The English Martyrs Catholic School and Sixth Form College

Year 11 Knowledge organiser

PE (CTEC)

A Member Of Bishop Hogarth Catholic Education Trust

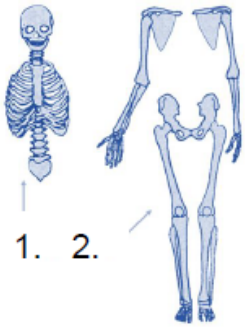
Name:

LO1 SKELETAL SYSTEM- RECALL

CAMBRIDGE TECHNICALS LEVEL 3 SPORT AND PHYSICAL ACTIVITY UNIT 1- PRINCIPLES OF ANATOMY AND PHYSIOLOGY IN SPORT

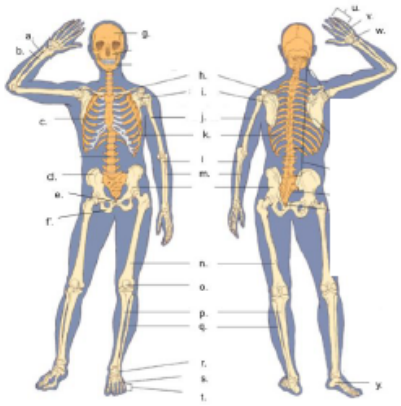
LO1- UNDERSTAND THE SKELETAL SYSTEM IN RELATION TO EXERCISE AND PHYSICAL ACTIVITY

Parts of the skeleton



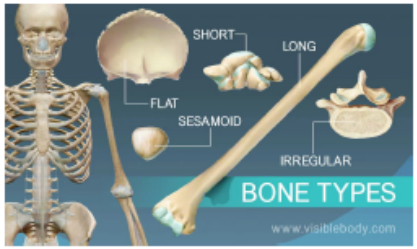
Name of part of skeleton	Function
1 AXIAL	TO PROTECT THE ORGANS
2 APPENDICULAR	TO PROVIDE THE BODY WITH A WAY TO MOVE.

Major bones of the skeleton



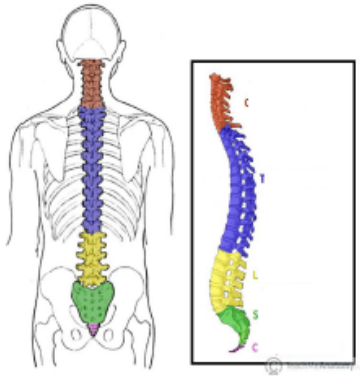
A. ULNA
B. RADIUS
C. STERNUM
D. ILIUM
E. PUBIS
F. ISCHIUM
G. CRANIUM
H. CLAVICLE
I. SCAPULA
J. HUMERUS
K. RIBS
L. RADIUS
M. ULNA
N. FEMUR
O. PATELLA
P. TIBIA
Q. FIBULA
R. TARSALS
S. METATARSALS
T. PHALANGES
U. PHALANGES
V. METACARPALS
W. TARSALS
X. VERTEBRAL COLUMN
Y. TALUS

Bone shapes



Bone shape	Example in the body
FLAT	SKULL, RIBS, SCAPULA
SHORT	CARPALS, TARSALS
LONG	FEMUR, TIBIA, PHALANGES
IRREGULAR	VERTEBRA
SESAMOID	PATELLA

Vertebral column



Name of section of vertebra	Nº of vertebra in section
CERVICAL	7
THORACIC	12
LUMBAR	5
SACRUM	–
COCCYX	–

Functions of the skeleton

Function of skeleton	Description of function/example
PROTECTION	SKELETON PROTECTS (VITAL) ORGANS (FROM DAMAGE DUE TO IMPACT). E.G. CRANIUM- BRAIN, RIBS- LUNGS OR VERTEBRA- SPINAL CORD.
SUPPORT	BONES PROVIDE A SUPPORT ORGANS IN THE BODY. E.G. THE LUNGS ARE ATTACHED TO THE RIBS
MOVEMENT	SKELETON IS JOINTED (TO ALLOW MOVEMENT) AND ATTACHMENT TO MUSCLES (ALLOWS MOVEMENT) E.G.KNEE/FEMUR FOR JUMPING, SHOULDER/ HUMERUS FOR THROWING A BALL
BLOOD CELL PRODUCTION	(RED/WHITE) BLOOD CELLS ARE FORMED IN (BONE) MARROW
SHAPE	BONES PROVIDE SHAPE TO BODY AND DEFINE HEIGHT
MINERAL STORAGE	BONES ARE STORES OF MINERALS LIKE CALCIUM & PHOSPHORUS THAT CAN BE USED IN OTHER PROCESSES IN THE BODY

LO1 SKELETAL SYSTEM- RECALL

CAMBRIDGE TECHNICALS LEVEL 3 SPORT AND PHYSICAL ACTIVITY UNIT 1- PRINCIPLES OF ANATOMY AND PHYSIOLOGY IN SPORT

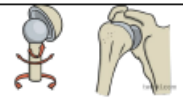
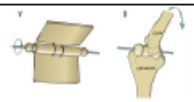
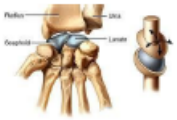
LO1- UNDERSTAND THE SKELETAL SYSTEM IN RELATION TO EXERCISE AND PHYSICAL ACTIVITY

Classification of joints

Name the three different classifications of joint and give an example of each:

Type of joint	Example
FIXED/FUSED	SKULL/PELVIS
CARTILAGINOUS	VERTEBRAL COLUMN
SYNOVIAL JOINT	KNEE/ELBOW/SHOULDER

Type of synovial joints

	Type of synovial joint	Example
	BALL AND SOCKET	SHOULDER, HIP
	HINGE	KNEE, ELBOW
	CONDYLOID	WRIST
	PIVOT	RADIO ULNA, TOP 2 VERTEBRA (ATLAS & AXIS)
	SADDLE	THUMB
	GLIDING	CARPALS, TARSALS

Synovial joint

Use the words in the box below to complete the table.

Ligaments *Meniscus* *Pads of fat* *Synovial membrane*
Articular cartilage *Joint capsule* *Bursae* *Synovial fluid*

Feature	Structure	Function
JOINT CAPSULE	Fibrous tissue encasing the joint	Helps to strengthen joint and add stability
LIGAMENTS	Join bone to bone	Reinforces and strengthens the joint
MENISCUS	Discs of fibrocartilage improve the fit between the ends of long bones at a joint	Makes the joint more stable and minimises wear and tear
ARTICULAR CARTILAGE	Covers the ends of articulating surfaces of the joint	Reduces friction
SYNOVIAL FLUID	A fluid that fills the joint capsule	Nourishes and lubricates the articular cartilage
SYNOVIAL MEMBRANE	Connective tissue that surrounds the synovial fluid	Contains the synovial fluid and helps to remove debris from the joint
BURSAE	A sac filled with synovial fluid between tendons & ligaments	Forms a capsule around the joints and adds stability
PADS OF FAT	Made of fat cells	Protect the articular cartilage from trauma

Use a pencil and complete the diagram below

Short and long term effects of exercise on skeletal system

Effects of a warm up and cool down on the skeletal system

1. Reduce the impact of exercise of the joint
2. Help increase the range of movement at joints

Short term effects of exercise on the skeletal system

1. Increase in production of synovial fluid in the joints
2. Leads to an increase in range of motion (ROM) in the joints

Long term effects of exercise on the skeletal system

Positive	Negative
1. Stronger thicker bones 2. Increased joint stability/stronger joints 3. Prevents osteoporosis 4. Reduced risk of (osteo)arthritis 5. Improved posture 6. Weight management	1. Increased risk of (osteo)arthritis 2. Increased risk if chronic/overuse injuries (e.g. shin splints, tennis elbow) 3. Increased risk of acute/impact injuries (e.g. strains, spains, fractures, etc.)

LO2 MUSCULAR SYSTEM- RECALL

CAMBRIDGE TECHNICALS LEVEL 3 SPORT AND PHYSICAL ACTIVITY UNIT 1- PRINCIPLES OF ANATOMY AND PHYSIOLOGY IN SPORT

LO2- UNDERSTAND THE MUSCULAR SYSTEM IN RELATION TO EXERCISE AND PHYSICAL ACTIVITY

Types of muscular contraction

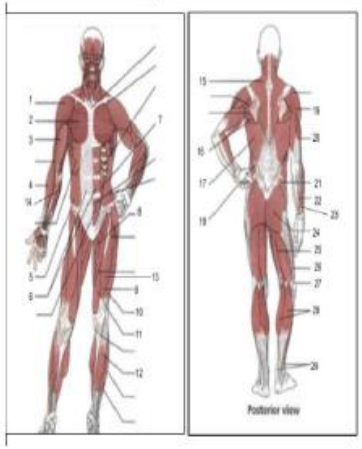
Give a definition and practical example of when the following types of contraction could occur in sport::

Concentric This occurs when a muscle shortens against a resistance. e.g. in a bicep curl. The bicep brachii shorten when bringing your forearm towards your upper arm.

Eccentric This occurs when a muscle returns to its normal length after shortening against resistance. e.g. in the bicep curl, the controlled lowering of your arm to its starting position.

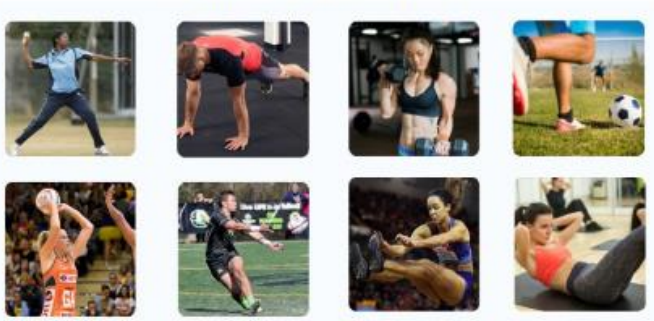
Isometric The length of the muscle does not change nor does the joint angle. e.g. gymnast holding a position on the rings

terior View	Posterior View
1. DELTOIDS	15. TRAPEZIUS
2. PECTORALIS MAJOR	16. TERES MAJOR
3. BICEPS	17. LATISSIMUS DORSI
4. WRIST FLEXORS	18. ERECTOR SPINAE
5. EXTERNAL OBLIQUES	19. DELTOIDS
6. RECTUS ABDOMINIS	20. TRICEPS
7. I INTERNAL OBLIQUES	21. GLUTEUS MEDIUS
8. ADDUCTOR GROUP (Adductor Magnus, Adductor Brevis, Adductor Longus)	22. WRIST EXTENSORS
	23. SUPINATOR
	24. GLUTEUS MAXIMUS
9. RECTUS FEMORIS	25. BICEPS FEMORIS
10. VASTUS LATERALIS	26. SEMIMEMBRANOSUS
11. VASTUS MEDIALIS	27. SEMITENDINOSUS
12. TIBIALIS ANTERIOR	28. GASTROCNEMIUS
13. VASTUS INTERMEDIUS	29. SOLEUS
14. PRONATOR TERES	



Dominant muscle fibre type	Examples from sport
Type 1 oxidative	Marathon, jogging back into position in football, long distance cycling
Type 2a fast oxidative	400m sprint, 800m run, 200m freestyle,
Type 2b fast glycolytic	Jumping for ball in basketball, short sprint in rugby, bowling in cricket

Agonist and antagonists

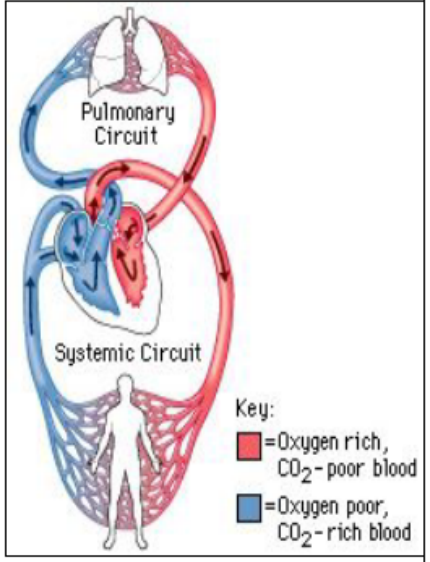


For each of the sporting actions identify the agonist and antagonist for the named joint in the table below.

Sporting action	Joint	Agonist	Antagonist
Cricket ball throw	Shoulder (R)	Deltoid	Latissimus Dorsi
Press up	Shoulder	Pectoralis major	Trapezius
Bicep curl	Elbow	Bicep brachii	Triceps brachii
Kicking a football	knee	Vastus medialis Vastus lateralis Vastus intermedius Rectus femoris	Semi-membranosus semi-tendinosus Bicep femoris
Netball shot	Elbow	Triceps brachii	Biceps brachii
Rugby spin pass	radioulnar (R)	Pronator teres	supinator
Long jump	Hip	Iliopsoas	Gluteus maximus
Sit ups	Spine	Rectus abdominis	Erector spinae

LO3 CARDIOVASCULAR SYSTEM- RECALL

LO3- UNDERSTAND THE CARDIOVASCULAR SYSTEM IN RELATION TO EXERCISE AND PHYSICAL ACTIVITY



Pulmonary and systemic circulation

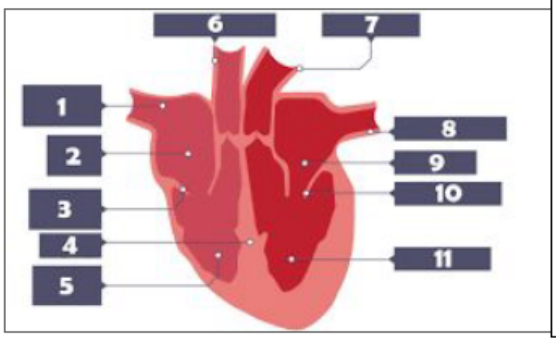
Use the diagram to the right to help describe the:

Systemic circulation

- Occurs in the left hand side of the heart
- The left side receives oxygenated blood from the lungs and pumps it around the body
- Oxygen is dropped of at the tissues and carbon dioxide is picked up
- It then brings deoxygenated blood back to the right hand side of the heart

Pulmonary circulation

- Occurs in the right hand side of the heart
- The right side receives deoxygenated blood from the body and pumps it to the lungs
- Carbon dioxide is dropped off at the lungs and oxygen is picked up
- It then brings oxygenated blood back from the lungs to the left hand side of the heart

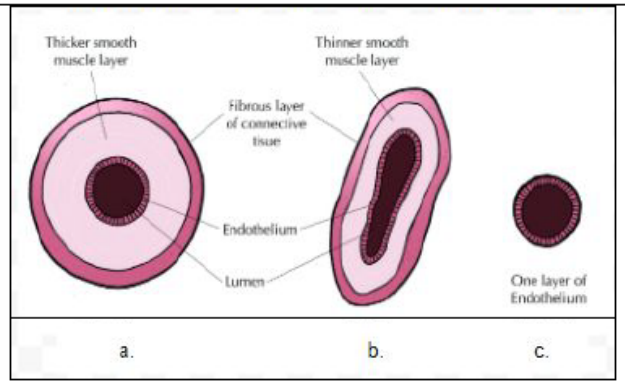


Heart Anatomy

Identify the parts of the heart labelled in the diagram:

1. VENA CAVA
2. RIGHT ATRIA
3. TRICUSPID VALVE
4. SEPTUM
5. RIGHT VENTRICLE
6. PULMONARY ARTERY
7. AORTA
8. PULMONARY VEIN
9. LEFT ATRIA
10. BICUSPID VALVE
11. LEFT VENTRICLE

Heart measurements	Units	Definition
Heart rate (HR)	bpm	The number of times the heart beats per minute (bpm)
Stroke volume (SV)	ml	The volume of blood pumped out of the left ventricle (of the heart) in one contraction
Cardiac output (Q)	Litres per min (l/min)	Volume of blood pumped out of the heart per minute, calculated using the formula CO= SV x HR

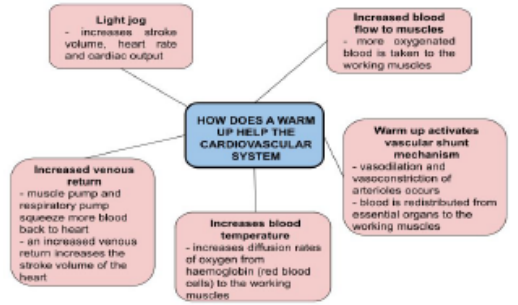


Blood vessels

Complete the table below for the three blood vessels above.

	Name	Function	Characteristic
a	Artery	Carry blood away from the heart	Muscular walls, relatively large lumen
b	Vein	Carry blood back to the heart	Large lumen, contain valves to prevent backflow of blood
c	Capillary	Carry blood to the tissue/cells	Thin walls (1 cell thick), very narrow (wide enough only for 1 red blood to pass through at a time

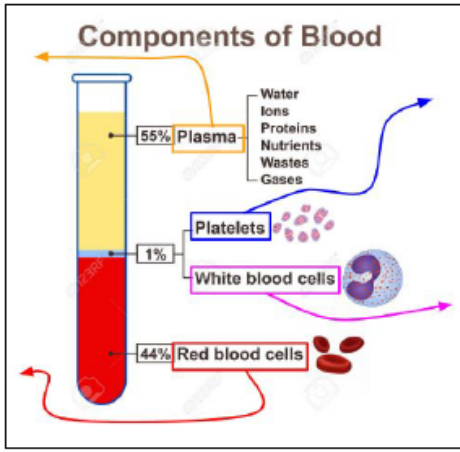
Effects of a warm up on cardiovascular system



LO3 CARDIOVASCULAR SYSTEM- RECALL

CAMBRIDGE TECHNICALS LEVEL 3 SPORT AND PHYSICAL ACTIVITY UNIT 1- PRINCIPLES OF ANATOMY AND PHYSIOLOGY IN SPORT

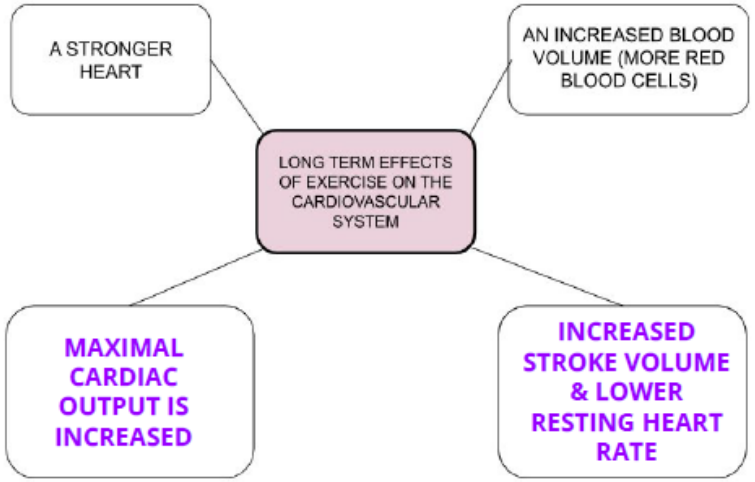
LO3- UNDERSTAND THE CARDIOVASCULAR SYSTEM IN RELATION TO EXERCISE AND PHYSICAL ACTIVITY



Component of blood	Function
PLASMA	FLUID THAT TRANSPORTS NUTRIENTS & BLOOD CELLS
PLATELETS	HELP BLOOD TO CLOT
WHITE BLOOD CELLS	PROTECT AGAINST/FIGHT DISEASE/INFECTION
RED BLOOD CELLS	TRANSPORT OXYGEN

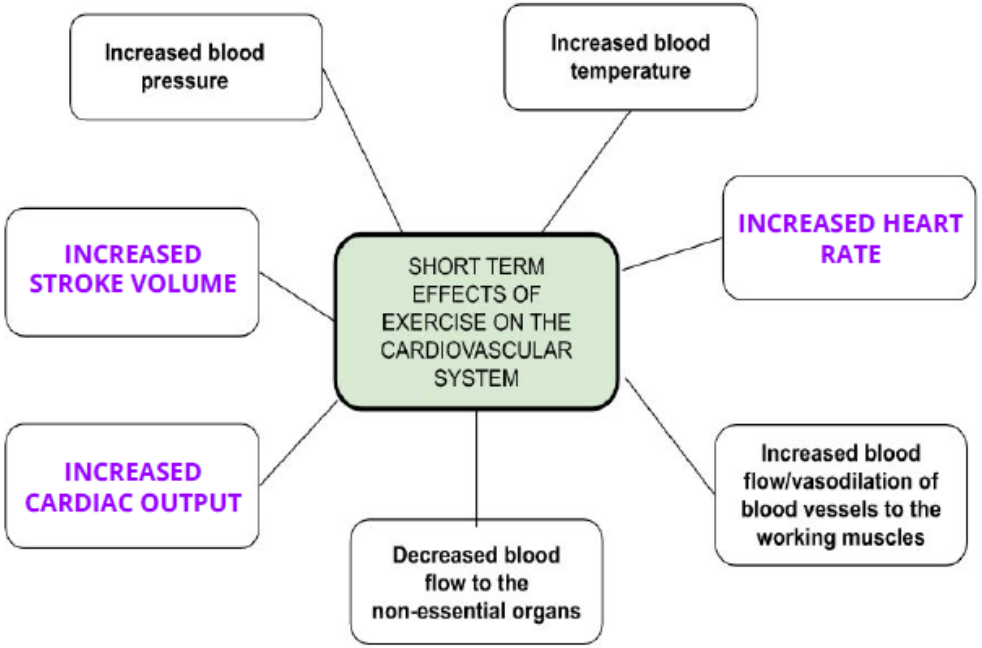
Long term effects on the cardiovascular system

Complete the table below:

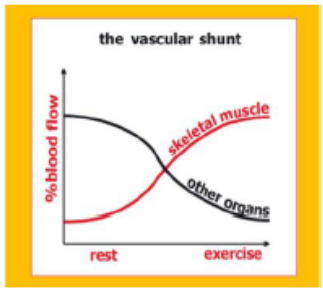


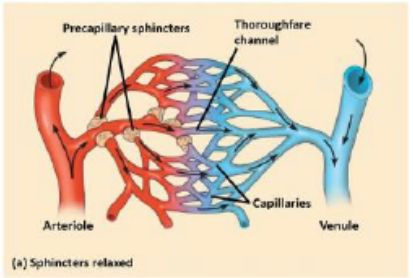
Short term effects on the cardiovascular system

Complete the table below:



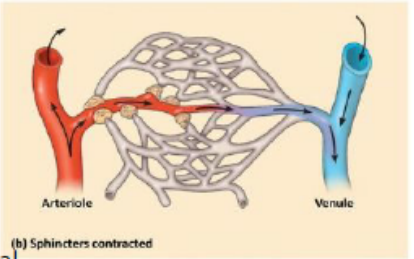
Vascular shunt mechanism





What happens during vascular shunt mechanism

1. Arterioles to the working muscles **vasodilate**
2. Arterioles to non-essential organs/stomach/gut **vasoconstrict**
3. **Precapillary sphincters** to working muscles are opened/**dilated**
4. Precapillary sphincters to non-essential organs are closed/**constricted**



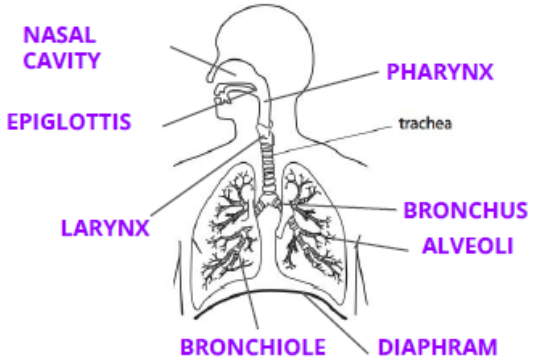
LO4 RESPIRATORY SYSTEM- EXAM QUESTIONS

CAMBRIDGE TECHNICALS LEVEL 3 SPORT AND PHYSICAL ACTIVITY UNIT 1- PRINCIPLES OF ANATOMY AND PHYSIOLOGY IN SPORT

LO4- UNDERSTAND THE RESPIRATORY SYSTEM IN RELATION TO EXERCISE AND PHYSICAL ACTIVITY

Structure and function of the respiratory system organs

Label the diagram below and complete the table:



Organ	Description (i.e. structure and function)
Nasal cavity	Warms the air and traps microbes in mucus
Epiglottis	Flap at the back of the throat. Prevents food/water entering the trachea and air entering the oesophagus.
Pharynx	Point where mouth, nasal cavity and throat join. Warms and moistens the air.
Larynx	Also known as the 'voice box'. Where speech is created.
Trachea	Tube connecting pharynx to the lungs via the bronchi. Has C shaped rings of cartilage to keep the trachea open.
Bronchi	Bronchi are extensions of the trachea that lead into the left and right lungs. Similar in structure to trachea.
Bronchioles	Branch off from the bronchi into all of the lungs. They get progressively smaller and take air to and from the alveoli.
Alveoli	Gas exchange occurs in the alveoli. They are covered in capillaries.

Mechanics of breathing- Inspiration and expiration

Complete the sentences below.

INSPIRATION (BREATHING IN)

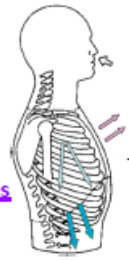
The diaphram and external intercostal muscles contract

↓

Ribs move up and out

↓

The volume of the thoracic cavity increases



↓

Air pressure in the lungs decreases

↓

Air rushes into lungs (down the trachea)

EXPIRATION (BREATHING OUT)

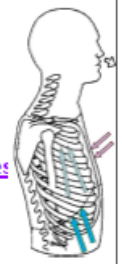
The diaphram and external Intercostal muscles relax

↓

Ribs move down and in

↓

The volume of the thoracic cavity decreases



↓

Air pressure in the lungs increases

↓

Air is forced out of the lungs

Additional respiratory muscles used during exercise

During expiration- sternocleidomastoid, scalene and pectoralis major contract to pull the clavicle upwards and outwards

During expiration- internal intercostal muscles contract to force the ribs downwards and inwards. The rectus abdominis contracts to help force the diaphragm upwards

Breathing measures

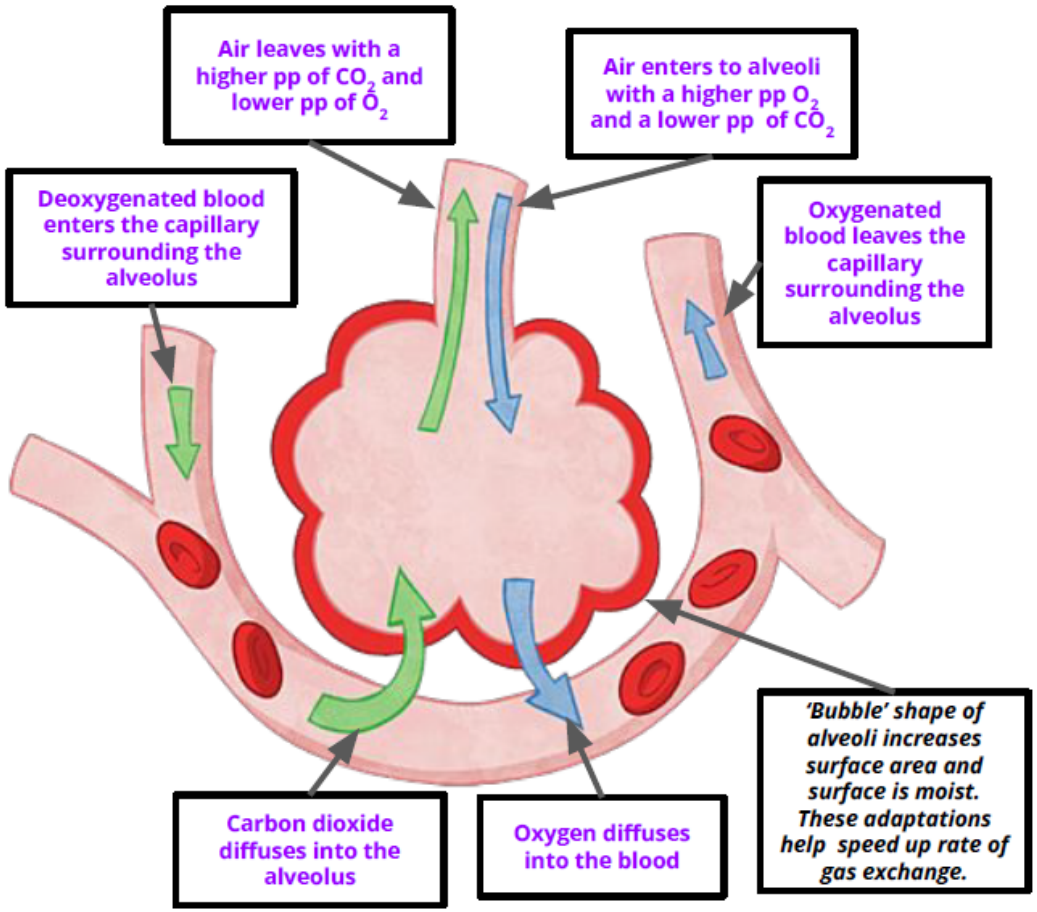
Complete the table below:

Breathing measure	Definition	Typical value at rest	Changes during exercise
Breathing rate	The number of breaths you take per minute	**10-15 breaths per min**	40-60 breaths per minute
Tidal volume	The amount of air you can breath in and out during one breath	0.5 litres/ 500ml	**3 litres/ 3000ml**
Minute ventilation	The volume of air you breathe in and out each minute	**6 litres per min**	90 litres per min

Gaseous exchange at the alveoli

Use the sentences below to complete correctly label the diagram of the alveoli:

- ❑ *Air leaves with a higher pp of CO_2 and lower pp of O_2*
- ❑ *Carbon dioxide diffuses into the alveolus*
- ❑ *Oxygenated blood leaves the capillary surrounding the alveolus*
- ❑ *Oxygen diffuses into the blood*
- ❑ *Air enters to alveoli with a higher pp O_2 and a lower pp of CO_2*
- ❑ *Deoxygenated blood enters the capillary surrounding the alveolus*



Short term effects of exercise on the respiratory system

Fill in the missing words below to describe the short term effects of exercise on the respiratory system.

Increased **breathing rate**

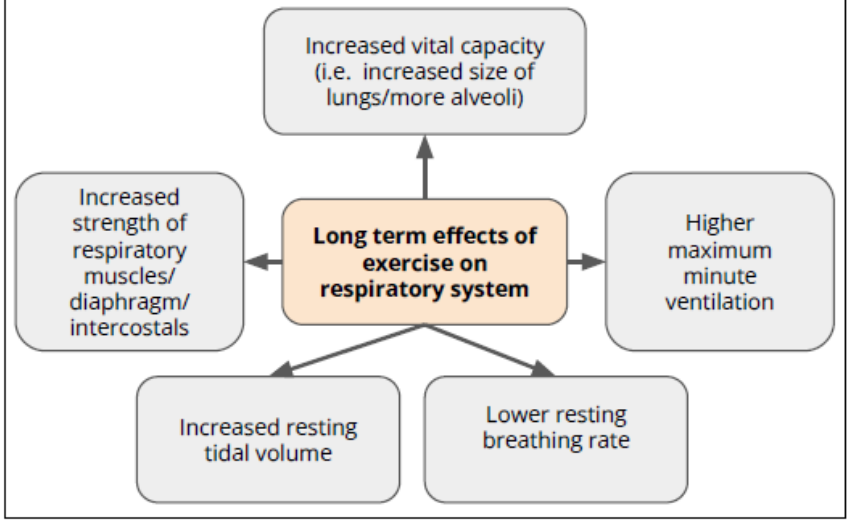
Deeper breaths to get more air in. i.e. increase **tidal volume**

Increased **minute ventilation**

More **oxygen** taken in

More **carbon dioxide** expired/breathed out

Long term effects of exercise on the respiratory system



LO5 ENERGY SYSTEMS- EXAM QUESTIONS

LO5- UNDERSTAND THE DIFFERENT ENERGY SYSTEMS IN RELATION TO EXERCISE AND PHYSICAL ACTIVITY

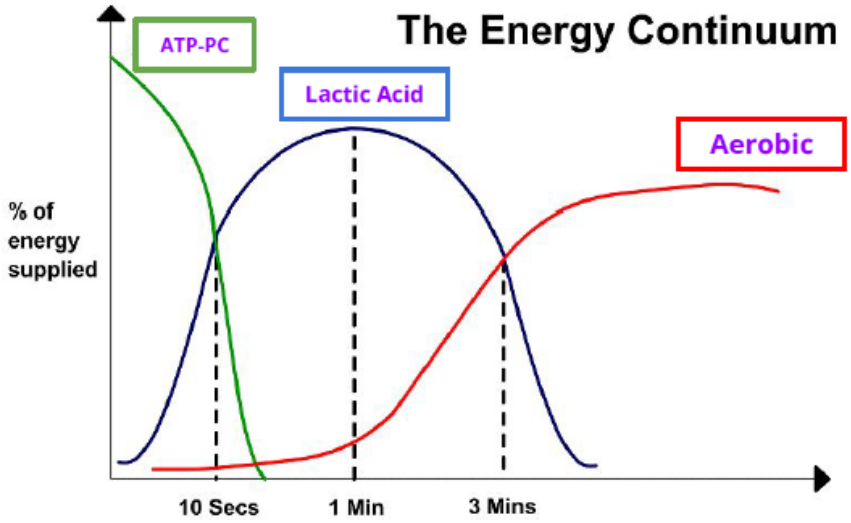
Energy Continuum

one intensity system contribute duration

The relative contribution of each energy **system** to overall energy production depending on the **intensity** and **duration** of exercise.

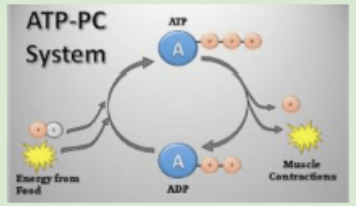
Although only **one** energy system is *predominant* at any time, all three will **contribute** to activities performed.

Duration and intensity of exercise	Sporting example	Energy system predominantly being used
Intensity- very high ***Duration***- less than 10s	High jump, 100m sprint, Olympic weightlifting	ATP-PC/ Alactic system
Intensity- high ***Duration***- 10s-3min	400m run, 200m swim, squash rally	Lactic acid system
Intensity- low ***Duration***- 3+min	Marathon, triathlon,	Aerobic system



ATP-PC SYSTEM

Overview of system
- Creatine phosphate (CP) is stored in the muscle cells
- CP is broken down by enzyme creatine kinase
- When CP is broken down into a creatine molecule and a phosphate molecule energy is released
- This energy is used to resynthesise ADP back to ATP

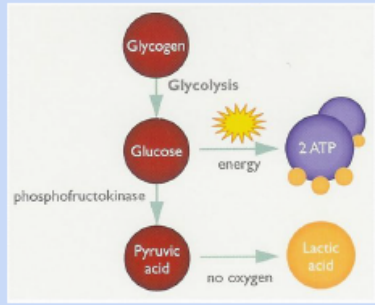


Advantages
- No fatiguing by products
- Energy is stored in the muscles
- Energy is provided immediately
- It doesn't need oxygen to provide energy
- Fewer reactions are involved

Disadvantages
- It only lasts 10 seconds
- The ratio of ATP resynthesis is only 1:1
- There are limited stores of CP (these cannot be greatly increased)

LACTIC ACID SYSTEM

Overview of system
- In intensity of exercise remains high, after 10 sec or so the lactic acid system becomes the predominant energy system
- Glucose is broken down by enzyme PFK into pyruvic acid
- This releases enough energy to resynthesise 2 ATP
- As the physical activity is still at a high intensity there is insufficient oxygen
- Pyruvic acid is converted into lactic acid
- Build up of lactic acid lowers the pH in the muscles
- The body's ability to produce energy and perform declines



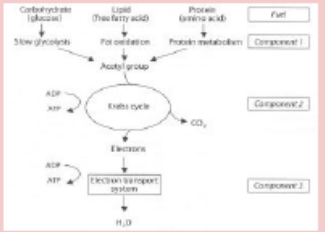
Advantages
- It has a fast speed of reaction for fast work
- It does not require oxygen
- There are few chemical reactions
- It provides more ATP than the ATP-PC system

Disadvantages
- It only lasts between 30 sec and 2 minutes dependent on the intensity of exercise
- The by product lactic acid is fatiguing to muscles

AEROBIC SYSTEM

Overview of system
- If the intensity of exercise is moderate or low then the aerobic system is dominant
- Relies on presence of/sufficient oxygen
- Fuel is glucose/ glycogen/ carbohydrates and fats
- Three stages to aerobic system

Glycolysis- occurs In muscle cell, 2 ATP produced
Krebs Cycle- occurs in mitochondria, 2 ATP produced
Electron transport chain- In mitochondria, 32-34 ATP produced
- Total ATP produced 36-39 ATP. If fat broken down up to 144 ATP



Advantages
- It is a very efficient production of energy
- Almost limitless energy production potential
- There are no fatiguing by products
- It uses fats as an energy source

Disadvantages
- It is only suited to low to moderate intensity activities
- It takes time to transition to the system
- It takes up to 20 minutes to start to use fats as an energy source

LO5 ENERGY SYSTEMS- EXAM QUESTIONS

LO5- UNDERSTAND THE DIFFERENT ENERGY SYSTEMS IN RELATION TO EXERCISE AND PHYSICAL ACTIVITY

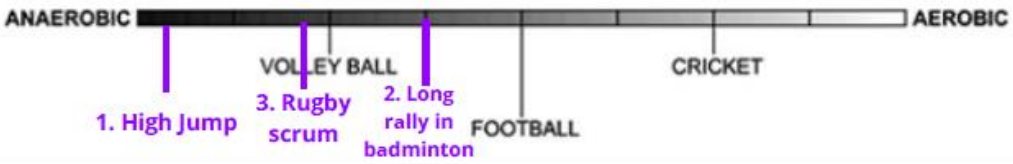
Energy Continuum

The energy continuum allows different sports and activities to be placed in relation to how aerobic or anaerobic they are. Activities to the left (anaerobic) will rely heavily on the **ATP-PC** system and **lactic acid** system. Activities to the right (aerobic) rely heavily on the **aerobic** system for energy.

Energy Continuum

Can you place following activities on the energy continuum below:

1. High jump
2. Long rally in badminton
3. Rugby scrum



EPOC

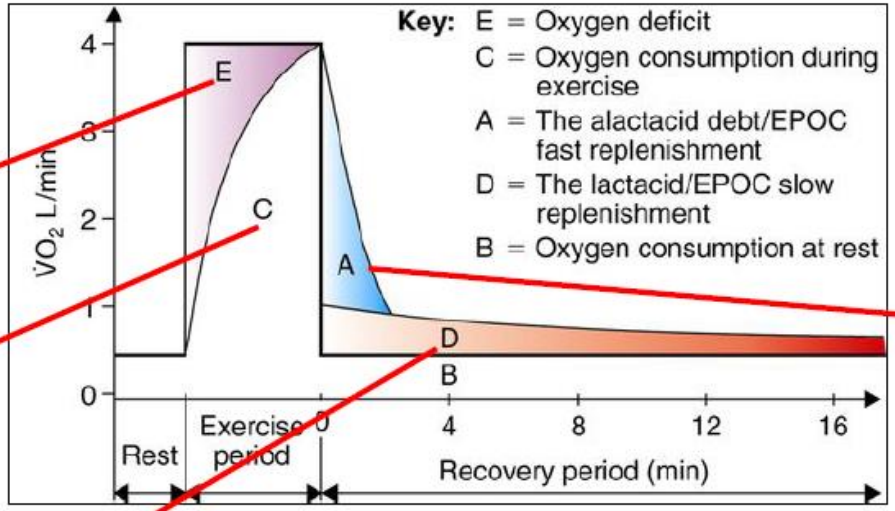
EPOC stands for, **Excess Post-Exercise Oxygen Consumption**. It is also known as oxygen debt. It is the volume of O_2 required post (after) exercise to return the body to a **resting** state.

Oxygen deficit

The volume of **oxygen** that would be required to complete an activity entirely **aerobically**.

Oxygen consumption

the volume of oxygen consumed during the **whole** of the activity.



Fast/alactic component of EPOC

This stage involves the recovery of the ATP-PC system.

- **Phosphocreatine** (PC) stores are **fully** replenished in 2-3mins
- PC stores are 50% restored in 30 secs
- **Myoglobin** stores are resaturated takes 2-3min
- Whole process requires approximately 4 litres of O_2

Slow/lactic component of EPOC

This stage involves the recovery of the lactic acid stage. It can take between 30 minutes and 2 hours

- Removal of **lactic acid** from the muscles and the blood. It is converted into other substances e.g. pyruvate, glycogen, glucose
- Removal of **carbon dioxide** from the bloodstream that has built up during anaerobic exercise
- Replacement of **glycogen** in the muscles
- **Breathing rate** and **cardiac output** remain elevated during this stage to get lactic acid out of bloodstream and expel CO_2 from the body

Effects of a cool down on EPOC

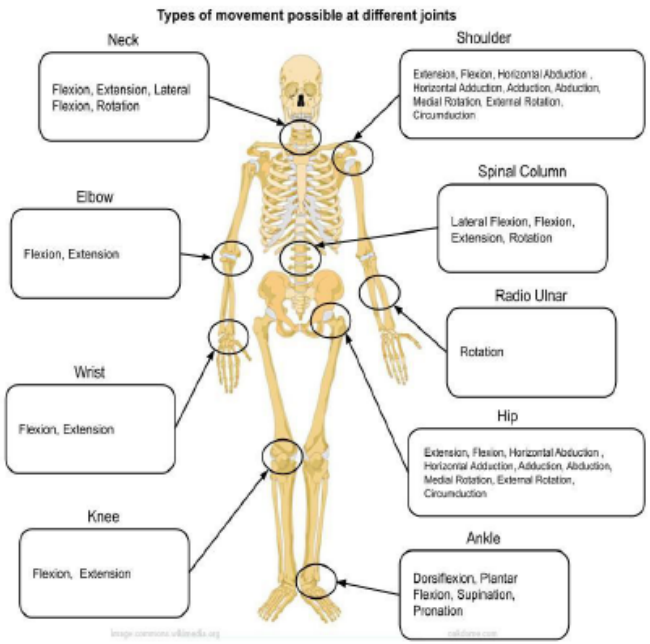
EPOC an be sped up with a cool down

- **Cool down** helps to keep muscles 'metabolically' active (so more able to break down lactic acid)
- **capillary** beds that supply the muscles are left dilated so more **oxygen** can reach the muscles to help break down and remove lactic acid

LO1 & LO2 MOVEMENT ANALYSIS- RECALL

CAMBRIDGE TECHNICALS LEVEL 3 SPORT AND PHYSICAL ACTIVITY UNIT 1- PRINCIPLES OF ANATOMY AND PHYSIOLOGY IN SPORT

LO1 & LO2- UNDERSTAND THE SKELETAL AND MUSCULAR SYSTEM IN RELATION TO MOVEMENT ANALYSIS



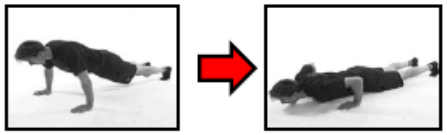
Movements:

- Flexion/Extension
- Lateral flexion
- Abduction/Adduction
- Horizontal abduction/Horizontal adduction
- Medial Rotation/Lateral Rotation
- Circumduction
- Pronation/ Supination
- Dorsiflexion/Plantar flexion

Movement Analysis of Sprinting

Name of Joint		Type of Joint	Bones Articulating	Movement Occuring
1	(R) Ankle	**Hinge**	**Tibia, Fibula, Talus**	**Dorsiflexion**
2	(R) Knee	**Hinge**	**Femur, patella, fibula, tibia**	**Flexion**
3	(R) Hip	**Ball and socket**	**Pelvi, femur**	**Flexion**
4	(L) Hip			**Extension**
5	(L) Knee			**Extension**
6	(L) Ankle			**Plantar flexion**
7	(R) Elbow	**Hinge**	**Humerus, radius, ulna**	**Extension**

Movement analysis of a press up (downward movement)



Site of Joint	Joint movement	Agonist (+ type of contraction)	Antagonist
Shoulder	**Horizontal abduction**	**Pectoralis major (eccentric)**	**Trapezius**
Elbow	**Flexion**	**Triceps brachii (eccentric)**	**Biceps brachii**

Movement analysis of kicking a football

Site of Joint	Joint movement	Agonist (+ type of contraction)	Antagonist
Hip	Flexion	**Iliopsoas (concentric)**	Gluteus maximus
Knee	Extension	**Vastus medialis Vastus intermedius Vastus lateralis Rectus femoris (concentric)**	**Semitendinosus Semimembranosus Bicep femoris**
Ankle	Plantar flexion	**Gastrocnemius Soleus (concentric)**	**Tibialis anterior**