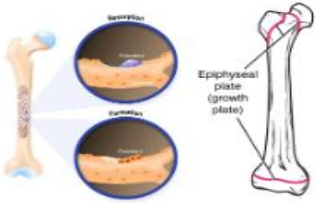
## Functions

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

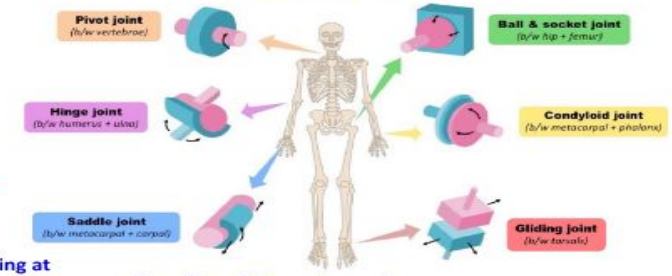
## Structure of a joint



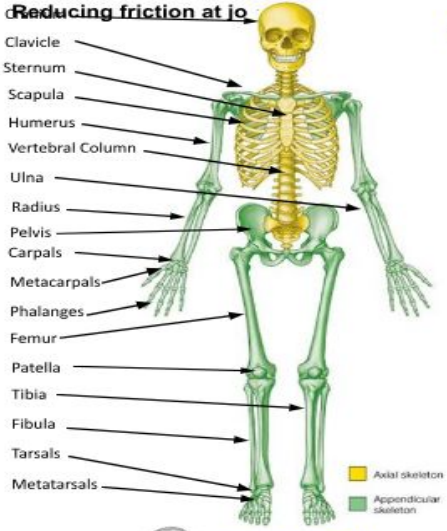

## Bone Growth




## 6 Types of synovial joint




## Bones




## 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<br>**Joint Type:** Ball & Socket |
| **Elbow** | Humerus, Radius, Ulna<br>**Joint Type:** Hinge |
| **Wrist** | Carpals, Radius, Ulna<br>**Joint Type:** Hinge |
| **Hip** | Illium, Pubis, Ischium, Femur<br>**Joint Type:** Ball & Socket |
| **Knee** | Femur, Tibia, Fibula<br>**Joint Type:** Hinge |
| **Ankle** | Tibia, Fibula, Talus<br>**Joint Type:** Hinge |

## Short Term Effects of exercise

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

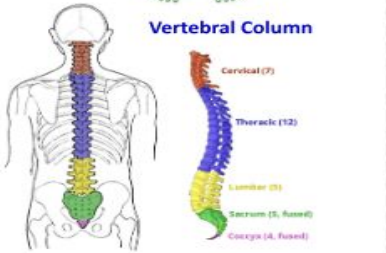
## Long Term Effects of exercise

- Increased bone strength
- Increased ligament strength

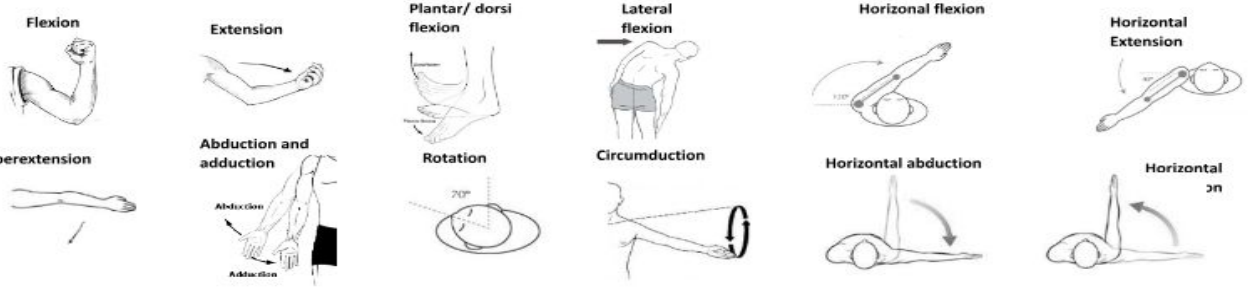
## Kyphosis

## Lordosis

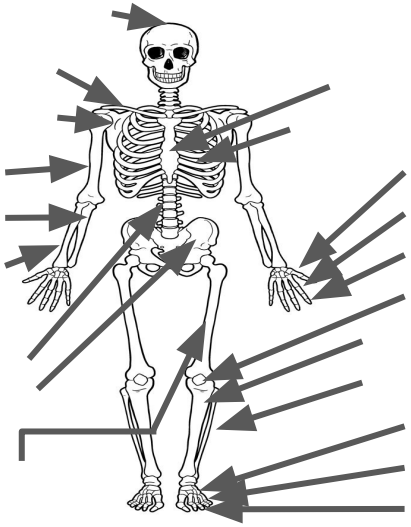

## Vertebral Column




## Ranges of movement at synovial joints



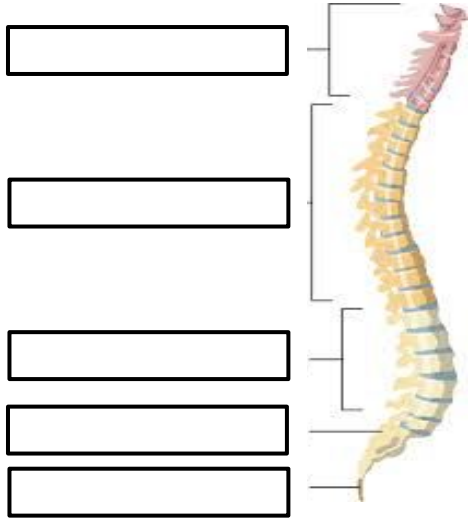
# THE SKELETAL SYSTEM



| FUNCTION OF A SKELETON |
| --- |
| Movement |
| |
| |
| |
| |

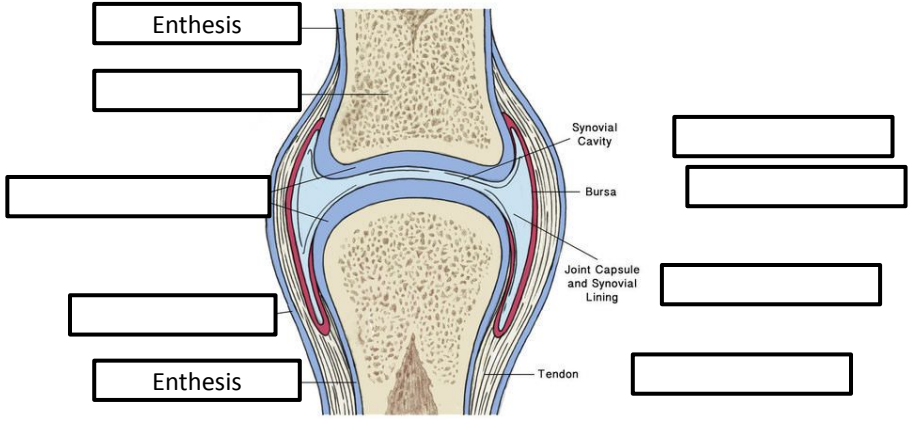
**PROCESS OF BONE GROWTH**

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



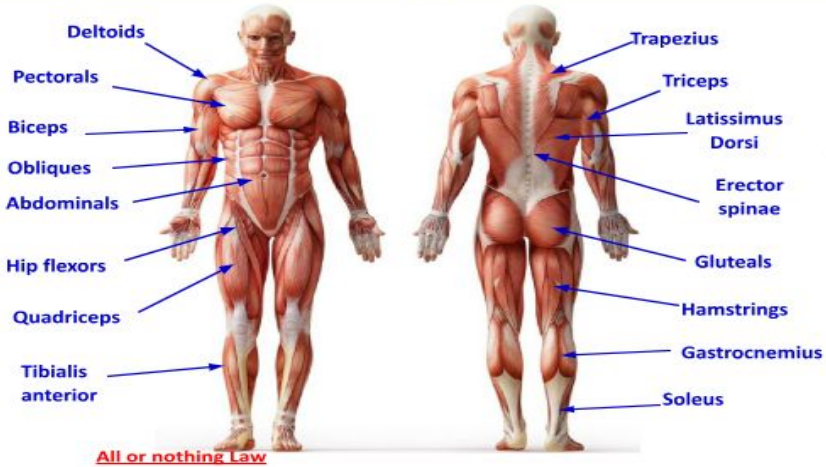
Cardiac, non-fatiguing | Involuntary, slow contraction | Skeletal, fatiguing

## Three types of Muscle Contraction

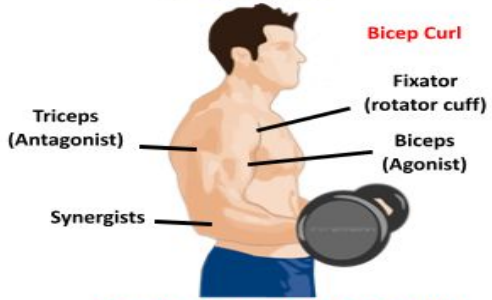
**Isometric**
Length of muscle does not change

**Concentric**
Muscle shortens

**Eccentric**




## Antagonistic Pairs




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

**Agonist** = muscle shortens to create movement

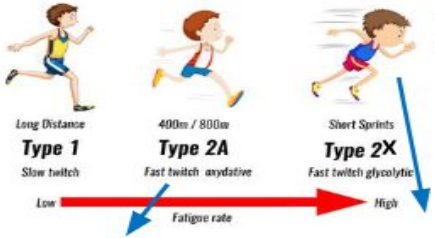
**Antagonist** = muscle relaxes during movement

**Fixator** = stops unwanted movement/stabilises

**Synergists** = Assists the agonist

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

## Muscle Fibre Types



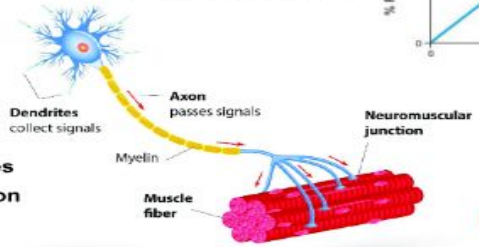

- Fast twitch fibres
- Fast contraction and powerful force
- Resistant to fatigue
- Need less oxygen
- Suited to speed, power and strength activities

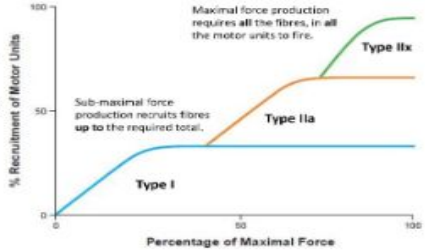
- Fast twitch fibres
- Rapid contraction
- Large force produced
- Fatigue so better suited to anaerobic short events
- Stop- start- sports

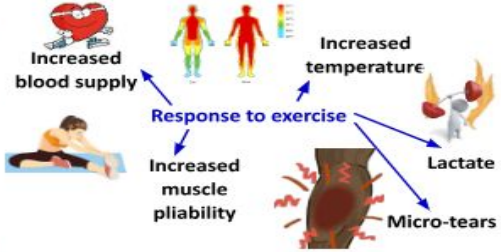
**All or nothing Law**

- 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



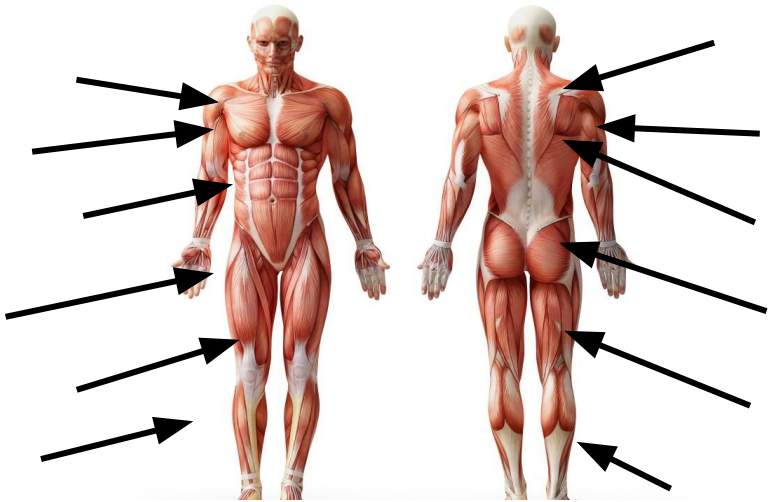





**Additional Factors**

Age: Muscle atrophy

Cramp: involuntary contraction



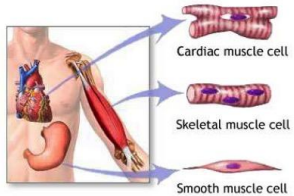
# THE MUSCULAR SYSTEM

| 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?**

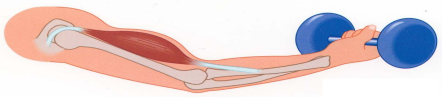
Responses

Adaptations

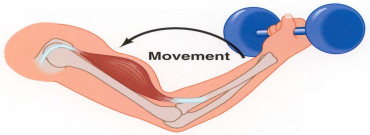



**State the additional factors affecting the muscular system**

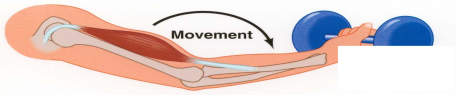
| Muscle | Function |
|---|---|
| Triceps | |
| Deltoids | |
| Pectorals | |
| Biceps | |



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

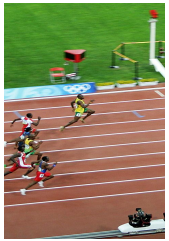
TYPE 2A

Fast twitch muscle fibres are designed to work _____.

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

INVASION GAMES PLAYER

TYPE 2X

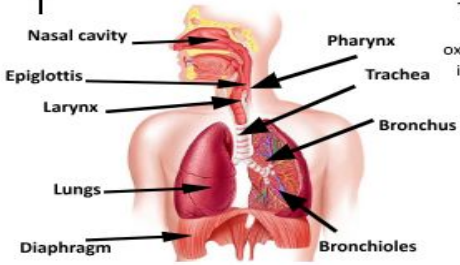


They are pure fast twitch muscle fibres, which work _____.

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

# The Respiratory System

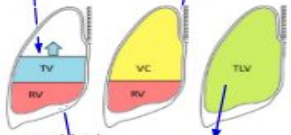
## Structure of the Respiratory System




## Lung Volumes

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

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




**Pulmonary ventilation** (Total amount of air inhaled per minute)

**Residual Volume** (volume of air left in the lungs

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

## Mechanics of breathing

### Inspiration (air in)

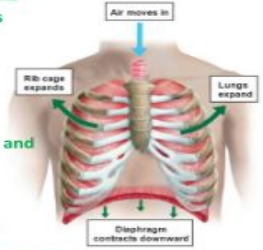
Intercostal muscles contract

Ribs lifted

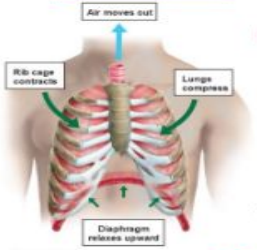
Diaphragm contracts and flattens

Thoracic cavity pressure drops

Air drawn in




### Expiration (air out)



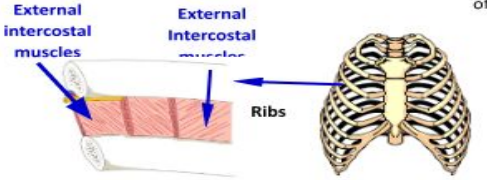

Intercostal muscles relax

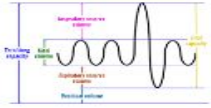
Ribs lower

Diaphragm relaxes

Thoracic cavity increased

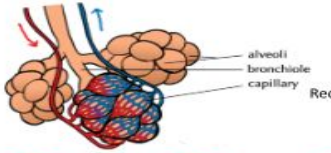
Air drawn out

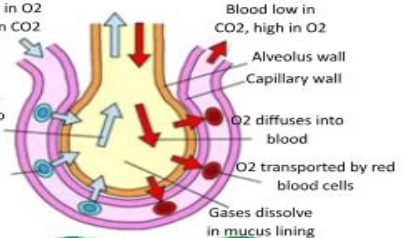


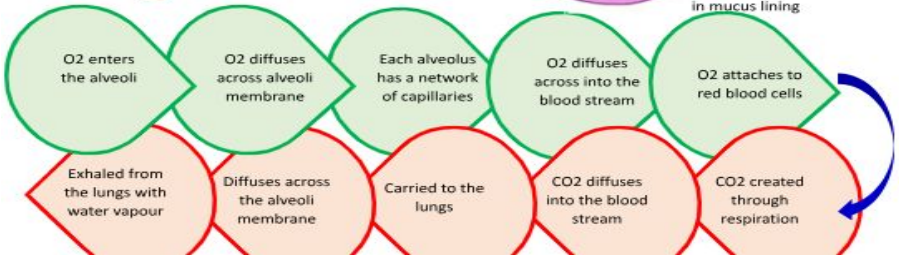



## Gaseous Exchange

**Process of exchanging oxygen and nutrients with waste products**



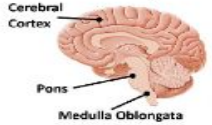




## Control of ventilation

### 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
- Latic 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)

## 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 ($O_2/CO_2$)

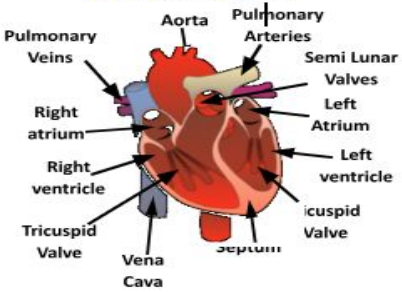
## Additional Factors

Asthma

Effects of altitude/ partial pressure

# The Cardiovascular System

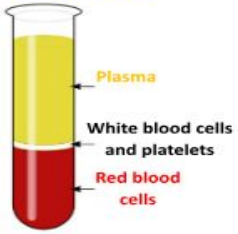
## Structure of the Heart

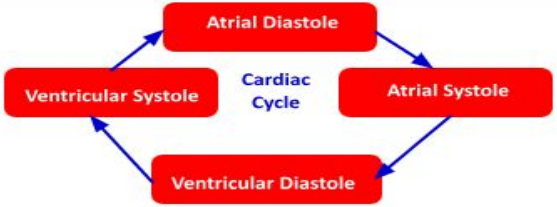



## Functions of the System

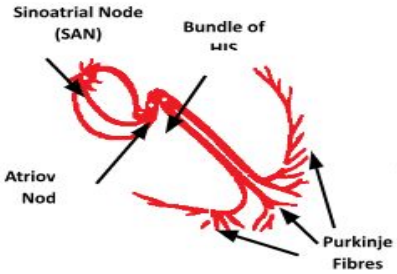
- Delivering oxygen and nutrients
- Removing waste products
- Thermoregulation
- Fighting infection
- Clot blood


## Composition of blood




## Conduction of the Heart



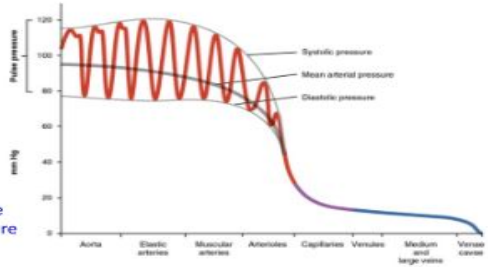

## YOU THERE (YEAH, YOUUUUUU!!!)

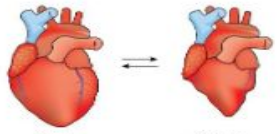
THERE'S A DIFFERENCE BETWEEN EXERCISING AND TRAINING. LEARN IT!!!

**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

## Blood pressure




**Diastolic** **Systolic**

## Neural control of heart rate

### Sympathetic nervous system

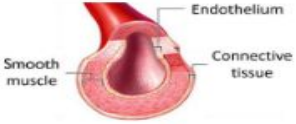
**Excites – fight or flight**
1) Secretes adrenaline
2) Increases heartrate
3) Increased blood pressure
4) Increases contractibility of the heart
5) Stimulates vasoconstriction/ vasodilation

### Parasympathetic nervous system

**Calms/relaxes**
1) Decrease heart rate
2) Decrease blood pressure
3) Decrease cardiac output (Q)

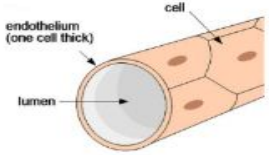
## Structure of Blood Vessels

### Artery / Arterioles



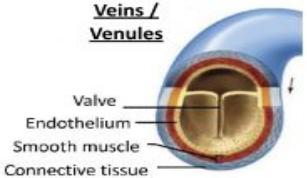

- Takes blood **A**way from the heart (exception the pulmonary artery)
- Oxygenated blood
- Thick elastic walls
- High pressure

### Capillary

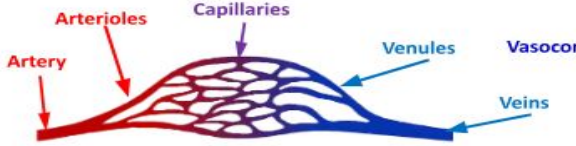



- One cell thick
- Diffusion
- Gaseous exchange (oxygen in $CO_2$ waste out)

### Veins / Venules



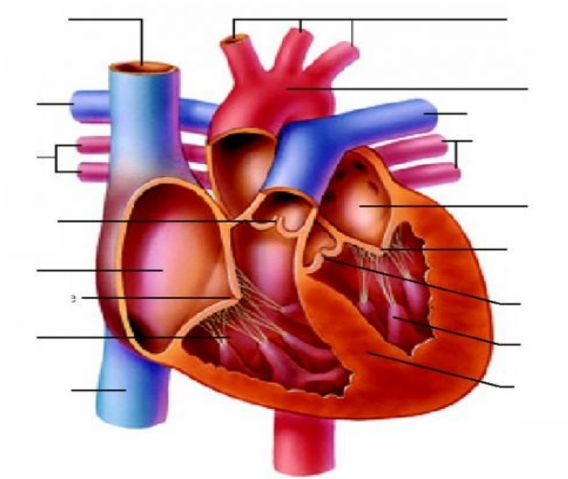

- Blood back to the heart
- Deoxygenated blood
- Thin walls
- Large lumen
- Lower pressure
- Valves




## Vasodilation

## Vasoconstriction

# THE CARDIOVASCULAR SYSTEM



State the functions of the cardiovascular system?

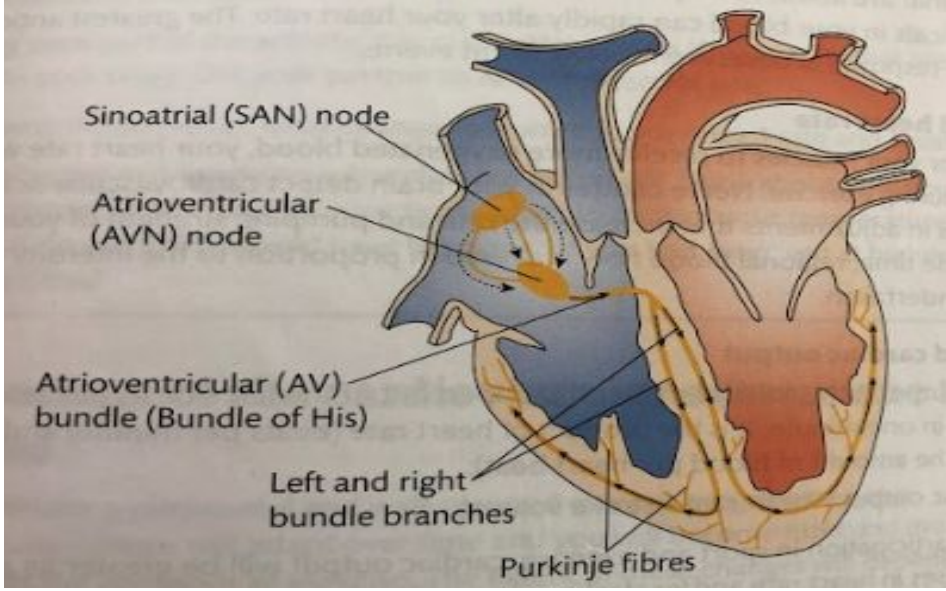
**Describe the pathway of blood**
The blood is pumped from the right ventricle through the pulmonary valve into the pulmonary artery carrying deoxygenated blood to the lungs.


Artery Function


Vein Function


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

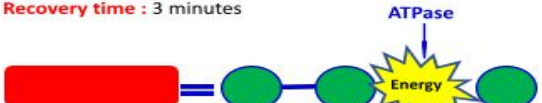
## Adenosine Triphosphate (ATP)

The energy comes from breaking the bonds between each phosphate

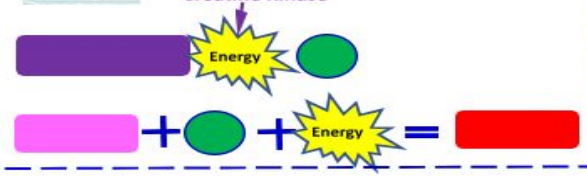

- ATP is the only usable form of energy in the body.
- The body has a store of 3 seconds of ATP.
- Then there are 3 systems that can resynthesise it

## ATP-PC System

**Type:** Anaerobic
**Fuel source :** Phosphocreatine (PC)
**Duration:** 8-10 seconds
**Used in :** short explosive power
**Recovery time :** 3 minutes

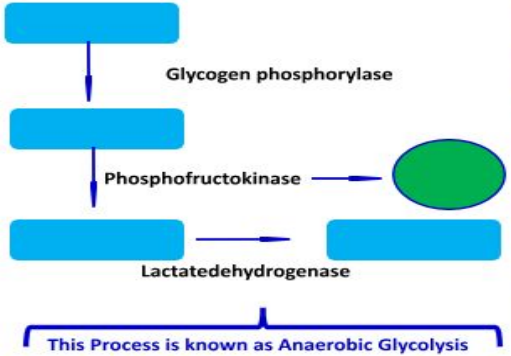



Let's Refuel using Creatine Phosphate




## Lactate System

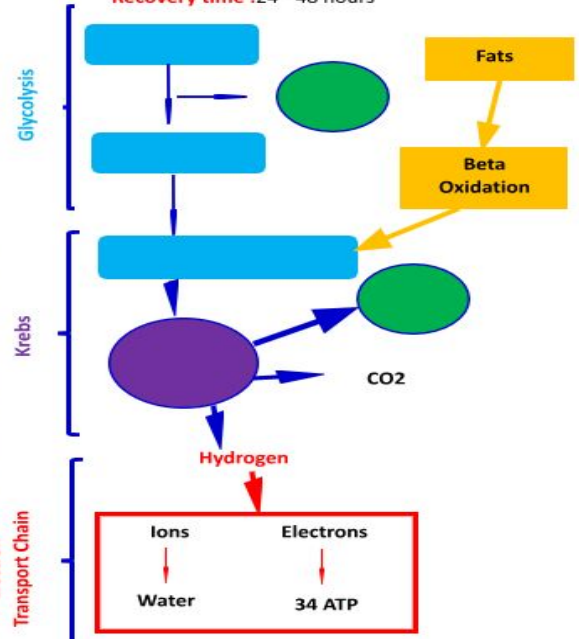
**Type:** Anaerobic Glycolysis
**Fuel source :** Glycogen
**Duration:** 10 secs to 2 mins
**Used in :** stop start games/ court sports/400m
**Recovery time :** 1-2 hours




This Process is known as Anaerobic Glycolysis

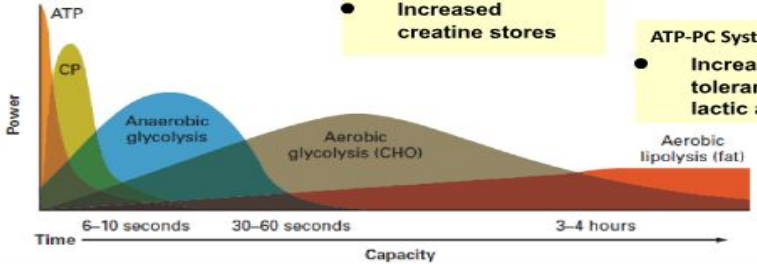
## Aerobic System

**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




**Total Yield: 38 ATP**

## Adaptations to Systems Long Term




**ATP-PC System**
- Increased creatine stores

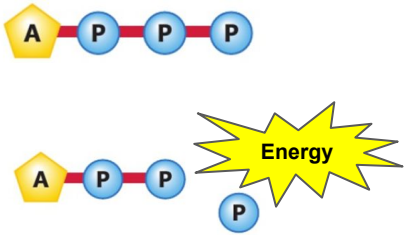
**ATP-PC System**
- Increased tolerance to lactic acid

**Aerobic System**
- Increased use of fats
- Increased storage of glycogen

# THE ENERGY SYSTEM

Use these spaces to familiarise yourself with the energy system.

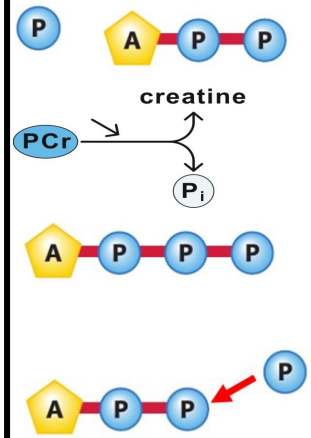
## The role of ATP




What is ATP?

How does it release energy?

## ATP-PC (Alactic System)



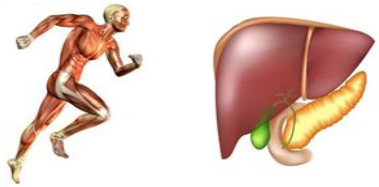

How long does ATP Last for?

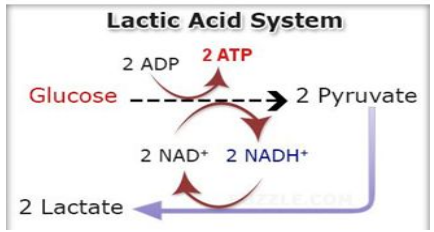
What compound is broken, allowing the phosphate molecule to join an ADP molecule to create a new ATP molecule?

How long does the ATP-PC System last for?

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

## The Lactate System






Where is glycogen stored?

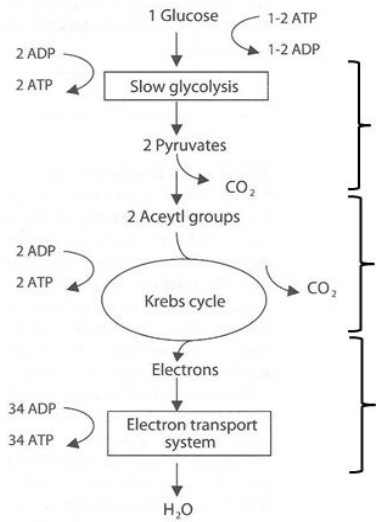
When one molecule of glycogen is broken down, how many ATP is produced? What else is produced?

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?

| 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

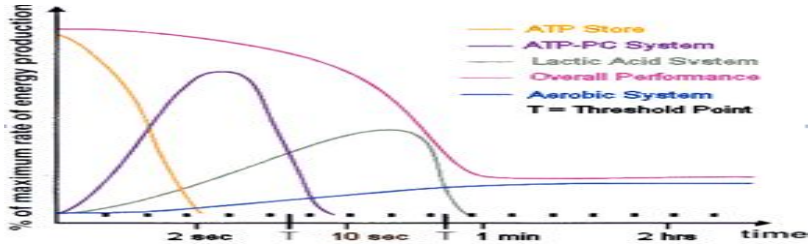



**Stage 1 - anaerobic glycolysis**

**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 |
|---|---|---|---|---|---|
| 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 |
|---|---|---|
| | | |