OCR AS
Physical Education

Anatomy & Physiology

Teacher Resource File

The Skeletal and Muscular Systems
Motion and Movement
The Cardiovascular and Respiratory Systems in relation to performance of physical activity

Dr Sarah Powell
for

Introduction

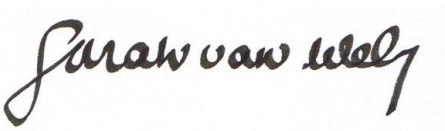
OCR Physical Education
AS – Anatomy and Physiology
Teacher Resource File

Introduction

This Teacher Resource File has been designed to support teaching and learning of the AS Anatomy and Physiology section of the G451 theory unit. It has been written for PEfocus by Dr Sarah Powell who is a highly experienced teacher of A Level Physical Education whose PHd is in objective physical activity assessment and bone density in children.

On this CD/file you will find handouts, worksheets, fill-ins, match up games and various other 'masters' to photocopy and use in your classroom. Some will help students with course organisation while others can conveniently be used as warm up and plenary tasks. Some offer handy class or homework activities to check learning and others are for making resources such as cue/question cards that can be used year after year when reviewing work at test or revision time. There are often four per set to represent the four main sections of the A&P specification. A number of documents have been included to help with preparation for the extended 10-mark questions. It's not expected that you'll use everything each year with each group but will select, develop and adapt tasks to suit your needs and your learners. The aim is to provide time saving, high quality and reliable support for busy, enthusiastic teachers.

I hope that you and your students find this resource stimulating, engaging and valuable and I wish you all the very best for an enjoyable and beneficial teaching and learning experience.



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Anatomy and Physiology – 'Skeleton' OCR specification

The Musculoskeletal System: Movement analysis and skeletal health

Movement analysis

- **Wrist**: flexion and extension; wrist flexors and extensors
- **Radio-ulnar**: pronation and supination, pronator teres and supinator muscle
- **Elbow**: flexion and extension, biceps brachii and triceps brachii
- **Shoulder**: abduction, adduction, flexion, extension, rotation, horizontal flexion, horizontal extension, circumduction, deltoid, latissimus dorsi, pectoralis major, subscapularis, infraspinatus, teres major and teres minor; trapezius, the role of the rotator cuff muscles, supraspinatus infraspinatus, teres minor and subscapularis
- **Spine** (cartilaginous, gliding and pivot), flexion, extension, lateral flexion, rectus abdominus, external and internal oblique and the erector spinal group, sacrospinalis (the role of the transverse abdominus and multifidus in relation to core stability)
- **Hip**: abduction, adduction, flexion, extension, rotation illiopsoas, gluteus maximus, medius and minimus, adductor longus, brevis and magnus
- **Knee**: flexion and extension, biceps femoris, semi-membranosus , semi-tendinosus, rectus femoris, vastus lateralis, vastus intermedius and vastus medialis
- **Ankle**: dorsi flexion, plantar flexion, tibialis anterior, gastrocnemius and soleus

Muscular contraction

- Concentric, eccentric and isometric contraction
- Carry out a movement analysis making reference to joint type, the type of movement produced, the agonist and antagonist muscle (or muscles) in action and the type of muscle contraction taking place
- Muscle fibre types in relation to choice of physical activity
- Structure and function of the different muscle fibre types (slow oxidative, fast oxidative, glycolytic and fast glycolytic) in relation to different types of physical activity
- Explain how an individual's mix of muscle fibre type might influence their reasons for choosing to take part in a particular type of physical activity
- Analyse the effect of a warm up and cool-down on skeletal muscle tissue in relation to the quality of performance of physical activity

Skeletal health

- Evaluate critically the impact of different types of physical activity (contact sports, high impact sports and activities involving repetitive actions) on the skeletal and muscular systems (osteoporosis, osteoarthritis, growth plate, joint stability, posture and alignment) with reference to lifelong involvement in an active lifestyle

Motion and Movement: Newton's laws of motion, force and stability

Basic biomechanics

- Define Newton's Laws of Motion
- Describe the types of motion produced (linear, angular or general)
- Describe the effect of size of force, direction of the force and the position of application of force on a body,
- Define centre of mass
- Explain the effect of changes in the position of the centre of mass and the area of support when applied to practical techniques

The Cardiovascular System: heart & vascular system re physical activity & health

Cardiac output

- Describe the link between the cardiac cycle (diastole and systole) and the conduction system of the heart
- Describe the relationship between stroke volume, heart rate and cardiac output and resting values for each and the changes during different intensities of activity
- Explain the regulation of heart rate during physical activity (to include neural, hormonal and intrinsic factors)
- Describe the distribution of cardiac output at rest and during exercise (the vascular shunt mechanism) explaining the role of the vasomotor centre and the involvement of arterioles and pre-capillary sphincters

Blood flow regulation

- Explain how carbon dioxide and oxygen are carried within the vascular system, how effective transportation of carbon dioxide and oxygen within the vascular system aids participation in physical activity and how smoking affects the transportation of oxygen
- Define blood pressure and identify resting values, changes that occur during physical activity and hypertension
- Explain how venous return is maintained, the effects that a warm-up and cool-down period has on the cardiovascular system and how venous return affects the quality of performance

Cardiac health

- Evaluate critically the impact of different types of physical activity on the CV system (coronary heart disease (CHD), arteriosclerosis, atherosclerosis, angina, heart attack) with reference to lifelong involvement in an active lifestyle

The Respiratory System: gaseous exchange re physical activity and health

Mechanics

- Describe the mechanics of breathing at rest and the respiratory muscles involved (including the diaphragm and external intercostal muscles)
- Explain the changes in the mechanics of breathing during physical activity including reference to additional muscles involved (sternocleidomastoid and pectoralis minor) and the active nature of expiration (internal intercostals and abdominal muscles)
- Explain how changes in the mechanics of breathing during physical activity are regulated by the respiratory centre (both neural and chemical control) to take into account the demands of different intensities of physical activity

Gaseous exchange and altitude

- Describe the process of gaseous exchange that takes place between the alveoli and the blood and between the blood and the tissue cells (an awareness of partial pressure is required but candidates will not be expected to provide specific respiratory pressures)
- Explain changes in gaseous exchange that take place between the alveoli and blood and between blood and tissue cells (increased diffusion gradient and accelerated dissociation of oxy-haemoglobin) as a direct result of particip^{n} in physical activity
- Explain the effect of altitude on the respiratory system and how it influences the performance of different intensities of physical activity

Respiratory health

- Evaluate critically the impact of different types of physical activity on the respiratory system with reference to lifelong involvement in an active lifestyle (to include an awareness of asthma and smoking)

Revision checklist – 1

The Musculoskeletal System	✓
Joint type, movement patterns, agonist and antagonist muscles for ▫ Wrist ▫ Radio-ulna ▫ Elbow ▫ Shoulder ▫ Spine ▫ Hip ▫ Knee ▫ Ankle	
Muscular contraction: concentric, eccentric, isometric	
Structure and function of **muscular fibre type** (slow oxidative, fast oxidative glycolytic and fast glycolytic) in relation to choice of physical activity	
Effect of warm-up and cool-down on quality of performance (speed and force of muscular contraction)	
Impact of different types of activity ▫ Contact ▫ High impact ▫ Repetitive action With reference to: ▫ Osteoporosis ▫ Osteoarthritis ▫ Growth plate disorders ▫ Joint stability ▫ Posture and alignment	

Revision checklist – 2

Motion and Movement	✓
Newton's laws of motion 1. Inertia 2. Acceleration 3. Reaction	
Types of motion ❑ Linear ❑ Angular ❑ General	
Effects of ❑ Size ❑ Direction ❑ Point of application of force on a body	
❑ Centre of mass ❑ Effect of changes in position of CofM and area of support with practical application	

Revision checklist – 3

The Cardiovascular System	✓
Cardiac cycle (diastole, atrial systole and ventricular systole) and conduction system	
Heart rate, stroke volume and cardiac output - rest and exercise	
Regulation of heart rate/cardiac control (neural, intrinsic and hormonal)	
Distribution of cardiac output at rest and during exercise (vascular shunt mechanism) and vasomotor control	
Oxygen and carbon dioxide transportation in the vascular system. How smoking effects transportation of oxygen	
Blood pressure – definition and resting values Hypertension	
Venous return mechanisms and effect on physical activity (Starling's Law) Effects of warm-up and cool-down on cardiovascular system	
Impact of different types of physical activity on CV system ❑ Coronary heart disease ❑ Arteriosclerosis ❑ Atherosclerosis ❑ Angina ❑ Heart attack	

Revision checklist – 4

The Respiratory System	✓
Mechanics of breathing: changes at rest and changes during physical activity (including muscles involved)	
Respiratory control (neural and chemical) of breathing rate during different intensities of physical activity	
Gaseous exchange at the external (alveoli-capillary membrane) and internal (capillary-muscle tissue membrane) sites at rest	
Response of gaseous exchange to physical activity including ❑ Increased diffusion gradient ❑ Increased dissociation of oxy-haemoglobin	
Effect of altitude on the respiratory system and its influence on the performance of physical activity	
Different types of physical activity and their effects on the respiratory system ❑ Asthma ❑ Smoking	

Draft scheme of work - 1 hr sessions – not endorsed by an examining body

1	**Course overview** ❑ Introduction to healthy balanced lifestyles
2	**Musculoskeletal System** ❑ Joint types ❑ Muscle roles (agonist, antagonist and fixator) ❑ Contraction types (concentric, eccentric and isometric)
3	❑ Muscle fibre types (SO, FOG and FG) ❑ Warm-up and cool-down
4	❑ Movement patterns ❑ Introduction to joint analysis: ankle and wrist
5	❑ Elbow, knee, radio-ulnar
6	❑ Hip and shoulder ❑ Joint stability (role of the rotator cuff)
7	❑ Spine ❑ Core stability ❑ Posture and alignment
8	**Musculoskeletal: health conditions** ❑ Osteoporosis ❑ Osteoarthritis ❑ Growth plate disorders etc
9	**Motion and Movement** ❑ Force ❑ Newton's Laws (inertia, acceleration and reaction) ❑ Motion (linear, angular and general)
10	❑ Centre of mass ❑ Stability
11	**Cardiovascular System** ❑ Conduction system ❑ Cardiac cycle (systole and diastole)
12	❑ Heart rate ❑ Stroke volume ❑ Cardiac output
13	❑ Cardiac control (neural, intrinsic and hormonal)
14	❑ Venous return mechanisms ❑ Warm-up and cool-down
15	❑ Vasomotor control ❑ Vascular shunt
16	❑ Oxygen and carbon dioxide transportation ❑ Effect of smoking
17	Cardiovascular system: health conditions ❑ Blood pressure and hypertension ❑ Arteriosclerosis and atherosclerosis
18	❑ Coronary heart disease ❑ Heart attack and angina
19	**Respiratory system** ❑ Mechanics of breathing
20	❑ Respiratory control
21	❑ Gaseous exchange
22	❑ Altitude
23	**Respiratory system: health conditions** ❑ Asthma
24	**Revision**

Glossary of Key A&P Terms

A	
Abduction	Abduction of a joint makes the body part move away from the midline e.g. the outward phase of a star jump
Accelerator nerve	This stimulates the SA node to increase heart rate (HR) and stroke volume (SV)
Adduction	Adduction of a joint makes the body part move towards the midline e.g. the inward phase of a star-jump
Aerobic adaptation	Structural changes in response to aerobic training e.g. increased mitochondrial density
Aerobic work	Work performed with the use of oxygen - low intensity and long duration
Agonist	A muscle responsible for creating movement at a joint
Altitude training	Training in areas >1500m above sea level for a period of 4-6 weeks
Alveoli	Grape-like clusters of tiny air sacs in the lungs
Angina	Partial blockage of a coronary artery causing chest pain
Angular motion	When a body moves in a circular path about an axis of rotation
Antagonistic pair	Two (or more) muscles which work together to provide co-ordinated movement
Altitude	High altitude is an area >1500m above sea level where the partial pressure of oxygen in the air is lower (than at sea level)
Anaerobic work	Work performed without the use of oxygen - high intensity and short duration due to production of lactic acid as a by-product
Antagonist	A muscle that acts in opposition to the agonist to provide a co-ordinated movement
Antagonistic muscle action	When two muscles work together to produce co-ordinated movement - as one muscle lengthens the opposing muscle shortens
Artery	Blood vessel which transports oxygenated blood away from the heart to the tissues
Articular cartilage	Smooth, slightly spongy cartilage that covers the ends of bones in a joint and absorbs shock and prevents friction
Arteriosclerosis	Condition where walls of coronary arteries become thicker/harder/less elastic. Results in less efficient vasoconstriction and vasodilatation of arterioles and reduced efficiency of vascular shunt mechanism
Asthma	Reversible narrowing of the airways with symptoms of wheezing, coughing and breathlessness
Atherosclerosis	The accumulation of fatty deposits/cholesterol/plaque/atheroma on walls of coronary arteries causing a narrowing of blood vessels and a likelihood of blood clots. The most common cause of CHD
Atrial diastole	Relaxation of the atria
Atrial systole	Contraction of the atria which forces remaining blood into the ventricles
B	
BAHL	**B**alanced **a**ctive, **h**ealthy **l**ifestyle consisting of regular activity and a healthy diet
Baroreceptor	A sensory receptor responsible for sensing changes in pressure
Base of support	The area of a body in contact with the floor
Biomechanics	The study of human movement, force and its effects on the body
Blood pressure	Pressure exerted by blood against the artery walls
Blood viscosity	The resistance to blood flow
Bohr shift/effect	An increase in acidity which causes the oxygen-dissociation curve to shift to the right increasing the dissociation of O_2 from haemoglobin
Bone Spurs	Small bony projections which form around the joint surface that cause pain and limit movement. Associated with osteoarthritis
Bradycardia	A resting heart rate below 60bpm
Bursa	Flattened fibrous sac lined with synovial fluid which prevents friction at sites where muscles, tendons, ligaments and bones may rub together

C	
Capillary	A blood vessel which brings blood into direct contact with the tissues for gaseous exchange
Carbon monoxide	Poisonous gas inhaled when smoking. Haemoglobin has a higher affinity for CO than O_2
Cardiac control centre (CCC)	Control centre in the medulla oblongata that is primarily responsible for heart regulation
Cardiac cycle	Events of one heart beat. The atria contract together and force blood into the ventricles (disastole) which then contract (systole) and force blood out of the heart to be pumped around the body
Cardiac hypertrophy	An increase in the size of the heart muscle
Cardiac output	The volume of blood ejected from the left ventricle per minute. CO = HR x SV (l/min)
Centre of mass	The point at which the body is balanced in all directions. Point where mass concentrated
Chemoreceptor	Sensory receptor responsible for sensing changes in chemicals levels e.g. levels of lactic acid or oxygen
Cholesterol	Blood lipids that can be deposited on arterial walls leading to atherosclerosis
Circumduction	Circumduction of a joint makes the body part describe a cone shape, e.g. when holding a sparkler a circle is drawn when circumduction of shoulder occurs
Concentric contraction	A type of muscle contraction in which the muscle shortens while generating force/producing tension. It causes joint movement
Contact sports	Sporting activities where players' bodies make contact e.g. rugby
Cool-down	Light aerobic exercise and stretches that follow a session of physical activity. The aim is to gradually reduce heart and respiratory rates and prevent blood pooling
Coronary circulation	Blood flow to and around the cardiac muscle
Coronary Heart Disease (CHD)	General term for all diseases relating to the coronary blood vessels and heart muscle
Core stability	The ability of the trunk region to stabilise the body during physical activity. It allows muscles and joints to work safely and efficiently
D	
Diastole	Relaxation phase of cardiac cycle - atrial diastole and ventricular diastole
Diaphragm	A thin muscle separating the chest and the abdomen. The main muscle used in passive and active breathing
Diffusion gradient	The difference in partial pressures across a membrane which allows gaseous exchange
Dorsi-flexion	Dorsi-flexion of the ankle joint makes the foot move towards the tibia e.g. when walking on your heels
E	
Eccentric contraction	A type of muscle contraction in which the muscle lengthens while generating force/producing tension. It controls joint movement
Eccentric force	A force applied outside the centre of mass causing angular motion
End-diastolic volume (EDV)	Volume of blood remaining in the ventricles after diastole (relaxation)
End-systolic volume (ESV)	Volume of blood remaining in the ventricles after systole (contraction)
Endurance activity	Physical activity lasting a significant period of time where the heart and respiratory rates plateau e.g. triathlon training
Enzyme	A protein produced to catalyse a reaction
Extension	Extension of a joint makes the body part move in a backwards direction e.g. the drawback of the leg in the preparation phase of kicking a football
External respiration	Gaseous exchange between the alveolar air and capillaries

F	
Fast glycolytic (FG)(2a) **Fast oxidative glycolytic(FOG)**(2b)	These muscle fibres are associated with anaerobic or explosive events e.g. sprinting. They have a high speed and force of contraction but fatigue very quickly. Type 2b have the greatest anaerobic capacity and contract with the most speed and force
Flexion	Flexion of a joint makes the body part move in a forwards direction e.g. the leg in the execution phase of kicking a football
Force	A push or pull that can alter the state of motion of a body, measured in Newtons
G	
Gaseous exchange	The exchange of oxygen and carbon dioxide by diffusion across the walls of the alveoli
General motion	A combination of linear and angular motion
Glycogen	Stored form of carbohydrate in the muscles and liver
Growth Plate	Referred to as the epiphyseal plate this is an area of growing tissue at the ends of long bones which is replaced by bone when fully mature
H	
Haemoglobin	A red blood cell (protein molecule) that transports oxygen in the bloodstream
HDLs (high density lipoproteins)	'Scavengers' which remove cholesterol from the arterial walls
Healthy diet	A diet containing the correct balance of carbohydrate, protein and fat, high in vitamins and minerals and low in salt
Heart attack	Total blockage of a coronary artery usually causing permanent damage
Heart Rate	The number of times the heart ventricles contract per minute (bpm)
High impact sport	Sports which include vigorous physical activity where a large force is applied to the skeleton e.g. rugby
Hypertension	Long-term high blood pressure >140/90 mmHg
Hyperventilation	A state of breathing faster and/or deeper than the body needs
Hypoxic conditions	An area where the partial pressure or oxygen is significantly reduced
I	
IMT	**I**nspiratory **m**uscle **t**raining - strengthening of the respiratory muscles
Internal respiration	Gaseous exchange between the blood capillaries and muscle tissue
Intrinsic control	Internal factors of temperature and venous return that affect HR control
Isometric contraction	When a muscle increases in tension but there is no movement at the joint. Also known as a static contraction
Isotonic contraction	When a muscle increases in tension with movement at the joint. Also known as a dynamic contraction
J	
Joint	The point of connection between the bones in the skeleton. Depending on structure joints can be classified as: ball and socket, hinge, pivot, condyloid or gliding
Joint stability	Resistance offered by connective tissue (muscle, ligament and tendon) around a joint
Joint trauma	An injury or dislocation of joint
L	
LDLs (low density lipoproteins)	These deposit harmful blood lipids/cholesterol on the arterial walls
Ligament	Connective tissue that joins bone to bone
Linear motion	Motion along a line. It can be straight e.g. tobogganing straight down a hill or curved e.g in the skeleton bob event. All parts move the same distance, in the same direction at the same speed
Line of gravity	An imaginary line extending from the centre of mass vertically down to the ground

M	
Mechanics of breathing	The process of moving air into and out of the lungs that involves muscles, movement, thoracic cavity volume, lung air pressure, inspiration and expiration. Changes occur from rest to exercise
Medulla oblongata	An area of the brain containing the cardiac, vasomotor and respiratory control centres
Minute ventilation	The volume of air inspired or expired per minute
Mitochondria	The 'power house' of a cell responsible for aerobic respiration
Movement analysis	The analysis of a movement pattern including: joint type, articulating bones, movement patterns, agonist muscle, antagonist muscle and contraction types
Muscle tone	Continuous state of partial muscle contraction maintaining posture
Myocardial infarction	Heart attack involving a total blockage of a coronary artery
Myocardium	Cardiac muscle
Myoglobin	Red pigment found in muscle cells that stores oxygen
N	
Neural control	Sensory receptors that provide the cardiac control centre with information: proprio-receptors= motor activity, chemo- receptors=chemical changes, baro-receptors= pressure changes
Newton's law 1: Inertia	A body continues in a state of rest or uniform velocity unless acted upon by an external force
Newton's law 2: Acceleration	The rate of change in momentum experienced by an object is directly proportional to the size of the force applied and takes place in the same direction as the force applied
Newton's law 3: Reaction	For every action force there is an equal and opposite reaction force
O	
OBLA	**O**nset of **b**lood **l**actate **a**ccumulation. The point at which production of lactic acid exceeds its removal which causes muscle fatigue
Osteoarthritis	Painful, swollen joints caused by a loss of articular cartilage at the ends of long bones. It can severely limit involvement in physical activity
Osteoporosis	Disorder resulting in fragile bones that are prone to fracture
Oxygen-haemoglobin dissociation curve	A graph showing the amount of haemoglobin saturated/associated with oxygen. During exercise the following factors shift the dissociation curve to the right: 1. Increase in PP of CO_2 2. Decrease in PP of O_2 within muscle increasing O2 diffusion gradient 3. Increase in blood and muscle temperature 4. Bohr effect – increase in acidity (lower pH)
P	
Parasympathetic nervous system	System initiated by the cardiac control centre to decrease heart rate
Partial pressure	The pressure a gas exerts within a mixture of gases
Plantar-flexion	Plantar-flexion of the ankle joint moves the foot away from the tibia, e.g. when you walk on your tip-toes
Pronation	Pronation of radio-ulnar joint moves the hands & forearms so palm faces down
Proprioreceptor	A sensory receptor responsible for sensing changes in muscular movement
R	
Repetitive action sports	Sports which use the same movement pattern repeatedly e.g. tennis, golf, running
Resistance	Friction of blood cells against artery walls (fluid friction)
Respiratory control centre	(RCC) Control centre in the medulla oblongata that regulates pulmonary breathing
Rotation	Rotation of a joint turns the body part about its long axis. Can be medial or lateral

S	
SA node	The sino-atrial node (often termed the 'pacemaker') is responsible for initiating the cardiac impulse
Sedentary lifestyle	An inactive lifestyle with little or no physical activity
Slow oxidative muscle fibre (SO)	(Type 1) Fibre type associated with aerobic work e.g. marathon running / triathlon. It has a low speed and force of contraction but resists fatigue well
Smooth muscle	Involuntary muscle found in blood vessel walls
Sprain	An injury resulting from overstretching a ligament
Stability	The degree to which body is balanced, steady and difficult to move
Starling's Law	Stroke volume is dependent on venous return. Any increase in venous return will cause an increase in stroke volume and therefore cardiac output
Strain	An injury resulting from overstretching a muscle or tendon
Stress fracture	A break in a bone caused by over use rather than a specific injury
Stroke volume (SV)	The volume of blood ejected from the left ventricle per beat (ml)
Supination	Supination of the radio-ulnar joint moves the hands and forearms so that the palm faces upwards
Sympathetic nervous system	System initiated by the cardiac control centre to increase heart rate
Systole	Contraction phase of the cardiac cycle
T	
Tendon	Connective tissue that attaches skeletal muscle to bone
Tidal volume	The volume of air inspired or expired per breath
Triglycerides	Lipids that form much of the stored, excess body fat / calories in the body. They circulate in the blood as lipoproteins
V	
Vascular shunt	The redistribution of cardiac output between the organs and muscles from rest to exercise
Vagus nerve	This nerve has an inhibitory effect. It decreases SA node activity which decreases HR and SV
Vein	A blood vessel which carries deoxygenated blood away from the tissues towards the heart
Venous return	The return of deoxygenated blood to the heart
Ventricular contractility	Capacity of the ventricles to contract
Ventricular diastole	Relaxation of the ventricles
Ventricular systole	Contraction of the cardiac ventricles forcing blood through the aorta and pulmonary artery
Vital capacity	The maximum volume of air expired after a maximal inspiration
VO_2 max	Maximum volume of oxygen consumed and used during exercise
W	
Warm-up	Light aerobic exercise, mobilisers and stretches that precede a session of physical activity. The aim is to increase heart and respiratory rate, raise temperature and prevent injury.
WHO	The World Health Organisation recommend how to achieve a balance active healthy lifestyle

Glossary of Key A&P Terms

A	
Abduction	
Accelerator nerve	
Adduction	
Aerobic adaptation	
Aerobic work	
Agonist	
Altitude	
Alveoli	
Anaerobic work	
Angina	
Angular motion	
Antagonistic pair	
Altitude training	
Antagonist	
Antagonistic muscle action	
Artery	
Articular cartilage	
Asthma	

Arteriosclerosis	
Atherosclerosis	
Atrial diastole	
Atrial systole	
B	
BAHL	
Baroreceptor	
Base of support	
Biomechanics	
Blood pressure	
Blood viscosity	
Bohr shift/effect	
Bone Spurs	
Bradycardia	
Bursa	
C	
Capillary	
Carbon monoxide	
Cardiac control centre (CCC)	
Cardiac cycle	

Cardiac hypertrophy	
Cardiac output	
Centre of mass	
Chemoreceptor	
Cholesterol	
Circumduction	
Concentric contraction	
Contact sports	
Cool-down	
Coronary circulation	
Coronary Heart Disease (CHD)	
Core stability	
D	
Diastole	
Diaphragm	
Diffusion gradient	
Dorsi-flexion	
E	
Eccentric contraction	
Eccentric force	

End-diastolic volume (EDV)	
End-systolic volume (ESV)	
Endurance activity	
Enzyme	
Extension	
External respiration	
F	
Fast glycolytic muscle fibre (FG)	
Fast oxidative glycolytic (FOG)	
Flexion	
Force	
G	
Gaseous exchange	
General motion	
Glycogen	
Growth Plate	
H	
Haemoglobin	
HDLs (high density lipoproteins)	
Healthy diet	
Heart attack	

Heart Rate	
High impact sport	
Hormonal control	
Hypertension	
Hyperventilation	
Hypoxic conditions	
I	
IMT	
Internal respiration	
Intrinsic control	
Isometric contraction	
Isotonic contraction	
J	
Joint	
Joint stability	
Joint trauma	
L	
LDLs (low density lipoproteins)	
Ligament	
Linear motion	
Line of gravity	

M	
Mechanics of breathing	
Medulla oblongata	
Minute ventilation	
Mitochondria	
Movement analysis	
Muscle tone	
Myocardial infarction	
Myocardium	
Myoglobin	
N	
Neural control	
Newton's law 1: Inertia	
Newton's law 2: Acceleration	
Newton's law 3: Reaction	
O	
OBLA	
Osteoarthritis	

Osteoporosis	
Oxygen-haemoglobin dissociation curve	
P	
Parasympathetic nervous system	
Partial pressure	
Plantar-flexion	
Pronation	
Proprioreceptor	
R	
Repetitive action sports	
Resistance	
Respiratory control centre	
Rotation	
S	
SA node	
Sedentary lifestyle	
Slow oxidative muscle fibre (SO)	
Smooth muscle	
Sprain	
Stability	
Starling's Law	
Strain	

Stress fracture	
Stroke volume (SV)	
Supination	
Sympathetic nervous system	
Systole	
T	
Tendon	
Tidal volume	
Triglycerides	
V	
Vascular shunt	
Vagus nerve	
Vein	
Venous return	
Ventricular contractility	
Ventricular diastole	
Ventricular systole	
Vital capacity	
VO_2 max	
W	
Warm-up	
WHO	

Command Words

Account for Give reasons or an explanation for	**Analyse** Examine…investigate….give an account/evaluation	**Assess** Weigh up or consider something
Briefly… Be concise/straightforward	**Comment** Give a commentary or opinion on something	**Classify** Put something into a group or category
Compare Identify **similarities** and **differences**. **Either** use comparative adjectives e.g. larg**er** than, **more** competitive – **or** say something about one of the subjects followed by **whereas**, **however** or **in contrast** before making the comparative point about the other.		
Contrast (When on its own) means only looking for differences	**Comment on** Summarise the various points and give an opinion	**Define** Give a precise meaning of the term identified
Discuss Build an argument/ balanced written debate…give examples and try to reach a conclusion	**'Discuss the extent to which'** Judge the validity of the evidence or outcome	**Describe** Give a description - no need to **explain** unless you have been asked to do so
Explain Give **reasons or causes**. Show understanding Description is not enough (and may not be needed)	**Critically Evaluate** (e.g. critically evaluate the impact of media on sport) weigh it up or assess in terms of advantages/disadvantages independent opinion (& evidence)	**Examine** Look at/inspect/study
How What methods are or could be involved?	**Identify State Name** A short answer to a straightforward task needed here e.g. 'Identify characteristics of …'	**Justify** Often used when you have to make a decision e.g. justify the placement of something on a continuum
Outline Note main features of	**Select** Choose	**Suggest** Give a reason
Summarise Sum up/recap/review	**To what extent** Agree and disagree … comment for and against … **yes/but**	**Always do exactly what the question asks**

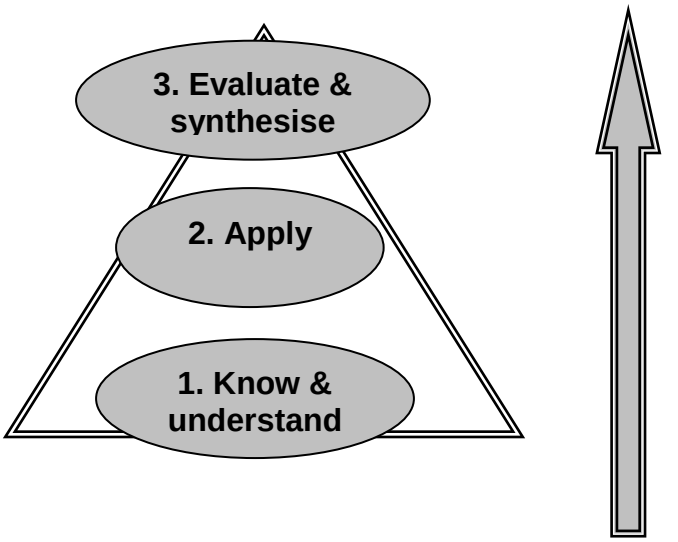
Exam Questions – stages of cognitive demand/development

Your AS PE written exam consists of three sections as follows:

- Section A - Anatomy and physiology
- Section B – Acquiring movement skills
- Section C – Socio-cultural studies

In the exam each of these three sections will have five questions (a–e)
One or more of the five question parts (a-e) may be sub-divided e.g. into a i) and a ii).
The first four questions (a-d) will usually have 4-6 marks (totalling 20) and the fifth part (e) will have 10 marks. This makes a total of 30 marks for each of the three sections. The fifth (10 mark) question (e) will need you to think or consider (analyse or critically evaluate) your knowledge more fully than questions a-d.

Stages of cognitive development



Linked 'command' words

Critically evaluate / analyse
Discuss
Explain
Describe
Identify

Stage 1 – Knowledge and understanding. You need a knowledge base (to learn the information from the spec) before you can move up the 'cognitive triangle'. You cannot apply your knowledge to more demanding questions if you don't know it in the first place! You are likely to get some straightforward level 1 marks at AS (e.g. *identify two structural characteristics of muscle fibre types associated with athletes participating in endurance events*) – but you should work towards operating beyond this stage.

Satge 2 – Apply. This is where you use your learned and understood knowledge and can shift it around in your head to answer a more engaging question e.g. *Using examples from PE or sport explain how changes in the position of a performer's centre of mass can affect performance.*

Stage 3 – Evaluate and synthesise. This is the 'fun' bit – the critical thinking! You know and understand the material, and can apply it. You can now consider it critically. You can add your opinions backed up with evidence and point out those of others. This is the **'yes, but'** stage. It can take some 'brain training' to reach – but it is worth the effort.
A 'Stage 3' question that asks you to 'critically evaluate' needs you to determine the value, significance, strengths and/or weaknesses of something, e.g. *critically evaluate the impact of long term aerobic training on the cardio vascular system.*

When critically evaluating a subject or issue (such as the potential impact of contact sports and activities involving repetitive actions on the skeletal system) you should ideally consider the following:

- *What's good about them – if anything?*
- *What's bad about them – if anything?*
- *What have others said or written about this issue?*
- *What do you think?*
- *Why do you think that?*
- *What is your evidence?*

Good answers contain evaluative or judgmental statements and descriptive points about the strengths and weaknesses associated with the topic, e.g. '*contact sports can cause broken bones, dislocated joints and meniscus tears. On the other hand they can also reduce the risk of osteoporosis, osteoarthritis and build stronger ligaments.'*

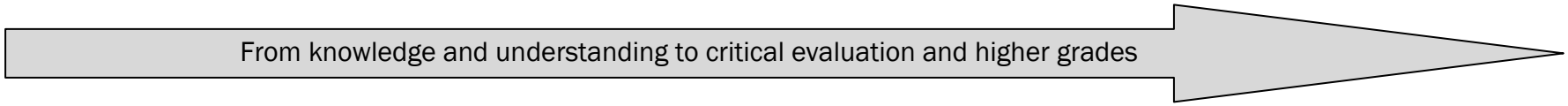
Better answers contain reasoned explanations for (or examples of) the points being made, e.g. '*contact sports such as rugby can cause broken bones (although after a break the bone is stronger). These sports can also cause dislocated joints and meniscus tears. On the other hand they can reduce the risk of osteoporosis (a disorder resulting in fragile bones that are prone to fracture), osteoarthritis (a degenerative disease due to loss of articular cartilage) and build stronger ligaments which can increase joint stability, and decrease risk of joint trauma.'*

So, you should not only say how good a particular idea is, but say exactly why you think that. The best answers really 'tussle' with the material probably having read about and around it as well as having discussed and debated it.

Developing 'higher order' thinking and writing skills – especially for your 10-mark questions

- First (and as always) read the exam question very carefully
- So, check the **command word**, the **subject** and **exactly what is being examined** about the subject
- Then (if required by the command word) set off on the road to **critical evaluation**

1. Know & understand	2. Apply	3. Evaluate & synthesise
Identify **Describe**	**Explain** **Give reasons for**	**Discuss** **Analyse** **Critically evaluate**
Brainstorm	Write….develop	Develop further Think of alternatives
Think of points that relate directly to the exam question	Develop key points by saying **why** and **how** they are significant to the question **Explain** significance	**Critically reflect** on what you have written
List or 'spider diagram' your points/ ideas	Give **examples** and **evidence** to support your points	Complete key points or paragraphs with **alternative evidence** / a different view
Each of the points can be used as central theme of sentences or even paragraphs	Keep application relevant and stay focused on the exact requirements of the question.	Sum up or make a **relevant conclusion**



The aim here is to take a key idea and to develop it into something more critically evaluative by adding examples, evidence, explanations and alternative views where relevant

1. Know and understand	2. Apply		3. Evaluate and synthesis
Key idea	Example/ evidence	Explanation	Development/ critical evaluation What's good or bad? How does it affect health or sport? What do you think? Why?
Repetitive action sports are associated with osteoarthritis			
A high level of core stability is important for a healthy, balanced lifestyle			

1. Know and understand	2. Apply		3. Evaluate and synthesis
Key idea	Example/ evidence	Explanation	Development/ critical evaluation What's good or bad? How does it affect health or sport? What do you think? Why?
A high level of stability is beneficial for effective sports performance			
Newton's laws of motion can be applied to a 100m sprint start			

1. Know and understand	2. Apply		3. Evaluate and synthesis
Key idea	Example/ evidence	Explanation	Development/ critical evaluation What's good or bad? How does it affect health or sport? What do you think? Why?
Atherosclerosis is closely linked to developing coronary heart disease			
The vascular shunt mechanism is controlled by the vasomotor control centre			

1. Know and understand	2. Apply		3. Evaluate and synthesis
Key idea	Example/ evidence	Explanation	Development/ critical evaluation What's good or bad? How does it affect health or sport? What do you think? Why?
Altitude training is an effective training technique to improve endurance performance			
Smoking has a negative impact on gaseous exchange			

Exam Preparation – True or False

	True	False
1. There are five parts to each AS exam question		
2. A-D are usually 4-6 marks each and part E is a 10 mark question		
3. If the number of required responses is written as a word in the question e.g. state **two** structural characteristics of…..– only two will be marked		
4. Depending on the 'command word' I need to develop my answers with explanation, evidence and examples to hit the top marks		
5. In the anatomy and physiology section marks are often lost by candidates being Too Vague (TV)		
6. I must be able to apply my A&P knowledge to different types of sporting movement		
7. Students sometimes find internal respiration difficult to understand at first		
8. A&P questions will probably refer to **balanced healthy lifestyles** and **lifelong involvement in an active and healthy lifestyle**		
9. A&P questions usually include parts from each of the following key areas of the spec: ▫ The skeletal and muscular systems ▫ Motion and movement (smaller section) ▫ Response of CV system to physical activity ▫ Response of respiratory system to physical activity		
10. In the exam I should generally avoid using bullet points		

(See page 3 for answers)

Key term card match 1 - The Musculoskeletal System

Plantar-flexion of the ankle	**Agonist**: gastrocnemius/soleus **Antagonist**: tibialis anterior
Isotonic concentric contraction	Muscular contraction where muscle shortens under tension
Slow oxidative muscle fibre	Type of muscle fibre which has many mitochondria and resists fatigue
Extension of the hip	**Agonist**: gluteus maximus **Antagonist**: iliopsoas
Osteoporosis	Disease characterised by low bone mineral density

Osteoarthritis	Wearing down of articular cartilage causing swollen, painful joints
Isotonic eccentric contraction	Muscular contraction where muscle lengthens under tension
Fast glycolytic muscle fibre	Type of muscle fibre with few capillaries and high anaerobic capacity
Flexion of the knee	**Agonist**: biceps femoris **Antagonist**: rectus femoris
Extension of the elbow	**Agonist**: triceps brachii **Antagonist**: biceps brachii

Key term card match 2 – Motion and Movement.

Newton's first law of motion	A body continues in a state of rest or uniform velocity unless acted upon by an external force
Newton's second law of motion	The rate of change in momentum experienced by an object is directly proportional to the size of force applied and takes place in the same direction as the force applied
Linear motion	When a body moves in a straight or curved line, with all parts moving the same distance, in the same direction at the same speed
Angular motion	When a body moves in a circular path about an axis of rotation
Effects of force	Motion, acceleration, deceleration, change of direction or shape of a moving object

Size of force	The greater this is when applied to an object the greater the change in momentum
Centre of Mass	The point at which the body is balanced in all directions
Stability	The degree to which body is balanced, steady and difficult to move
Newton's third law of motion	For every action force there is an equal and opposite reaction force
General motion	A combination of linear and angular motion

Key term card match 3 – Cardiovascular System.

Diastole	Relaxation of the cardiac muscle
Atrial Systole	Contraction of the upper chambers of the heart
Sino-atrial (SA) node	Structure responsible for initiating the cardiac impulse
Atrio-ventricular node	Structure responsible for delaying the cardiac impulse allowing the atria to finish contracting
Heart Rate (HR)	The number of times the heart ventricles contract per minute (bpm)

Stroke Volume (SV)	The volume of blood ejected from the left ventricle per beat (ml)
Cardiac Output	The volume of blood ejected from the left ventricle per minute CO = HR x SV (l/min)
Vascular Shunt	The redistribution of cardiac output between the organs and muscles from rest to exercise
Starling's Law	This states that stroke volume is dependent on venous return. An increase in venous return causes an increase in stroke volume
Venous Return	The return of deoxygenated blood to the heart

Atherosclerosis	Fatty plaques on the artery walls causing a narrowing of blood vessels and a likelihood of blood clots
Arteriosclerosis	Loss of elasticity in the blood vessel walls which reduces their ability to regulate blood pressure
Coronary Heart Disease	General term for all diseases relating to the coronary blood vessels and heart muscle
Heart Attack	Total blockage of a coronary artery usually causing permanent damage
Angina	A partial blockage of a coronary artery causing chest pain

Key term card match 4 – Respiratory System.

Pectorlaris Minor	An additional muscle which aids inspiration during exercise
Internal intercostals	An additional muscle which aids expiration during exercise
Diffusion	The movement of gases from an area of high to low pressure
Altitude	A training area >1500m above sea level where partial pressure of oxygen in the air is lower (than at sea level)
Myoglobin	Red pigment in muscle cells that stores oxygen

Asthma	Reversible narrowing of the airways with associated wheezing/ coughing/breathlessness
Inspiratory Muscle Training	Strengthening of the respiratory muscles
Carbon monoxide	Poisonous gas inhaled when smoking. Haemoglobin has higher affinity for this than O_2
Internal Respiration	The exchange of oxygen for carbon dioxide at the capillary – muscle site
Capillaries	A blood vessel that maximises diffusion by being only one cell thick

Answers to Key term card match 1 – The Musculoskeletal System	
Plantar-flexion of the ankle	Agonist: gastrocnemius/soleus Antagonist: tibialis anterior
Isotonic concentric contraction	Muscular contraction where muscle shortens under tension
Slow oxidative muscle fibre	Type of muscle fibre which has many mitochondria and resists fatigue
Extension of the hip	Agonist: gluteus maximus Antagonist: iliopsoas
Osteoporosis	Disease characterised by low bone mineral density
Osteoarthritis	Wearing down of articular cartilage causing swollen, painful joints
Isotonic eccentric contraction	Muscular contraction where muscle lengthens under tension
Fast glycolytic muscle fibre	Type of muscle fibre with few capillaries and high anaerobic capacity
Flexion of the knee	Agonist: biceps femoris Antagonist: rectus femoris
Extension of the elbow	Agonist: triceps brachii Antagonist: biceps brachii
Answers to Key term card match 2 – Motion and Movement	
Newton's first law of motion	A body continues in a state of rest or uniform velocity unless acted upon by an external force
Newton's second law of motion	The rate of change in momentum experienced by an object is directly proportional to the size of force applied and takes place in the same direction as the force applied
Linear motion	When a body moves in a straight or curved line, with all parts moving the same distance, in the same direction at the same speed
Angular motion	When a body moves in a circular path about an axis of rotation
Effects of force	Motion, acceleration, deceleration, change of direction or shape of a moving object
Size of force	The greater this is when applied to an object the greater the change in momentum
Centre of Mass	The point at which body is balanced in all directions
Stability	The degree to which body is balanced, steady and difficult to move
Newton's third law of motion	For every action force there is an equal and opposite reaction force
General motion	A combination of linear and angular motion

Answers to Key term card match 3 – Cardiovascular System	
Diastole	Relaxation of the cardiac muscle
Atrial Systole	Contraction of the upper chambers of the heart
Sino-atrial (SA) node	Structure responsible for initiating the cardiac impulse
Atrio-ventricular node	Structure responsible for delaying the cardiac impulse allowing the atria to finish contracting
Heart Rate (HR)	The number of times the heart ventricles contract per minute (bpm)
Stroke Volume (SV)	The volume of blood ejected from the left ventricle per beat (ml)
Cardiac Output	The volume of blood ejected from the left ventricle per minute CO = HR x SV (l/min)
Vascular Shunt	The redistribution of cardiac output between the organs and muscles from rest to exercise
Starling's Law	This states that stroke volume is dependent on venous return. An increase in venous return causes an increase in SV
Venous Return	The return of deoxygenated blood to the heart
Atherosclerosis	Fatty plaques on the artery walls causing a narrowing of blood vessels and a likelihood of blood clots
Arteriosclerosis	Loss of elasticity in the blood vessel walls which reduces their ability to regulate blood pressure
Coronary Heart Disease	General term for all diseases relating to the coronary blood vessels and heart muscle
Heart Attack	Total blockage of a coronary artery usually causing permanent damage
Angina	A partial blockage of a coronary artery causing chest pain
Answers to Key term card match 4 – Respiratory System	
Pectorlaris Minor	An additional muscle which aids inspiration during exercise
Internal intercostals	An additional muscle which aids expiration during exercise
Diffusion	The movement of gases from an area of high to low pressure
Altitude	A training area >1500m above sea level where partial pressure of oxygen in the air is lower (than at sea level)
Myoglobin	Red pigment in muscle cells that stores oxygen
Asthma	Reversible narrowing of the airways with associated wheezing/ coughing/breathlessness
Inspiratory Muscle Training	Strengthening of the respiratory muscles
Carbon monoxide	Poisonous gas inhaled when smoking. Haemoglobin has higher affinity for this than O_2
Internal Respiration	The exchange of oxygen for carbon dioxide at the capillary – muscle site
Capillaries	A blood vessel that maximises diffusion by being only one cell thick

What am I describing?

1 – The Musculoskeletal System

Shoulder	**Knee**
Ankle	**Radio-ulnar**
Warm-up	**Fast glycolytic fibre types**
Slow oxidative fibre types	**Concentric contraction**

Isometric contraction	**Posture and alignment**
Repetitive action physical activity	**High contact / collision physical activity**
Osteoporosis	**Osteoarthritis**
Growth plate disorders	**Joint stability**

What am I describing – possible clues
1 - The Musculoskeletal System

- **Ankle** – a joint which can plantar or dorsi-flex
- **Concentric contraction** – a type of muscular contraction where the muscle shortens in length under tension/a type of muscle contraction that causes joint movement
- **Fast glycolytic fibre type** – a type of muscle fibre used by 100m sprinters to create a fast speed and high force of contraction. It fatigues quickly
- **Growth plate disorder** – condition characterised by the premature closing of the epiphysis, often associated with gymnasts and weightlifters
- **High contact/collision physical activity** – type of physical activity which can be dangerous to joints due to overstretching connective tissues / a type of physical activity associated with dislocation e.g. rugby
- **Isometric contraction** – also known as static contraction this type of muscle contraction is used by gymnasts when holding the crucifix position on the rings. Here muscle produces tension whilst not changing length
- **Joint stability** – this can be increased by strengthening the ligaments and tendons around a joint. Due to its deep socket and high levels of connective tissue the hip joint has more of this than the shoulder joint
- **Knee** – a joint which extends to kick a ball. A joint whose agonist for extension is the rectus femoris
- **Osteoarthritis** – a disease of the skeletal system causing painful and swollen joints, bone spurs and decreased activity levels
- **Osteoporosis** – a disease of the skeletal system characterised by low bone mineral density and high fracture risk
- **Posture and alignment** – this can prevent lower back pain and increase muscular efficiency / this uses the transverse abdominis and multifidus / this is enhanced by having good core strength
- **Radio-ulnar** – a pivot joint in the arm / a joint which can pronate to put spin on a ball
- **Repetitive action physical activity** – sports that can be damaging in the long term by wearing away the articular cartilage / a type of activity associated with 'tennis elbow' or 'golfer's knee'
- **Shoulder** –a joint which uses the posterior deltoid as an agonist to extend the arm in the preparation phase of an underarm throw/ a joint which circumducts during a tennis serve
- **Slow oxidative fibre type** – a type of muscle fibre that resists fatigue well / type of muscle fibre with many capillaries, mitochondria and high myoglobin content
- **Warm-up** - this increases muscle temperature and elasticity and reduce risk of injury

What am I describing?

2 – Motion and Movement

Linear motion	**Angular motion**
General motion	**Newton's law 1**
Newton's law 2	**Newton's law 3**
Force	**Centre of mass**

Points of contact	**Line of gravity**
Base of support	**Inertia**
Acceleration	**Reaction**
Rotation	**Direct force**

What am I describing – possible clues
2 - Motion and Movement

- **Acceleration –** the rate of change in velocity / the opposite to deceleration / the name of Newton's second law
- **Angular motion** – a type of movement in a circular path about an axis of rotation
- **Base of support** – the area of a body in contact with the floor/ this is smaller in a handstand than in a bridge in gymnastics
- **Centre of mass** – the point at which the body is balanced in all directions
- **Direct force –** this creates linear motion / a type of force that is applied through the centre of mass
- **Force** – a push or pull that can change the direction or shape of an object / measured in Newtons
- **General motion** – a combination of linear and angular motion / a type of motion seen in a 100m sprint
- **Inertia –** the resistance of a body to change its state of motion / the name of Newton's first law
- **Line of gravity** – this comes from the centre of mass and should fall within the base of support for increased stability
- **Linear motion** – Movement along a line. This can be straight (e.g. tobogganing straight down a hill) or curved (e.g in the skeleton bob event)
- **Newton's law 1** – a football remains on the penalty spot until a footballer applies a force to create motion
- **Newton's law 2** – if a sprinter applies a greater force to the blocks they will accelerate away at a faster rate
- **Newton's law 3** – for every action there is an equal and opposite reaction
- **Points of contact** – the more of these there are the greater the base of support
- **Reaction –**the equal and opposite force in response to the first force exerted/the name of Newton's third law
- **Rotation –** created when the centre of mass moves outside the body / created by an eccentric force / can be medial or lateral

What am I describing?

3– The Cardiovascular System

Ventricular systole	Diastole
Conduction system	SA node
Venous return	Pocket valves
Starling's law	Cool-down

Vascular shunt	**Cardiac output**
Stroke volume	**Blood pressure**
Hypertension	**Atherosclerosis**
Coronary heart disease	**Heart attack**

What am I describing – possible clues
3 – The Cardiovascular System

- **Atherosclerosis** –the most common cause of CHD / a narrowing of the arteries / caused by fatty deposits / leads to coronary heart disease
- **Blood pressure** – the force exerted by the blood against the artery walls / average value of this is 120/80 mmHg
- **Cardiac output** – the volume of blood ejected from the left ventricle per minute / HR x SV = this!
- **Conduction system** – this controls the cardiac cycles / involves structures that pass a cardiac impulse through the heart walls
- **Cool-down** – performed after exercise to gradually lower the heart rate / this maintains venous return / light aerobic exercise and stretches that follow a session of physical activity / the aim of this is to gradually reduce heart and respiratory rates and to prevent blood pooling
- **Coronary heart disease** – the largest cause of death in the western world / caused by a combination of poor diet, inactivity and high blood pressure
- **Diastole** – when the heart relaxes / when the atria fill with blood
- **Heart attack** – a total blockage of a coronary artery / a potentially fatal consequence of coronary heart disease / myocardial infarction
- **Hypertension** – long-term high blood pressure / this accelerates arteriosclerosis/ this increases strain on the heart
- **Pocket valves** - prevent the backflow of blood / located in veins
- **SA node** – this generates a cardiac impulse
- **Starling's law** –this states that stroke volume is dependent on venous return
- **Stroke volume** – the volume of blood ejected by the left ventricle per beat / controlled by venous return
- **Vascular shunt** – redistribution of blood around the body / during exercise blood flow is redirected to the muscles and away from the organs
- **Venous return** – aided by gravity and the muscle pump / return of blood to the heart
- **Ventricular systole** – a type of contraction of the heart / contraction of the ventricles

What am I describing?

4 – The Respiratory System

Inspiration at rest	**Expiration during exercise**
Thermoreceptors	**Chemoreceptor**
Respiratory control centre	**Expiratory centre**
Gaseous exchange	**Diffusion gradient**

Bohr shift/effect	**Haemoglobin**
Carbon monoxide	**Asthma**
Inspiratory muscle training	**Altitude**
Partial pressure	**Capillarisation**

What am I describing – possible clues
4 – The Respiratory System

- **Altitude** – an area with low partial pressure of oxygen / an area above 1500m
- **Asthma** – a temporary narrowing of the airways / symptoms of this include coughing, wheezing and breathlessness
- **Bohr effect/shift** – an increase in the diffusion gradient caused by an increase in blood acidity/ an increase in acidity which causes the oxygen-dissociation curve to shift to the right increasing the dissociation of O_2 from haemoglobin
- **Capillarisation** – an increase in the number of capillaries due to aerobic training
- **Carbon monoxide** – poisonous gas linked with smoking / a partially combusted gas / CO
- **Chemoreceptors** – changes in oxygen, carbon dioxide or lactic acid are sensed by these structures
- **Diffusion gradient** – the difference between the concentration of a substance in one area compared to another area / also known as concentration gradient
- **Expiration during exercise** – this occurs when additional muscles such as the rectus abdominis, obliques and internal intercostals contract / a large decrease in thoracic cavity volume
- **Expiratory centre** – this sends stimulation to the rectus abdominis / this stimulates a forced expiration
- **Gaseous exchange** – the process of diffusion across a membrane
- **Haemoglobin** – a red blood cell that carries oxygen in the blood stream
- **Inspiration at rest** – this occurs when the diaphragm and external intercostals contract / a small intake of air
- **Inspiratory muscle training** – brings about a strengthening of the respiratory muscles / lessens breathlessness
- **Partial pressure** – oxygen has a high one of these in the alveolar air / the pressure a gas exerts within a mixture of gases
- **Respiratory control centre** – this is found in the medulla oblongata / this has two areas - one inspiratory and one expiratory
- **Thermoreceptors** – sensory structures that recognises changes in temperature

Quick Quiz 1 – The Musculoskeletal System

Fill in the missing blanks

The first letter of your answers will vertically spell '**OSTEOARTHRITIS**'

1.	A condition associated with increased fracture risk	O _ _ _ _ _ _ _ _ _ _ _
2.	A joint rotated by the internal and external obliques	S _ _ _ _
3.	A key muscle for core strength	T _ _ _ _ _ _ _ _ _ A _ _ _ _ _ _ _ _
4.	A joint used during a biceps curl	E _ _ _ _
5.	The formation of the adult skeleton	O _ _ _ _ _ _ _ _ _ _ _
6.	A smooth, slightly spongy structure that prevents bones rubbing together	A _ _ _ _ _ _ _ C _ _ _ _ _ _ _
7.	A movement which can be lateral or medial	R _ _ _ _ _ _
8.	The agonist for dorsi-flexion of the ankle	T _ _ _ _ _ _ _ A _ _ _ _ _ _ _
9.	This can be achieved by performing 30 minutes of physical activity five times a week (adults)	H _ _ _ _ _ B _ _ _ _ _ _ _ L _ _ _ _ _ _ _ _
10.	The antagonist for spine extension	R _ _ _ _ _ A _ _ _ _ _ _ _ _
11.	The agonist for hip flexion	I _ _ _ _ _ _ _
12.	A structure that connects muscle to bone	T _ _ _ _ _
13.	A warm-up has this effect on a muscle	I _ _ _ _ _ _ _ E _ _ _ _ _ _ _ _
14.	If you strengthen connective tissue surrounding a joint, it will have more…	S _ _ _ _ _ _ _

Quick Quiz 1 – The Musculoskeletal System

Answers

1.	A condition associated with increased fracture risk	**O**steoporosis
2.	A joint rotated by the internal and external obliques	**S**pine
3.	A key muscle for core strength	**T**ransverse abdominis
4.	A joint used during a biceps curl	**E**lbow
5.	The formation of the adult skeleton	**O**ssification
6.	A smooth, slightly spongy structure that prevents bones rubbing together	**A**rticular cartilage
7.	A movement which can be lateral or medial	**R**otation
8.	The agonist for dorsi-flexion of the ankle	**T**ibialis anterior
9.	This can be achieved by performing 30 minutes of physical activity five times a week (adults)	**H**ealthy balanced lifestyle
10.	The antagonist for spine extension	**R**ectus abdominis
11.	The agonist for hip flexion	**I**liopsoas
12.	A structure that connects muscle to bone	**T**endon
13.	A warm-up has this effect on a muscle	**I**ncreased elasticity
14.	If you strengthen connective tissue surrounding a joint, it will have more…	**S**tability

Quick Quiz 2 – Motion and Movement

Fill in the missing blanks

The first letter of your answers will vertically spell **'CENTRE OF MASS'**

1.	This is essential when holding a balance on the beam in gymnastics	C _ _ _ S _ _ _ _ _ _ _ _
2.	Acceleration, deceleration, changing direction, changing shape and creating motion, are all…	E _ _ _ _ _ _ O _ F _ _ _ _
3.	A set of rules governing the movement of bodies	N _ _ _ _ _ ' _ L _ _ _ O _ M _ _ _ _ _
4.	A muscle involved in core stability	T _ _ _ _ _ _ _ _ _ A _ _ _ _ _ _ _ _
5.	For every action there is an equal and opposite…	R _ _ _ _ _ _ _
6.	Newton's first law of motion is also known as: the Law of…	_ _ E _ _ _ _
7.	When a body travels in a straight line with all its parts moving the same distance, in the same direction at the same speed it is in a state of…	L _ _ _ _ _ _ O _ _ _ _
8.	A push or pull that changes the state of motion of a body	F _ _ _ _
9.	The greater this is the more stable the body will be	M _ _ _
10.	A gymnasts moving around the high bar will be performing…	A _ _ _ _ _ _ M _ _ _ _ _
11.	The greater this is the greater the acceleration of the object	S _ _ _ O _ F _ _ _ _
12.	This can be increased by widening the base of support	S _ _ _ _ _ _ _ _

Quick Quiz 2 – Motion and Movement

Answers

1.	This is essential when holding a balance on the beam in gymnastics	**C**ore stability
2.	Acceleration, deceleration, changing direction, changing shape and creating motion, are all…	**E**ffects of force
3.	A set of rules governing the movement of bodies	**N**ewton's laws of motion
4.	A muscle involved in core stability	**T**ransverse abdominis
5.	For every action there is an equal and opposite…	**R**eaction
6.	Newton's first law of motion is also known as: the Law of…	In**E**rtia
7.	When a body travels in a straight line with all its parts moving the same distance, in the same direction at the same speed it is in a state of…	Linear m**O**tion
8.	A push or pull that changes the state of motion of a body	**F**orce
9.	The greater this is the more stable the body will be	**M**ass
10.	A gymnasts moving around the high bar will be performing…	**A**ngular motion
11.	The greater this is the greater the acceleration of the object	**S**ize of force
12.	This can be increased by widening the base of support	**S**tability

Quick Quiz 3 – The Cardiovascular System

Fill in the missing blanks

The first letter of your answers will vertically spell **'VASCULAR SHUNT'**

1.	Blood going back to the heart	V _ _ _ _ _ R _ _ _ _ _
2.	The passage of blood into the ventricles is due to…	A _ _ _ _ _ S _ _ _ _ _ _
3.	Stroke volume is dependent on venous return - this is known as…	S _ _ _ _ _ _ _ ' _ L _ _
4.	The passage of electricity through the heart	C _ _ _ _ _ _ _ _ _ S _ _ _ _ _
5.	If you could reverse atherosclerosis you would be…	U N _ _ _ _ _ _ _ _ A _ _ _ _ _ _ _
6.	Performing a cool-down…	L _ _ _ _ _ _ _ _ G _ _ _ _ _ _ _ _
7.	A condition characterised by the hardening of arteries	A _ _ _ _ _ _ _ _ _ _ _ _ _ _ _
8.	The vascular shunt controls the…	R _ _ _ _ _ _ _ _ _ _ _ _ _ O _ B _ _ _ _ F _ _ _
9.	This reaches its maximum value at sub-maximal exercise	S _ _ _ _ _ V _ _ _ _ _
10.	This increases as exercise intensity increases	H _ _ _ _ R _ _ _
11.	A more technically correct term for heart	C _ _ _ _ _ _ _U _ _ _ _
12.	Proprioreceptors, baroreceptors, and chemoreceptors are all types of…	N _ _ _ _ _ C _ _ _ _ _ _
13.	A sensory receptor that picks up changes in temperature	T _ _ _ _ _ _ _ _ _ _ _ _ _

Quick Quiz 3 – The Cardiovascular System

Answers

1.	Blood going back to the heart	**V**enous return
2.	The passage of blood into the ventricles is due to…	**A**trial systole
3.	Stroke volume is dependent on venous return - this is known as…	**S**tarling's Law
4.	The passage of electricity through the heart	**C**onduction system
5.	If you could reverse atherosclerosis you would be…	**U**nblocking arteries
6.	Performing a cool-down…	**L**owers H R gradually
7.	A condition characterised by the hardening of arteries	**A**rteriosclerosis
8.	The vascular shunt controls the…	**R**edistribution of blood flow
9.	This reaches its maximum value at sub-maximal exercise	**S**troke volume
10.	This increases as exercise intensity increases	**H**eart rate
11.	A more technically correct term for heart	Cardiac m**U**scle
12.	Proprioreceptors, baroreceptors, and chemoreceptors are all types of…	**N**eural control
13.	A sensory receptor that picks up changes in temperature	**T**hermoreceptor

Quick Quiz 4 – The Respiratory System

Fill in the missing blanks

The first letter of your answers will vertically spell **'INSPIRATION AT REST'**

1.	A process used to strengthen muscles such as the external intercostals	I _ _ _ _ _ _ _ _ _ _ muscle T _ _ _ _ _ _ _
2.	A sensory mechanism that feeds the respiratory control centre	N _ _ _ _ _ C _ _ _ _ _ _
3.	An additional inspiratory muscle used when exercising	S _ _ _ _ _ _ _
4.	This is high in the capillary blood and low in the muscle tissues at rest	P _ _ _ _ _ _ P _ _ _ _ _ _ _ O _ O _ _ _ _ _
5.	This process is caused by an increase in thoracic cavity volume	I _ _ _ _ _ _ _ _ _ _
6.	This is located in the medulla oblongata and sends stimulation via the vagus and intercostal nerves	R _ _ _ _ _ _ _ _ _ _ C _ _ _ _ _ _ C _ _ _ _ _
7.	The temporary narrowing of the bronchi and bronchioles	A _ _ _ _ _
8.	An increase in tidal volume, capillarisation and strengthening of the respiratory muscles are all...	T _ _ _ _ _ _ _ E _ _ _ _ _ _
9.	The Bohr effect is caused by this happening during exercise	I _ _ _ _ _ _ _ _ A _ _ _ _ _ _ L _ _ _ _ _
10.	A gas used by the muscle tissues to create energy	O _ _ _ _ _
11.	Used to warm & moisten air while breathing	N _ _ _ _ C _ _ _ _ _
12.	Where the partial pressure of oxygen is lower in the alveolar air	A _ _ _ _ _ _ _
13.	Detected by thermorecepetors	T _ _ _ _ _ _ _ _ _ _
14.	Expiration is due to passive recoil of the external intercostals and diaphragm in this condition	R _ _ _
15.	This happens when oxygen and carbon dioxide move across membranes	E _ _ _ _ _ _ _ of G _ _ _ _
16.	An oxygen dissociation curve shows this level of oxygen in the haemoglobin	S _ _ _ _ _ _ _ _ _ _ (level)
17.	A way of using altitude to maximise training adaptations	*'T _ _ _ _ H _ _ _* *L _ _ _ L _ _'*

Quick Quiz 4 – The Respiratory System

Answers

1.	A process used to strengthen muscles such as the external intercostals	Inspiratory muscle training
2.	A sensory mechanism that feeds the respiratory control centre	Neural control
3.	An additional inspiratory muscle used when exercising	Scalenes
4.	This is high in the capillary blood and low in the muscle tissues at rest	Partial pressure of oxygen
5.	This process is caused by an increase in thoracic cavity volume	Inspiration
6.	This is located in the medulla oblongata and sends stimulation via the vagus and intercostal nerves	Respiratory control centre
7.	The temporary narrowing of the bronchi and bronchioles	Asthma
8.	An increase in tidal volume, capillarisation and strengthening of the respiratory muscles are all..	Training effects
9.	The Bohr effect is caused by this happening during exercise	Increased acidity levels
10.	A gas used by the muscle tissues to create energy	Oxygen
11.	Used to warm & moisten air while breathing	Nasal cavity
12.	Where the partial pressure of oxygen is lower in the alveolar air	Altitude
13.	Detected by thermorecepetors	Temperature
14.	Expiration is due to passive recoil of the external intercostals and diaphragm in this condition	Rest
15.	This happens when oxygen and carbon dioxide move across membranes	Exchange of gases
16.	An oxygen dissociation curve shows this level of oxygen in the haemoglobin	Saturation level
17.	A way of using altitude to maximise training adaptations	*'Train high live low'*

Cue Cards 1: The Musculoskeletal System

SHOULDER Joint type / articulating bones Movements and agonists **HIP** Joint type / articulating bones Movements and agonists	**ELBOW** Joint type / articulating bones Movements and agonists **RADIO-ULNAR** Joint type / articulating bones Movements and agonists **WRIST** Joint type / articulating bones Movements and agonists
SPINE Joint type / articulating bones Movements and agonists **KNEE** Joint type / articulating bones Movements and agonists **ANKLE** Joint type / articulating bones Movements and agonists	**WARM – UP EFFECTS** On speed and force of muscular contraction
MUSCLE FIBRE TYPE **FG / FOG / SO** 3 structural 3 functional Practical example	**HEALTH & ACTIVITY** Types of activity and general effects of exercise on: 1. MUSCLES 2. BONES
OSTEOPOROSIS **OSTEOARTHRITIS** **GROWTH PLATE DISORDERS**	**JOINT STABILITY** **POSTURE AND ALIGNMENT**

Cue Cards 1: The Musculoskeletal System – short answers

SHOULDER Ball & socket / head of humerus & glenoid cavity of scapula / flexion (anterior deltoid) / extension (posterior deltoid) / abduction (middle deltoid) / adduction (latissimus dorsi) **HIP** Ball & socket / acetabulum of pelvic girdle & head of femur / flexion (ilipsoas) / extension (gluteus maximus) / abduction (gluteus medius & minimus) / adduction (adductor longus)	**ELBOW** Hinge / humerus, radius & ulna / flexion (biceps brachii) / extension (triceps brachii) **RADIO-ULNAR** Pivot / radius & ulna / pronation (pronator teres) / supination (supinator) **WRIST** Condyloid / radius, ulna & carples / flexion (wrist flexors) / extension (wrist extensors
SPINE Gliding / vertebrae / flexion (rectus abdominis) / extension (erector spinae) **KNEE** Hinge / femur & tibia / flexion (biceps femoris) / extension (rectus femoris) **ANKLE** Hinge / tibia, fibula & talus / dorsi-flexion (tibialis anterior) / plantar-flexion (gastrocnemius & soleus)	**WARM – UP EFFECTS** Increased: muscle temperature / elasticity of connective tissue / flexibility / nerve transmission Decreased: Muscle viscosity Improved injury prevention & increased speed and force of muscular contraction
MUSCLE FIBRE TYPE **FG (100m sprinter)** **Structural**: large / few mitochondria & capillaries **Functional**: high speed & force of contraction / low fatigue resistance **FOG (team game player)** **Structural:** large /moderate mitochondria & capillaries **Functional:** high speed &force of contraction / low fatigue resistance **SO (marathon runner)** **Structural**: small / many mitochondria & capillaries **Functional**: low speed & force of contraction / high fatigue resistance	**HEALTH & ACTIVITY** In general physical activity can: **1. MUSCLES** Strengthen connective tissue & tone / improve posture & flexibility / reduce pain **2. BONES** Increase peak bone density / calcium salt deposition / vary line of stress / nourish & thicken articular cartilage High-impact can damage growth plate Contact sport compromises joint stability Repetitive action can lead to osteoarthritis No activity can lead to osteoporosis
OSTEOPOROSIS Low bone density leading to fracture risk (caused by sedentary lifestyle with low calcium & vitamin D in diet) **OSTEOARTHRITIS** Wear & tear of articular cartilage leading to bone spurs, swelling & joint pain **GROWTH PLATE DISORDERS** Caused by sudden forces that prematurely close the growth plate resulting in restricted growth	**JOINT STABILITY** Dislocations, sprains and strains can decrease physical activity & cause permanent lengthening of connective tissue (Rotator cuff: teres minor/supraspinatus) **POSTURE AND ALIGNMENT** Good posture prevents excess pressure and pain on lumbar vertebrae & maximum muscular efficiency (multifidus & transverse abdominis)

Cue Cards 2: Motion and Movement

LINEAR MOTION **ANGULAR MOTION** **GENERAL MOTION**	SPORTING EXAMPLES of: **Linear Motion** **Angular Motion** **General Motion**
NEWTON'S LAWS OF MOTION INERTIA (1) ACCELERATION (2) REACTION (3)	**EFFECTS OF FORCE** with examples
CENTRE OF MASS Define / Fosbury Flop	**SIZE OF FORCE** **DIRECTION OF FORCE** **POINT OF APPLICATION OF FORCE**
FACTORS AFFECTING STABILITY	

Cue Cards 2: Motion and Movement – short answers

LINEAR MOTION Straight line motion with body parts travelling at the same speed, direction & distance **ANGULAR MOTION** Circular motion about an axis of rotation **GENERAL MOTION** A combination of linear and angular motion	**Linear Motion** A tobogganist reaching maximum speed as they cross the finish line **Angular Motion** A gymnast rotating around the high bar **General Motion** A 100m sprinter (straight line motion with joints in angular motion)
NEWTON'S LAWS OF MOTION **1 (inertia)**: a body continues in a state of rest until an external force is applied **2 (acceleration):** the rate of change in momentum is proportional to the size of force applied & in the same direction **3 (reaction):** for every action force there is an equal and opposite reaction force	**EFFECTS OF FORCE** Force = push or pull that can alter the state of motion Create motion: football on penalty spot Accelerate: after the ball is kicked Decelerate: goalkeeper catch Change direction: side step in rugby Change shape: trampoline
CENTRE OF MASS The point at which the body is balanced in all directions Centre of mass can be moved outside the body to create rotation. Fosbury flop arched back moves centre of mass below the bar and becomes a pivot point allowing greater jump heights compared to the scissor kick method.	**SIZE OF FORCE** The greater the force applied the greater the change in momentum **DIRECTION OF FORCE** The body will travel in the same direction as the force applied **POINT OF APPLICATION OF FORCE** To create linear motion apply direct force through centre of mass To create angular motion apply eccentric force outside the centre of mass
FACTORS AFFECTING STABILITY Height of centre of mass (lower = more stable) Size of base of support (larger = more room for movement of centre of mass = more stable) Line of gravity (falls within the base of support = stable) Mass of athlete (higher mass = more stable)	

Cue Cards 3: The Cardiovascular System

CARDIAC CYCLE Diastole Atrial Systole / Ventricular Systole **CONDUCTION SYSTEM**	**VENOUS RETURN** Define List 5 mechanisms **STARLING'S LAW**
WARM-UP EFFECTS On the vascular system **COOL-DOWN EFFECTS** On the vascular system	**CO / SV / HR** Define terms Draw sub-max and max graphs showing values and units
BLOOD PRESSURE Define / resting value **HYPERTENSION** **O2 / CO2 TRANSPORT** Effects of smoking	**VASCULAR SHUNT** **VASOMOTOR CONTROL**
HORMONAL CONTROL OF HR **INTRINSIC CONTROL OF HR** **NEURAL CONTROL OF HR**	**CORONARY HEART DISEASE** **TYPES OF ACTIVITY** **AEROBIC** **WEIGHT/ISOMETRIC**

Cue Cards 3: The Cardiovascular System – short answers

CARDIAC CYCLE **Diastole**: relaxation of cardiac muscle (atria fill with blood) **Atrial Systole**: atria contract (blood forced into ventricles) **Ventricular Systole**: ventricles contract (blood forced to tissues & lungs) **CONDUCTION SYSTEM** Initiation and movement of the cardiac impulse to control the cardiac cycle SA node – AV node – bundle of His – bundle branches – purkinje fibres	**VENOUS RETURN** Return of blood to the heart Pocket valves Muscle pump Respiratory pump Smooth muscle Gravity **STARLING'S LAW** SV is dependant on VR SV increases when VR and ventricle stretch increases
WARM-UP EFFECTS Increased blood flow/CO/blood & muscle temperature/enzyme activity/oxygen dissociation. Decrease blood viscosity/ OBLA **COOL-DOWN EFFECTS** Gradual decrease of HR/SV/CO. Maintains respiratory & muscle pump/VR/blood pressure/capillary dilation to remove lactic acid & CO_2	**CO** = HR x SV, volume of blood ejected from left ventricle per minute (l.min) **SV** = volume of blood ejected from the left ventricle per beat (mls.min) **HR** = number of ventricle contractions in one minute (bpm) See Heinemann student text *OCR AS PE* page 71 for graphs
BLOOD PRESSURE Pressure exerted by blood on arterial walls, healthy value 120/80mmHg **HYPERTENSION** Long term high blood pressure >140/90mmHg **O_2**: haemoglobin/plasma **CO_2**: haemoglobin/plasma/carbonic acid **Smoking**: inhale carbon monoxide, higher affinity to haemoglobin, decrease HbO_2 saturation	**VASCULAR SHUNT** Redistribution of cardiac output from rest to exercise. **Rest**: 80% blood flow directed to organs. **Exercise**: 80% blood flow directed to muscle tissue **VASOMOTOR CONTROL** Acidity (chemoreceptors) & blood pressure (baroreceptors) increase = VCC increases stimulation of arterioles & pre-capillary sphincters to organs to vaso-constrict reducing blood flow
Effect of exercise: **HORMONAL CONTROL OF HR** Release of adrenaline directly stimulates the SA node to increase HR **INTRINSIC CONTROL OF HR** Temperature (thermoreceptors) & venous return increase = CCC increases HR sympathetically via accelerator nerve **NEURAL CONTROL OF HR** Motor activity (proprioreceptors), acidity (chemoreceptors) & blood pressure (baroreceptors) increase = CCC increases HR sympathetically via accelerator nerve	**CORONARY HEART DISEASE** **CHD**: reduction of coronary circulation/ decrease delivery of blood & oxygen to cardiac muscle. **Atherosclerosis**: build up of fatty plaques on arterial walls. **Arteriosclerosis**: hardening of arteries. **Angina**: partial blockage of coronary artery. **Heart attack**: total blockage of coronary artery **TYPES OF ACTIVITY** **Aerobic** = 3 x 30mins per week beneficial (decrease blood lipids/LDLs/obesity/ stress/risk of atherosclerosis/CHD) **Weight/isometric** = increases blood pressure = can trigger angina/ heart attack

Cue Cards 4: The Respiratory System

MECHANICS OF BREATHING **INSPIRATION** at rest and response to exercise	**MECHANICS OF BREATHING** **EXPIRATION** at rest and response to exercise
RESPIRATORY CONTROL **Inspiration** – rest / exercise **Expiration** – rest / exercise	**GASEOUS EXCHANGE** **EFFECT OF EXERCISE**
O_2 / CO_2 TRANSPORT **EFFECT OF SMOKING on health and performance**	**ASTHMA** **EXERCISE INDUCED ASTHMA** **TREATMENT**
EFFECT OF ALTITUDE On efficiency of respiratory system On performance	Effect of **AEROBIC** training

Cue Cards 4: The Respiratory System – short answers

MECHANICS OF BREATHING	MECHANICS OF BREATHING
Inspiration at rest = Diaphragm & external intercostals contract = up & out movement of ribs and sternum/diaphragm flattens = thoracic cavity volume increases = lung air pressure decreases **Exercise** = additional muscles contract (e.g. scalenes) = ribs & sternum lifted with more force/diaphragm flattens further = greater increase in thoracic cavity volume = lower pressure of lung air = greater inspiration	**Expiration at rest** = diaphragm + external intercostals relax = down & in movement of ribs & sternum/diaphragm domes = thoracic cavity volume decreases = lung air pressure increases **Exercise** = additional muscle contract (e.g. rectus abdominis) = ribs & sternum down with more force/diaphragm up further = greater decrease in thoracic cavity volume = higher pressure of lung air = greater expiration
RESPIRATORY CONTROL	**GASEOUS EXCHANGE**
Inspiration: Increased temperature (thermoreceptors), motor activity (proprioreceptors) & acidity (chemoreceptors) = RCC initiates IC = phrenic & intercostal nerve stimulate external intercostals & diaphragm at rest/additional muscles during exercise = increased breathing depth **Expiration:** Increased stretch (stretch receptors) = RCC initiates EC = stimulate internal intercostals & additional muscles during exercise = increased breathing rate	**External:** high PPO_2 in alveolar air - low PPO_2 in blood capillaries = diffusion gradient (O_2 into blood) **Internal:** high PPO_2 in blood capillaries – low PPO_2 in muscle tissue = diffusion gradient (O_2 into muscle tissue) **EFFECT OF EXERCISE** Increase diffusion gradient /lower PPO_2 in blood capillaries (external) and muscle tissue (internal)/increase temperature & acidity (Bohr effect)/HbO_2 dissociation. Increased diffusion of O_2
TRANSPORT	**ASTHMA**
O_2: haemoglobin/plasma **CO_2:** haemoglobin/plasma/carbonic acid **Smoking:** inhale carbon monoxide, higher affinity to haemoglobin, decrease HbO_2 saturation **Health:** impairs development/lung function & diffusion rates/ increased prevalence of disease, infection and damage (asthma/COPD/cancer) **Performance:** decreased VO_2max	Reversible narrowing of airways (wheezing breathlessness/excess mucus) Triggers: dust/pollen/pollutants **EXERCISE INDUCED ASTHMA** Bronchoconstriction brought on by exercise (especially cold & dry air) limits performance **Treatment:** Bronchodilators (reliever) corticosteroids (preventer) warm-up/ IMT
EFFECT OF ALTITUDE	Effect of **AEROBIC** training
On respiratory system: decreased alveolar PPO_2 (hypoxia) /diffusion gradient (external) /HbO_2 /O_2 transport in blood/diffusion gradient (internal) / O_2 supply to muscles **On performance:** Decreased VO_2max/ hyperventilation /aerobic performance/ increased muscular fatigue	**Respiratory structures:** increased alveoli/elasticity/longevity of structures **Breathing mechanics:** increased strength & endurance of respiratory muscles **Respiratory volumes:** increase minute ventilation (120 to 150l.min maximally) **Diffusion:** increased pulmonary diffusion/ VO_2 diff in maximal activity **Net Effect:** increase intensity & duration of aerobic performance (delay fatigue)

Fill in the blanks 1: The Musculoskeletal System

The Ankle, Knee and Hip

The ankle is a _____ joint with three articulating bones: talus, tibia and fibula.

- When a basketballer jumps and leaves the ground the ankle plantarflexes. The agonist for plantarflexion is the _____. The _____ is the tibialis anterior, which _____ contracts, lengthening under tension to provide a co-ordinated movement.

The knee is a hinge joint with two articulating bones: _____ and tibia.

- When a footballer strikes the ball, in the execution phase of a kick the knee extends. The agonist for extension is the _____ (vastus lateralis, vastus medialis and vastus intermedius), which concentrically contracts _____ under tension. The antagonist is the _____ (semimembranosus and semitendinosus) which eccentrically contract to control the movement.

The hip is a _____ joint, which has a large range of movement. The deep socket of the _____ articulates with the head of the humerus

- When rotating over the high jump bar using the Fosbury Flop technique, the hip joint extends. The agonist for hip extension is the _____ concentrically contracting. The antagonist is the iliopsoas eccentrically contracting.
- When performing a star jump, in the outward phase the hip joint abducts. The agonist for hip abduction is the gluteus medius and minimus, which _____ contract to create the movement. The antagonist is the adductor longus (_____ and brevis), which eccentrically contracts _____ under tension.

Word bank

biceps femoris	ball and socket	antagonist	gluteus maximus	lengthening
hinge	rectus femoris	pelvic girdle	eccentrically	gastrocnemius
magnus	concentrically	femur	shortening	

Answers - The Musculoskeletal System
The Ankle, Knee and Hip

The ankle is a **hinge** joint with three articulating bones: talus, tibia and fibula.

- When a basketballer jumps and leaves the ground the ankle plantarflexes. The agonist for plantarflexion is the **gastrocnemius**. The **antagonist** is the tibialis anterior, which **eccentrically** contracts, lengthening under tension to provide a co-ordinated movement.

The knee is a hinge joint with two articulating bones: **femur** and tibia.

- When a footballer strikes the ball, in the execution phase of a kick the knee extends. The agonist for extension is the **rectus femoris** (vastus lateralis, vastus medialis and vastus intermedius), which concentrically contracts **shortening** under tension. The antagonist is the **biceps femoris** (semimembranosus and semitendinosus) which eccentrically contract to control the movement.

The hip is a **ball and socket** joint, which has a large range of movement. The deep socket of the **pelvic girdle** articulates with the head of the humerus.

- When rotating over the high jump bar using the Fosbury Flop technique, the hip joint extends. The agonist for hip extension is the **gluteus maximus** concentrically contracting. The antagonist is the iliopsoas eccentrically contracting.
- When performing a star jump, in the outward phase the hip joint abducts. The agonist for hip abduction is the gluteus medius and minimus, which **concentrically** contract to create the movement. The antagonist is the adductor longus (**magnus** and brevis), which eccentrically contracts **lengthening** under tension.

Fill in the blanks 2: Motion and Movement
Stability

Factors that affect stability:

- The lower the centre of mass the greater the stability.
- Centre of mass is the point at which the body is _____ in all directions
- The wider the base of _____ the greater the stability
- If the line of _____ falls within the base of support the body will be stable
- The greater the _____ of the athlete the greater the stability

Stability is essential for _____ situations, such as a footballer withstanding a tackle or taking a shot on goal keeping the head, knee and toe in line, with the line of gravity falling through the planted foot.

Rugby players in a scrum widen their _____, leaning into the force and bending their _____ to lower the centre of mass.

Instability is an advantage for _____ sports such as netball where the performer must change _____ quickly, moving the line of gravity outside the base of support to gain maximum reach to intercept the ball.

Badminton players must change direction at _____ and move from left to right across the court with ease. They raise their centre of mass, staying on their toes with their racquet high and often place all their _____ over only one foot to push away from the ground in the opposite direction.

Word bank:

direction	mass	defensive	weight	support
stance	agility	balanced	gravity	knees
speed				

Answers - Motion and Movement
Stability

Factors that affect stability:

- The lower the centre of mass the greater the stability
- Centre of mass is the point at which the body is **balanced** in all directions
- The wider the base of **support** the greater the stability
- If the line of **gravity** falls within the base of support the body will be stable
- The greater the **mass** of the athlete the greater the stability

Stability is essential for **defensive** situations, such as a footballer withstanding a tackle or taking a shot on goal keeping the head, knee and toe in line, with the line of gravity falling through the planted foot.

Rugby players in a scrum widen their **stance**, leaning into the force and bending their **knees** to lower the centre of mass.

Instability is an advantage for **agility** sports such as netball where the performer must change **direction** quickly, moving the line of gravity outside the base of support to gain maximum reach to intercept the ball.

Badminton players must change direction at **speed** and move from left to right across the court with ease. They raise their centre of mass, staying on their toes with their racquet high and often place all their **weight** over only one foot to push away from the ground in the opposite direction.

Fill in the blanks 3: Cardiovascular System

Vascular shunt control during exercise

At rest 80% of the _____ leaving the heart distributes blood flow to the organs and only 20% to the muscles.

As a performer begins to _____ the sensory receptors pick up changes in our body and send information to the vasomotor control centre (VCC) in the _____ .

- _____ sense an increase in muscular movement
- _____ sense an increase in carbon dioxide and decrease in oxygen levels
- _____ sense an increase in the pressure of blood against the arterial walls

The VCC _____ the _____ and pre-capillary sphincters feeding the organs to _____. This decreases the blood flow to the organs.

The VCC decreases stimulation to the arterioles and pre-capillary sphincters feeding the working _____ allowing them the vasodilate. This increases the blood flow to the working muscles.

During intense activity roughly _____ of blood flow is distributed to the working muscles and only _____ to the organs.

Word bank

exercise	muscles	80%	stimulates	chemoreceptors
medulla oblongata	cardiac output	arterioles	proprioreceptors	20%
baroreceptors	vasoconstrict			

Answers - Cardiovascular System

Vascular shunt control during exercise

At rest 80% of the **cardiac output** leaving the heart distributes blood flow to the organs and only 20% to the muscles.

As a performer begins to **exercise** the sensory receptors pick up changes in the body and send information to the vasomotor control centre (VCC) in the **medulla oblongata**.

- **Proprioreceptors** sense an increase in muscular movement
- **Chemoreceptors** sense an increase in carbon dioxide and decrease in oxygen levels
- **Baroreceptors** sense an increase in the pressure of blood against the arterial walls

The VCC **stimulates** the **arterioles** and pre-capillary sphincters feeding the organs to **vasoconstrict**. This decreases the blood flow to the organs .
The VCC decreases stimulation to the arterioles and pre-capillary sphincters feeding the working **muscles** allowing them the vasodilate. This increases the blood flow to the working muscles.

During intense activity roughly **80%** of blood flow is distributed to the working muscles and only **20%** to the organs.

Fill in the blanks 4: Respiratory System

Gaseous Exchange

Respiration and gaseous exchange are essential for aerobic athletes such as Paula Radcliffe who require _____ to create energy for muscular contraction. At rest oxygen _____ into the bloodstream where the haemoglobin has a high _____ for oxygen and _____ up to 98% _____. At the internal site the capillary blood has a _____ partial pressure (pp) of O_2 and muscle tissue a _____ ppO_2. As gases move down a pressure _____ from an area of high to low pressure the oxygen diffuses into the muscle tissue.

As Paula Radcliffe begins to perform the marathon race, the demand for oxygen increases and the _____ _____ redirects 80% of the blood flow to the working _____ away from the organs
The effect of exercise on gaseous exchange is to:

- Increase the _____ of blood and muscle tissue
- Increase the production of _____
- Increase production of CO_2

CO_2 is converted into carbonic acid, and with lactic acid raises the _____ levels of the blood stream. This increases the _____ of O_2 from haemoglobin increasing the rate of diffusion. The is known as the _____ effect.

The muscles use greater volumes of oxygen, _____ the ppO_2 in the muscles tissue and increasing the diffusion gradient. The increased supply of oxygen to muscle cells increases _____ supply and enables Paula Radcliffe to exercise for longer at a higher intensity.

Word bank:

decreasing	lactic acid	gradient	associates	muscles
acidity	oxygen	high	temperature	saturation
diffuses	affinity	energy	low	dissociation
vascular shunt	Bohr			

Answers - Respiratory System

Gaseous Exchange

Respiration and gaseous exchange are essential for aerobic athletes such as Paula Radcliffe who require **oxygen** to create energy for muscular contraction. At rest oxygen **diffuses** into the bloodstream where the haemoglobin has a high **affinity** for oxygen and **associates** up to 98% **saturation**. At the internal site the capillary blood has a **high** partial pressure (pp) of O_2 and muscle tissue a **low** ppO_2. As gases move down a pressure **gradient** from an area of high to low pressure the oxygen diffuses into the muscle tissue.

As Paula Radcliffe begins to perform the marathon race the demand for oxygen increases and the **vascular shunt** redirects 80% of the blood flow to the working **muscles** away from the organs. The effect of exercise on gaseous exchange is to:

- Increase the **temperature** of blood and muscle tissue.
- Increase the production of **lactic acid.**
- Increase production of CO_2.

CO_2 is converted into carbonic acid, and with lactic acid raises the **acidity** levels of the blood stream. This increases the **dissociation** of O_2 from haemoglobin increasing the rate of diffusion. The is known as the **Bohr** effect.

The muscles use greater volumes of oxygen, **decreasing** the ppO_2 in the muscles tissue and increasing the diffusion gradient. The increased supply of oxygen to muscle cells increases **energy** supply and enables Paula Radcliffe to exercise for longer at a higher intensity.

Dominoes / 'follow me' 1: Musculoskeletal System

BURSA	..increases muscle temperature and enzyme activity
TENDON	...benefit of the hip joint
AEROBIC EXERCISE	...reduces the risk of delayed onset of muscle soreness
ANTAGONIST	...an athlete with a high percentage of FG fibres in the soleus
RADIO-ULNAR	...bone growth
BICEPS BRACHII	...lengthens under tension
ISOMETRIC	...sub-maximal activity where oxygen supply meets demand
A WARM-UP	...a fibre type rich in myoglobin
COOL-DOWN	...creates upward phase of a bicep curl

DEEP SOCKET	...prevents friction between articulating bones
ECCENTRIC	...a pivot joint which supinates
ROTATION	...a synovial fluid filled sac which reduces friction
OSSIFICATION	...connective tissue joining muscle to bone
SPRINTER	...cartilaginous / gliding / pivot
SLOW OXIDATIVE	a muscle which co-ordinates movement
ARTICULAR CARTILAGE	...movement of a bone around its longitudinal axis
SPINAL JOINTS	...muscle contraction with no change in muscle length

Answers/links - Musculoskeletal System

bursa	increases muscle temperature and enzyme activity	A warm-up	a fibre type rich in myoglobin	slow oxidative	a muscle which co-ordinates movement	antagonist
						an athlete with a high percentage of FG fibres in the soleus
						sprinter
reduces the risk of delayed onset of muscle soreness	aerobic exercise	sub-maximal activity where oxygen supply meets demand	isometric	muscle contraction with no change in muscle length	spinal joints	cartilaginous / gliding / pivot
Cool-down						
Creates upward phase of a bicep curl						
Biceps brachii	lengthens under tension	eccentric	pivot joint which supinates	radio-ulnar	bone growth	ossification
						connective tissue joining muscle to bone
						Tendon
synovial fluid filled sac which reduces friction	rotation	movement of a bone around its longitudinal axis	articular cartilage	prevents friction between articulating bones	deep socket	benefit of the hip joint

Dominoes / 'follow me' 2: Motion and Movement

CENTRE OF MASS	One effect of force is ...
LINE OF GRAVITY	Newton's first law of motion
BASE OF SUPPORT	A rugby scrum
SIZE OF FORCE	A netball goal-keeper defending a shot on goal...
MASS	Newton's third law of motion
...an example of CENTRE OF MASS BEING OUTSIDE OF THE BODY	The greater this is, the greater acceleration will be
INERTIA	Movement in a straight line
ECCENTRIC FORCE	The wider this is, the more stable the body
... an example of a STABLE POSITION	Fosbury flop

LINEAR MOTION	**Push or pull that alters motion**
...is in an UNSTABLE POSITION	**Quantity of matter in a body**
REACTION	**Circular path around an axis of rotation**
ACCELERATION	**A force that creates angular motion**
ANGULAR MOTION	**Imaginary line extending from the centre of mass**
FORCE	**Point at which a body is balanced**

Answers/links - Motion and Movement

Line of gravity	Newton's first law of motion	Inertia	movement in a straight line	Linear motion	Push or pull that alters motion	Force
						Point at which a body is balanced
						Centre of mass
A rugby scrum	Base of support	The wider this is, the more stable the body	Eccentric force	A force that creates angular motion	acceleration	One effect of force is...
..an example of a stable position						
Fosbury flop						
Is an example of Centre of Mass outside of the body	The greater this is, the greater the acceleration will be	Size of force	A netball goal-keeper defending a shot on goal...	...is in an unstable position	Quantity of matter in a body	Mass
						Newton's third law of motion
						Reaction
				Imaginary line extending from the centre of mass	Angular motion	Circular path around an axis of rotation

Dominoes / 'follow me' 3: Cardiovascular System

CAUSES ANTICIPATORY RISE	HR x SV
COOL-DOWN	Reduced with a warm-up
VENOUS RETURN	This transports gases in the bloodstream
HAEMOGLOBIN	Accumulation of lactic acid in the blood stream
ANAEROBIC	Narrowing of blood vessels
MYOGENIC	Generates the cardiac impulse
CARBON MONOXIDE	Blood vessels with a single cell wall
HEART RATE	The heart generates its own electrical impulse and so is said to be.....
CARDIAC CONTROL CENTRE	70mls at rest

DIASTOLE	Exercise without oxygen is...
BLOOD VISCOCITY	Release of adrenaline
CAPILLARIES	Blood flow back to the heart
SA NODE	Relaxation of the heart
VASO-CONSTRICTION	Inspired when smoking
CARDIAC OUTPUT	Receives information from the chemoreceptors
OBLA	Prevents blood pooling
STROKE VOLUME	Number of left ventricle contractions per minute

Answers/links - Cardiovascular System

Diastole	Exercise without oxygen is..	Anaerobic	Narrowing of blood vessels	Vaso-constriction	Inspired when smoking	Carbon monoxide	Blood vessels with a single cell wall
							Capillaries
							Blood flow back to the heart
Cool-down		Prevents blood pooling	OBLA	Accumulation of lactic acid in the blood stream	Haemoglobin	This transports gases in the bloodstream	Venous return
Reduced with a warm-up							
Blood viscosity							
Release of adrenaline		Causes anticipatory rise	HR x SV	Cardiac output	Receives information from the chemo-receptors	Cardiac control centre	70mls at rest
							Stroke volume
							Number of left ventricle contractions per minute
		Relaxation of the heart	SA node	Generates the cardiac impulse	Myogenic	The heart generates its own electrical impulse and so is said to be...	Heart rate

Dominoes / 'follow me' 4: Respiratory System

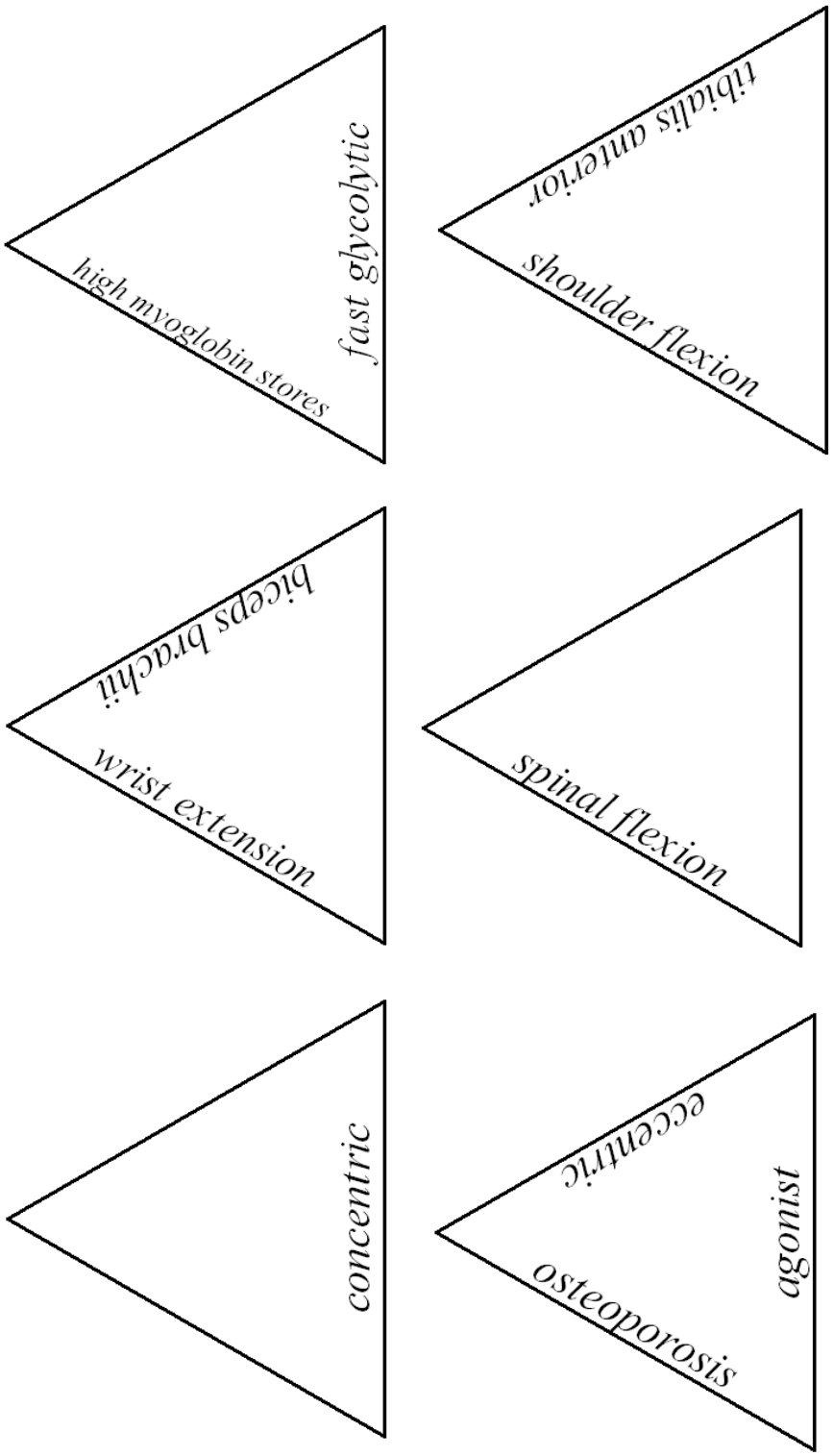
Inspiratory muscle training (IMT)	An area with a low partial pressure of oxygen in the air
O_2 deprivation linked to altitude	This strengthens the respiratory muscles
Alveoli	'Train high live low' =
Bohr shift	Tiny bundles of air sacs
Scalenes	Increased acidity responsible for increased oxygen dissociation
Tidal volume	Additional inspiratory muscles
Partial pressure	Volume of air inspired or expired per breath
External respiration	Pressure a gas exerts within other gases
Haemoglobin	Gaseous exchange between the alveolar air and capillary blood

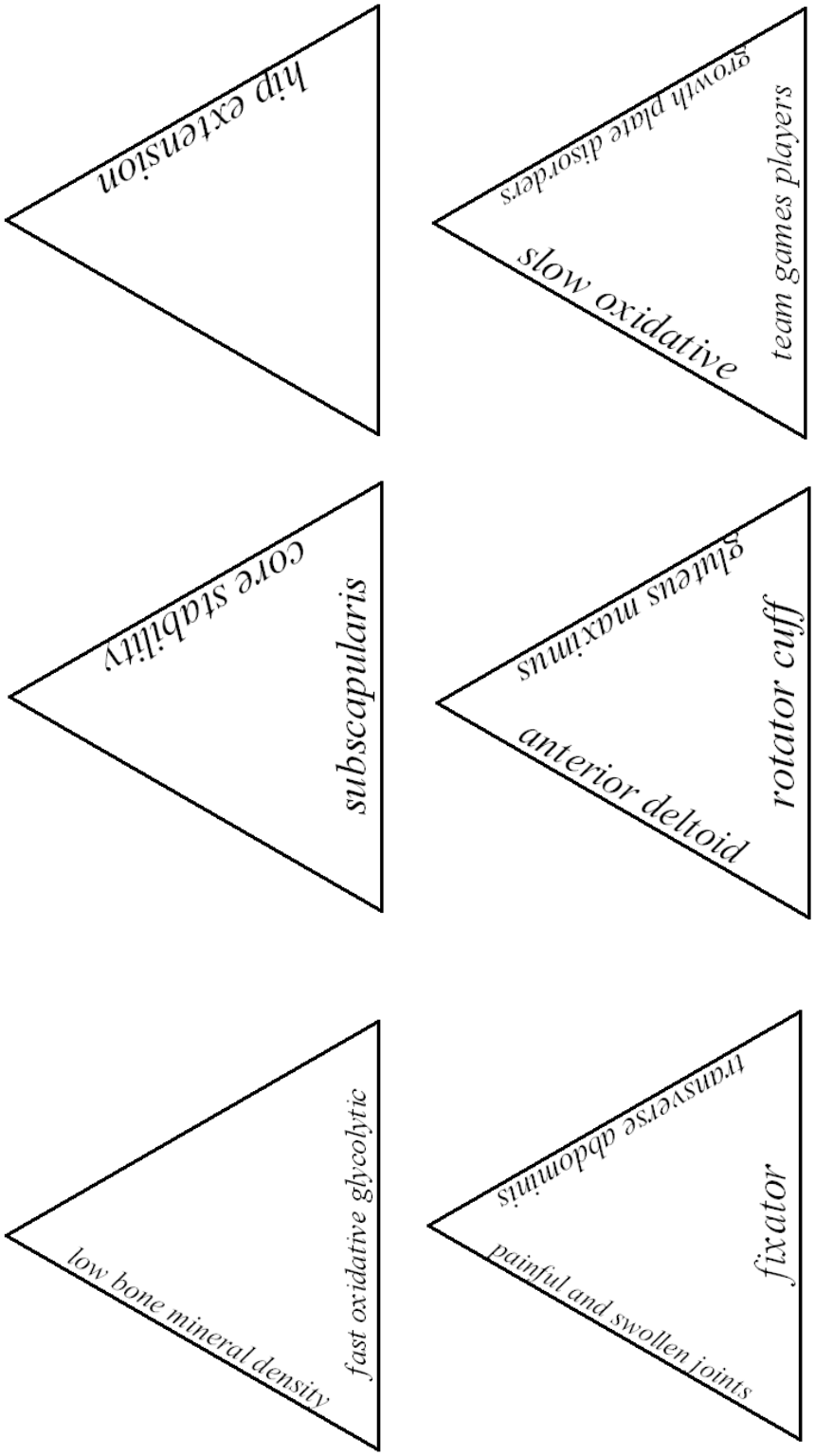
Chemoreceptors	**This transports oxygen in the blood**
Expiratory centre	**These send information about changes in PPO_2 to the RCC**
Myoglobin	**Stimulates the obliques to create a forced expiration during exercise**
Internal respiration	**Red pigment in muscle tissue that stores oxygen**
Altitude	**Gaseous exchange between the muscle tissue and capillary blood**
Altitude training	**Poisonous gas inhaled gas when smoking**
Asthma	**Hypoxia**
Carbon monoxide	**Temporary narrowing of the airways**

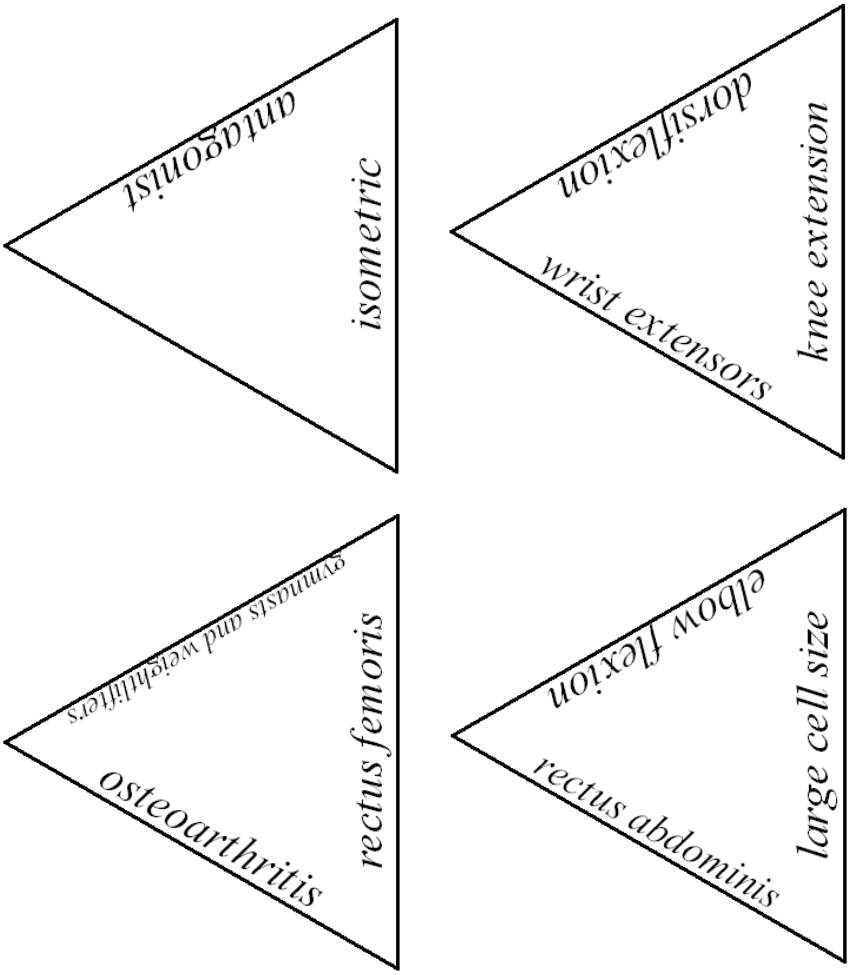
Answers/links - Respiratory System

Oxygen deprivation linked to altitude	This strengthens the respiratory muscles	Inspiratory muscle training	An area with a low partial pressure of oxygen in the air	Altitude	Gaseous exchange between the muscle tissue and capillary blood	Internal respiration
						Red pigment in muscle tissue that stores oxygen
						Myoglobin
Gaseous exchange between the alveolar air and capillary blood	Haemoglobin	This transports oxygen in the blood	Chemo-receptors	These send information about changes in PPO_2 to the RCC	Expiratory centre	Stimulates the obliques to create a forced expiration during exercise
External respiration						
Pressure a gas exerts within other gases						
Partial pressure	Volume of air inspired or expired per breath	Tidal volume	Additional inspiratory muscles	Scalenes	Increased acidity responsible for increased oxygen dissociation	Bohr shift/effect
						Tiny bundles of air sacs
						Alveoli
Hypoxia	Asthma	Temporary narrowing of the airways	Carbon monoxide	Poisonous gas inhaled when smoking	Altitude training	'Train high live low' =

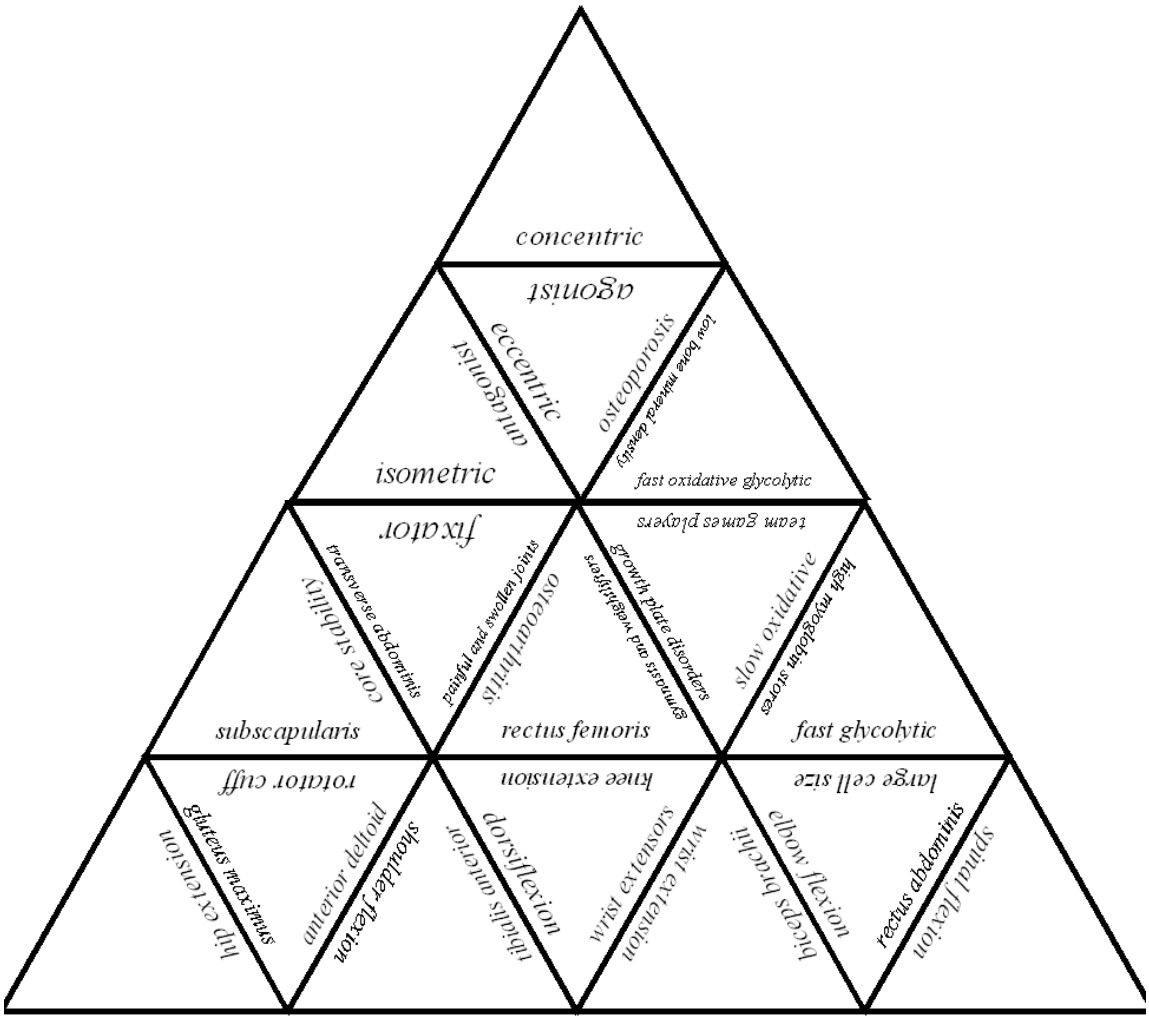
Jigsaw 1: Musculoskeletal System (16 piece triangle)




hip extension
growth plate disorders
team games players
slow oxidative
core stability
subscapularis
gluteus maximus
anterior deltoid
rotator cuff
low bone mineral density
fast oxidative glycolytic
transverse abdominis
painful and swollen joints
fixator


antagonist
isometric
dorsiflexion
knee extension
wrist extensors
gymnasts and weightlifters
rectus femoris
osteoarthritis
elbow flexion
large cell size
rectus abdominis

Jigsaw 1: Musculoskeletal system solution



Jigsaw 2: Motion and Movement (12 piece rectangle)

force creates motion
same speed / distance / same direction
line of gravity over base of support
change shape

Newton's law 3
angular motion

high mass
gymnastic bridge position
football penalty

goalkeeper's save
effect of force
stable

centre of mass
force
general motion

centre of mass outside body
sumo wrestler

change direction

base of support

push or pull that alters the state of motion

footballer head knee and toe inline

circular path around an axis of rotation

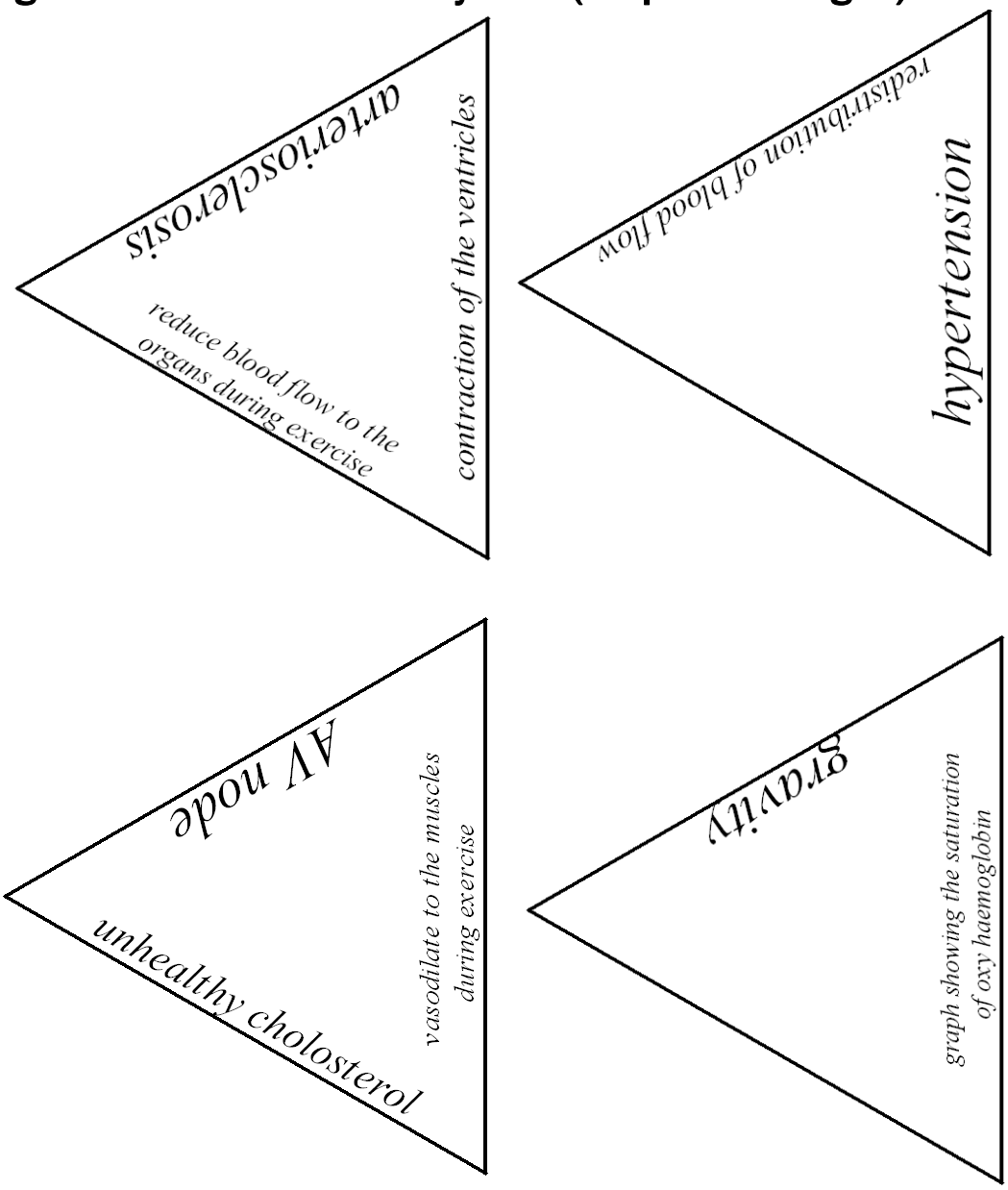
trampolinist contacting the bed

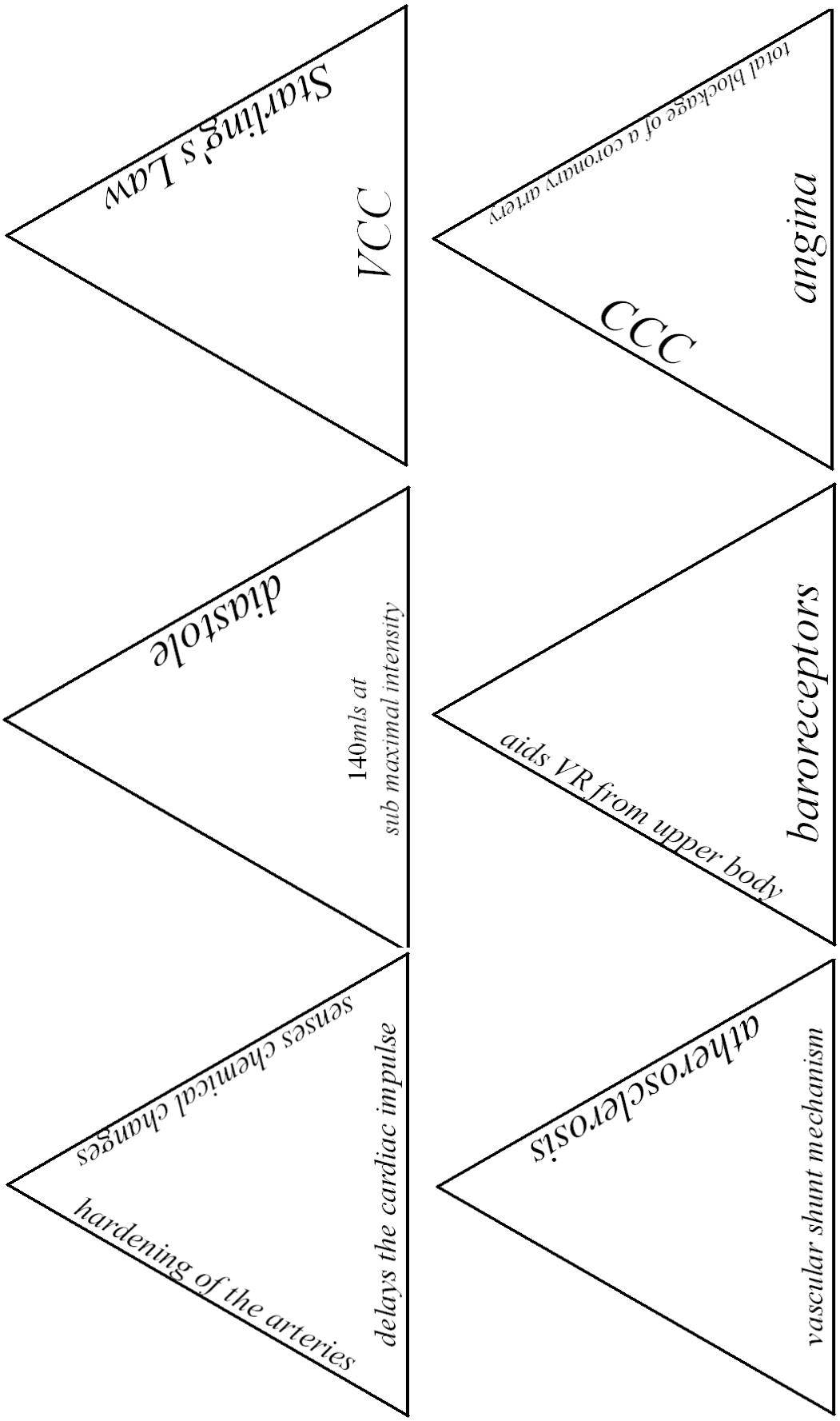
100m sprint

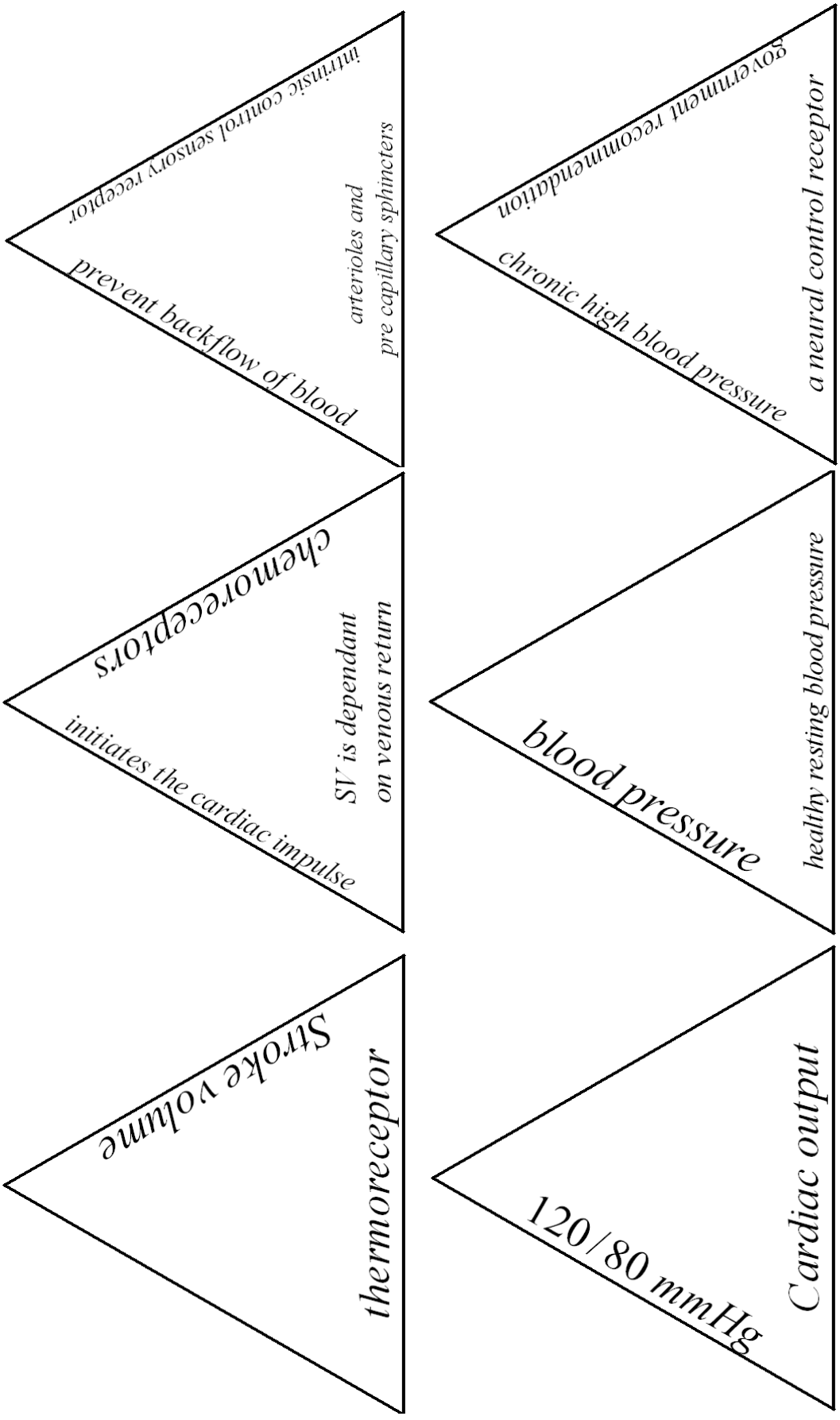
Jigsaw 2: Motion and Movement solution

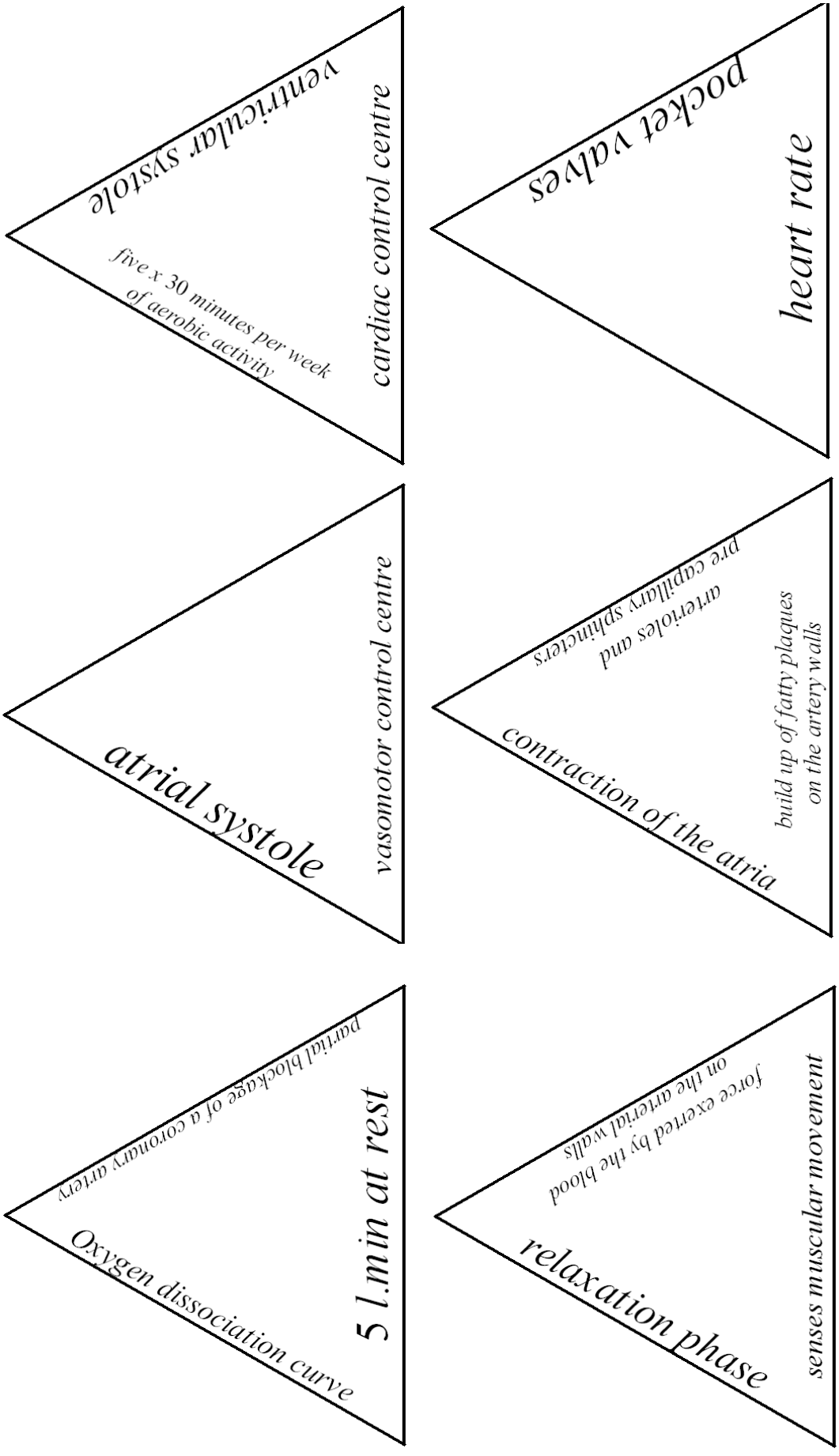
newton's law 1 unstable	inertia newton's law 2 feet shoulder width apart	acceleration point at which body is balanced in all directions
effect of force goalkeeper's save stable	change direction base of support push or pull that alters the state of motion footballer head knee and toe inline	force centre of mass general motion
football penalty gymnastic bridge position high mass	force creates motion change shape line of gravity over base of support same speed / distance / same direction	trampolinist contacting the bed 100m sprint circular path around an axis of rotation
centre of mass outside body sumo wrestler	fosbury flop linear motion equal and opposite reaction force	Newton's law 3 angular motion

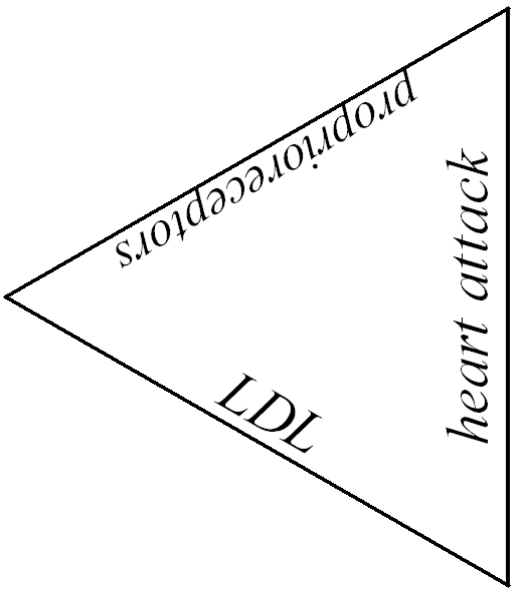
Jigsaw 3: Cardiovascular System (24 piece hexagon)

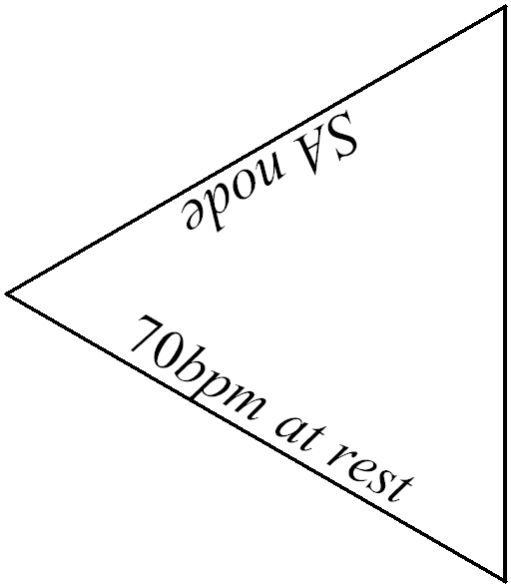



Starling's Law
VCC
total blockage of a coronary artery
CCC
angina
diastole
140mls at
sub maximal intensity
aids VR from upper body
baroreceptors
senses chemical changes
hardening of the arteries
delays the cardiac impulse
atherosclerosis
vascular shunt mechanism

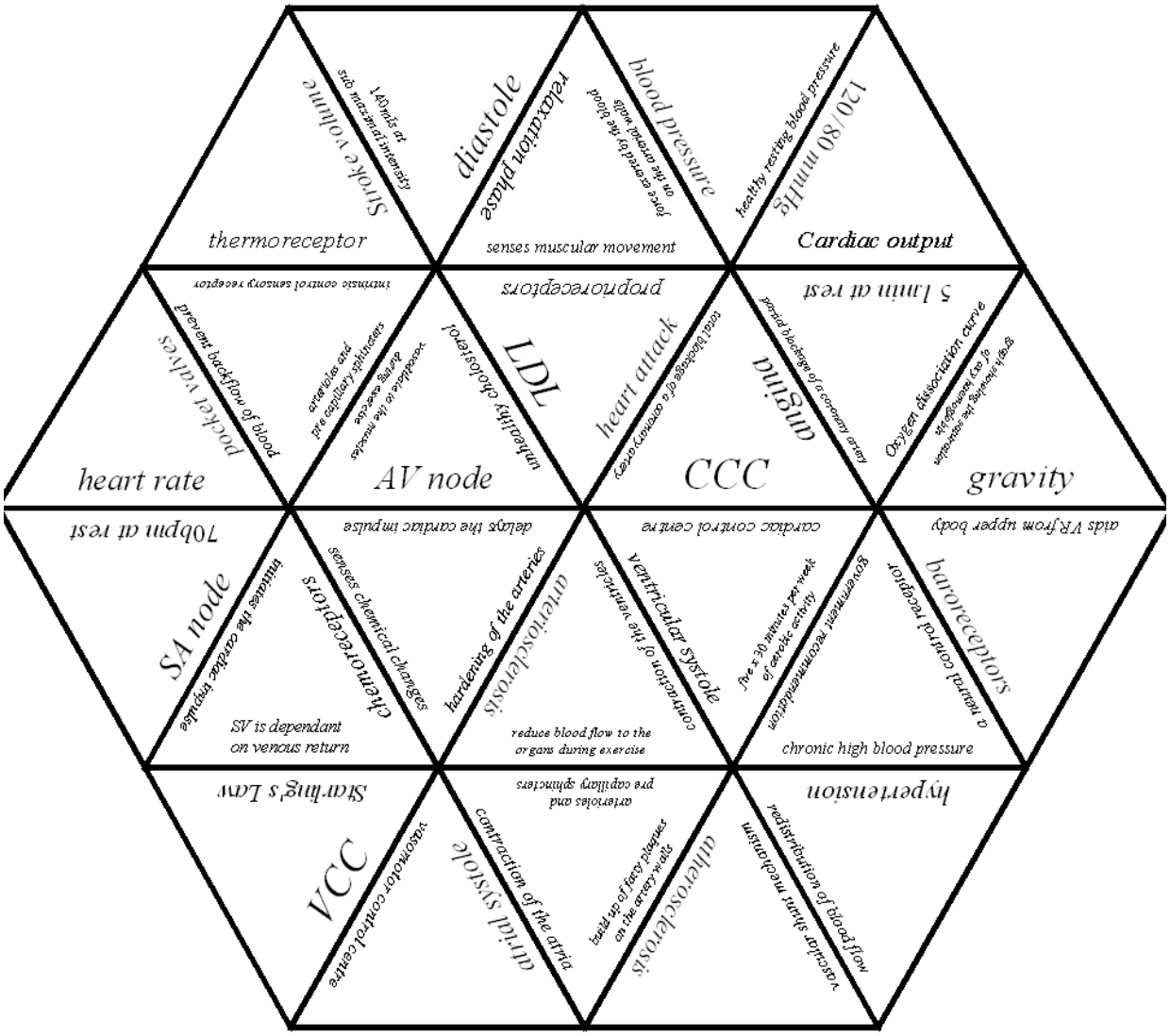

intrinsic control sensory receptor
arterioles and pre capillary sphincters
prevent backflow of blood
government recommendation
a neural control receptor
chronic high blood pressure
chemoreceptors
SV is dependant on venous return
initiates the cardiac impulse
blood pressure
healthy resting blood pressure
Stroke volume
thermoreceptor
Cardiac output
120/80 mmHg


ventricular systole
cardiac control centre
five x 30 minutes per week of aerobic activity
pocket valves
heart rate
atrial systole
vasomotor control centre
contraction of the atria
build up of fatty plaques on the artery walls
arterioles and pre capillary sphincters
5 l.min at rest
Oxygen dissociation curve
partial blockage of a coronary artery
relaxation phase
senses muscular movement
force exerted by the blood on the arterial walls

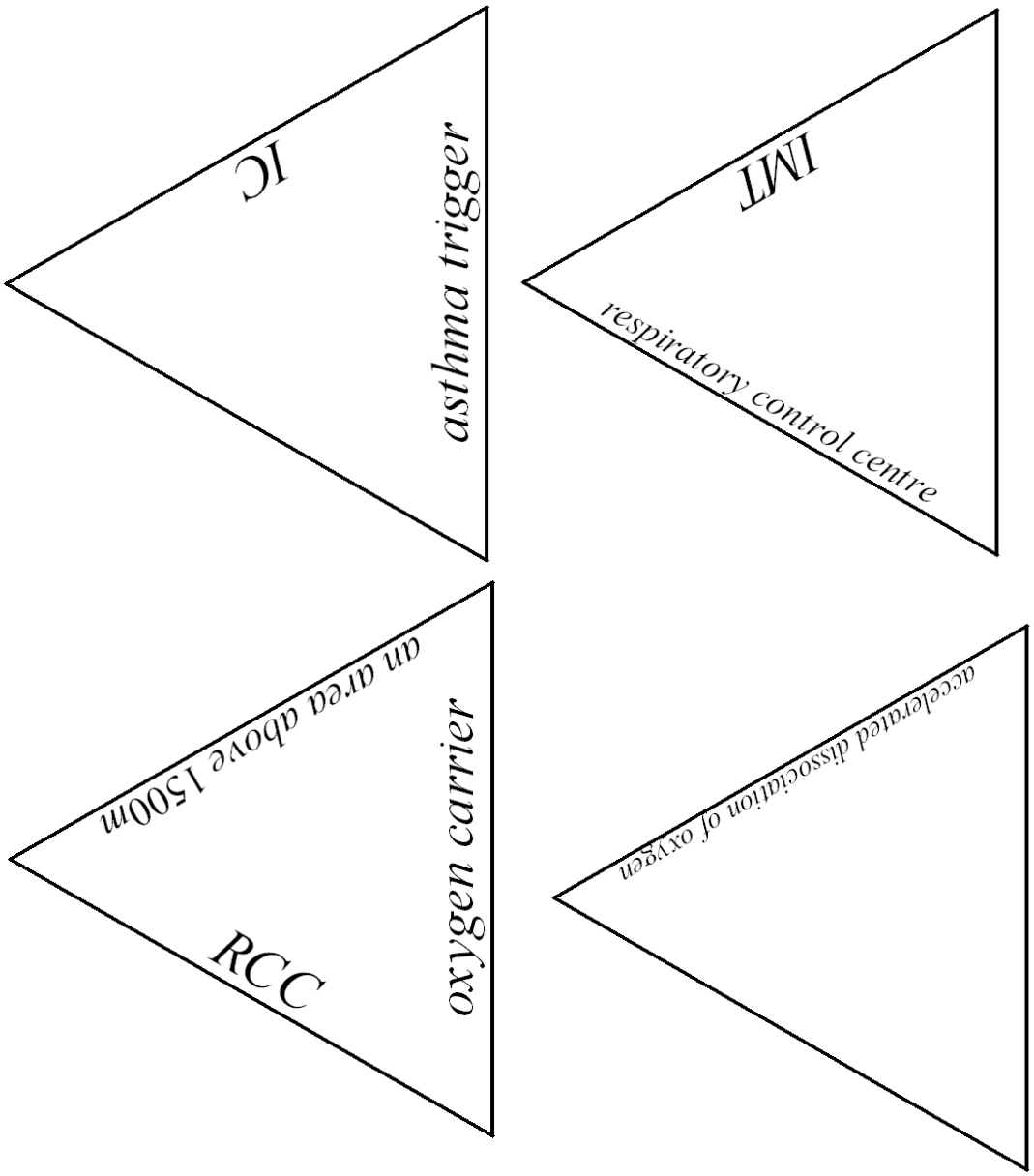

proprioreceptors
heart attack
LDL

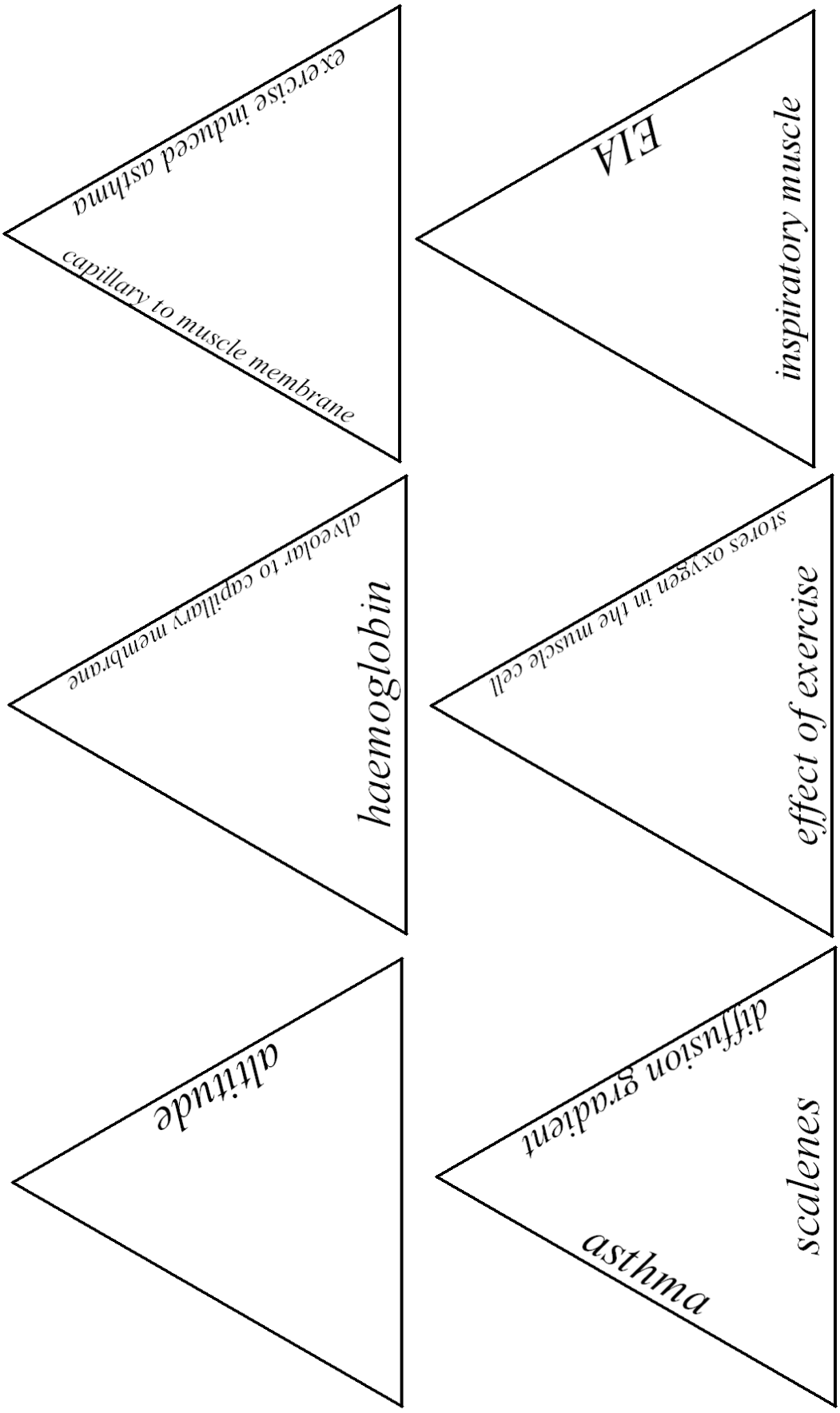

SA node
70bpm at rest

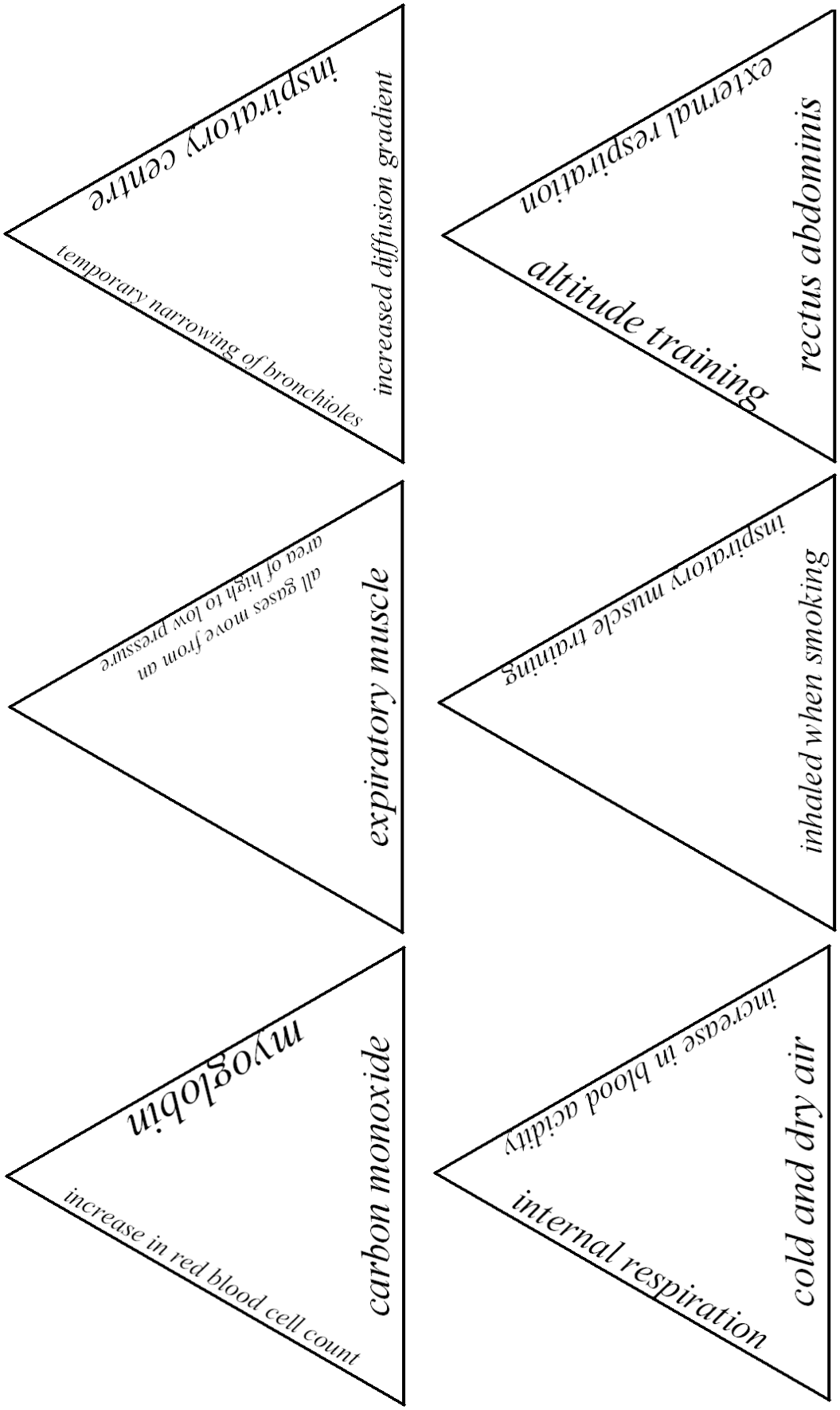
Jigsaw 3: Cardiovascular system solution



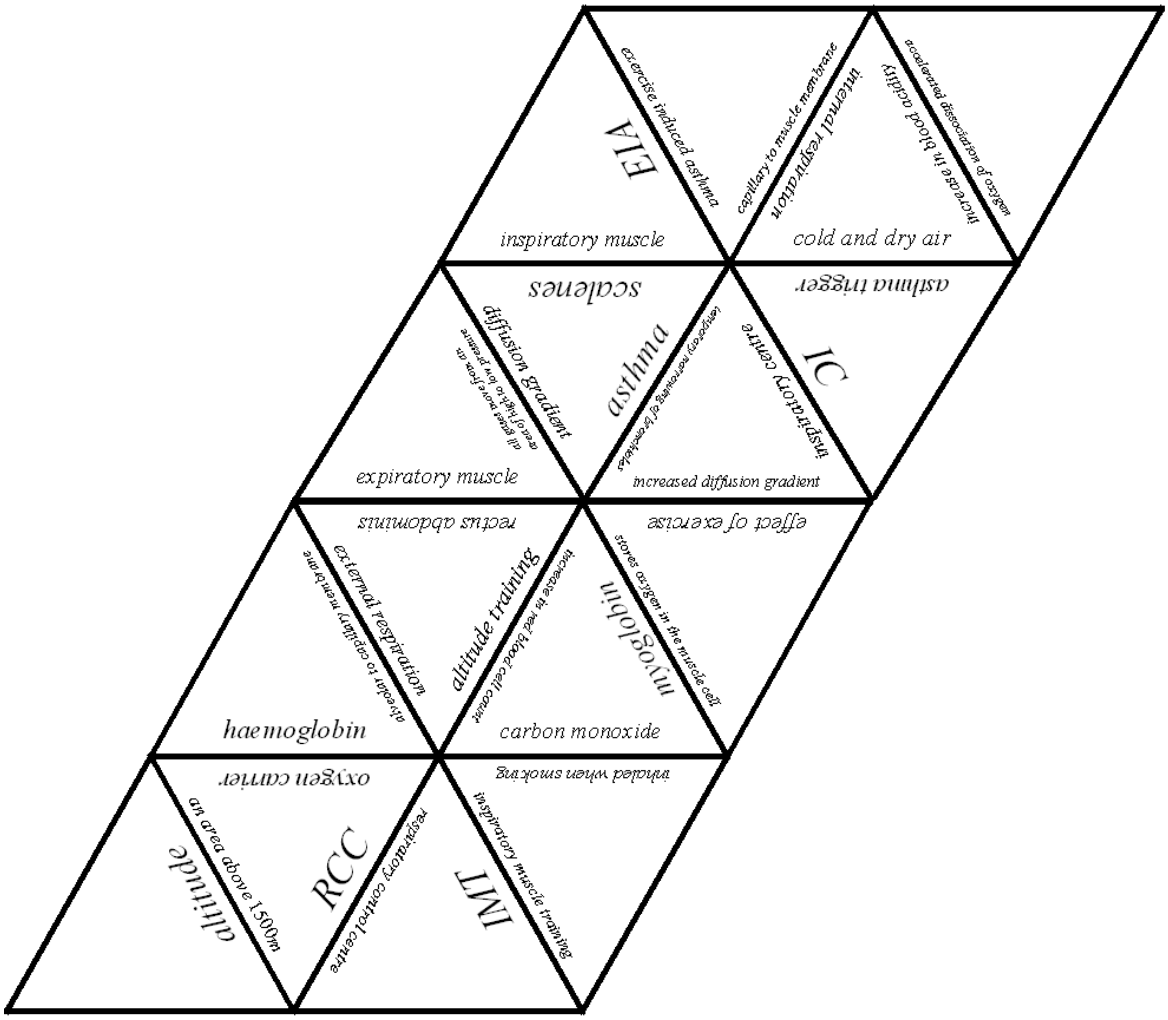
Jigsaw 4: Respiratory System (16 piece parallelogram)



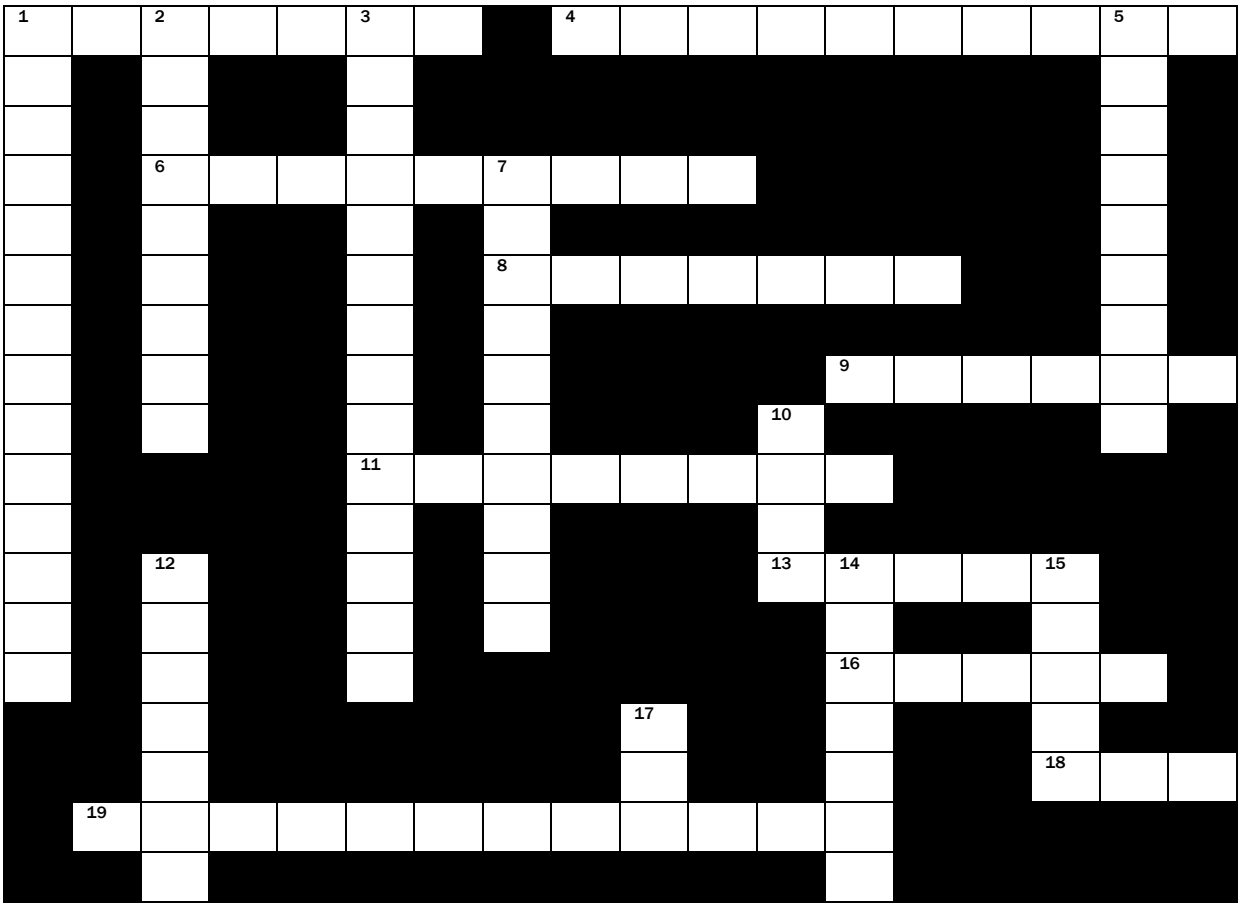

exercise induced asthma
capillary to muscle membrane
EIA
inspiratory muscle
alveolar to capillary membrane
haemoglobin
stores oxygen in the muscle cell
effect of exercise
altitude
diffusion gradient
asthma
scalenes


inspiratory centre
temporary narrowing of bronchioles
increased diffusion gradient
external respiration
altitude training
rectus abdominis
all gases move from an area of high to low pressure
expiratory muscle
inspiratory muscle trainings
inhaled when smoking
myoglobin
increase in red blood cell count
carbon monoxide
increase in blood acidity
internal respiration
cold and dry air

Jigsaw 4: Respiratory System solution



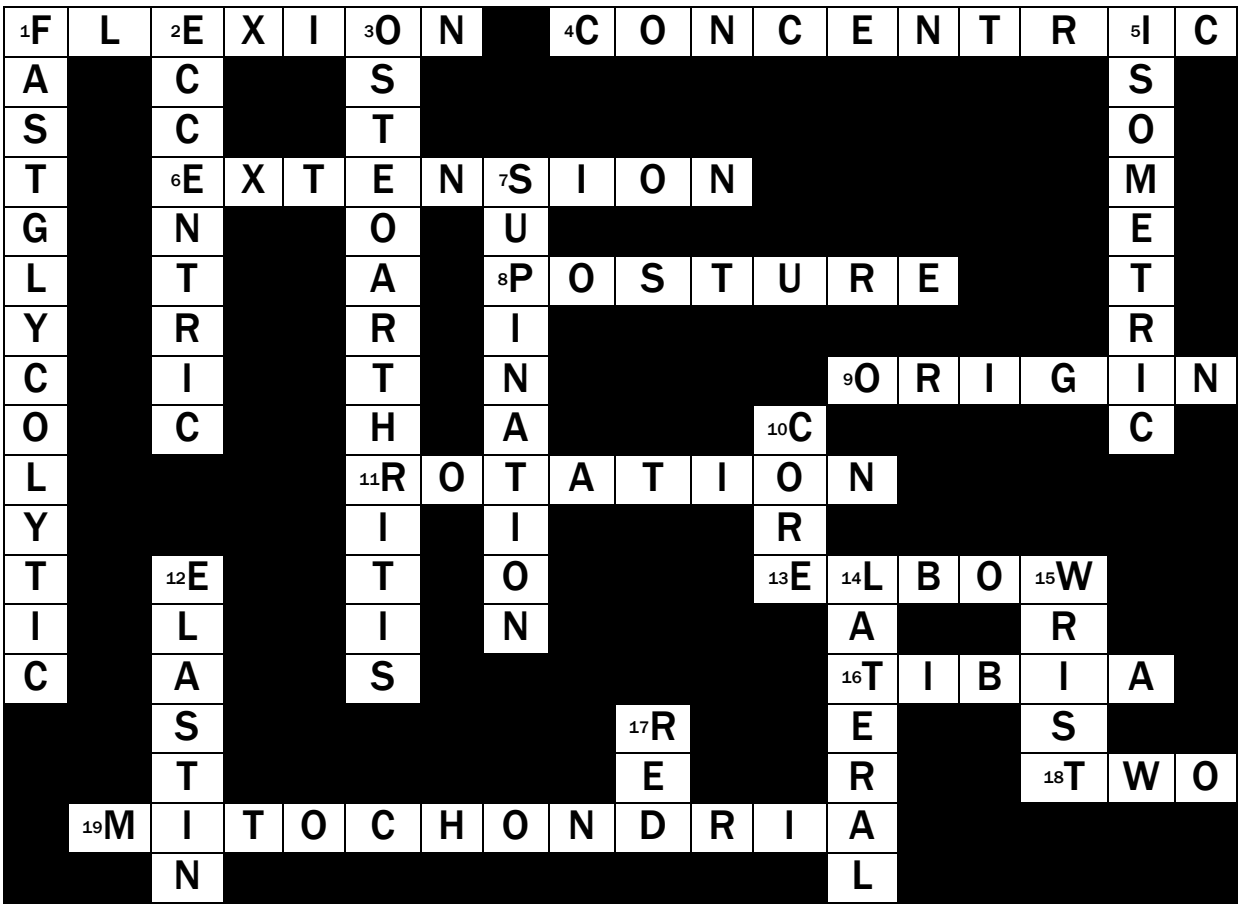
Quick puzzle 1: Musculoskeletal System



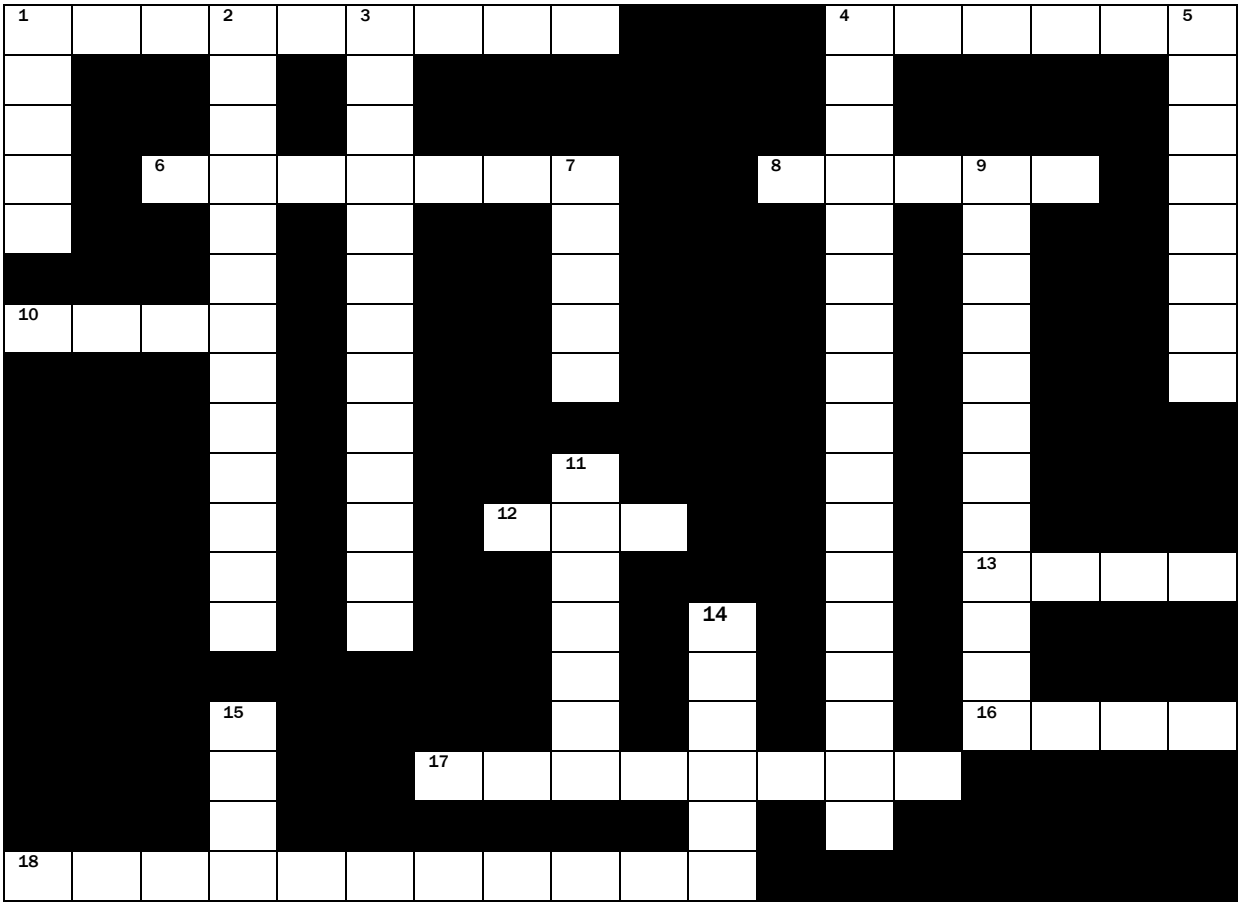
Clues

Across		Down	
1	Movement created by the biceps brachii at the elbow (7)	1	Sprinters have a large percentage of this fibre type (4-10)
4	Contraction often associated with an agonist (10)	2	Contraction where muscle lengthens under tension (9)
6	Movement created by the iliopsoas (9)	3	Joint trauma or repetitive action sports can lead to this in later life (14)
8	Core stability improves this (7)	5	Type of contraction where muscle does not change length (9)
9	The point of attachment of muscle to bone (6)	7	Radio-ulnar joint movement leaving palms facing upwards (10)
11	Movement of a bone around its longitudinal axis (8)	10	Transverse abdominis and multifidus increase stability here (4)
13	A hinge joint in the upper body (5)	12	Muscles are rich in this protein (7)
16	A long bone in the lower leg (5)	14	Rotation to the outside of the body (7)
18	Fast glycolytic and fast oxidative muscle fibres are this type (3)	15	Carpals, ulna and radius found here (5)
19	Slow oxidative muscle fibres are rich in this (12)	17	Structural feature of slow oxidative muscle fibre (3)

Solution puzzle 1: Musculoskeletal System



Quick puzzle 2: Motion and Movement



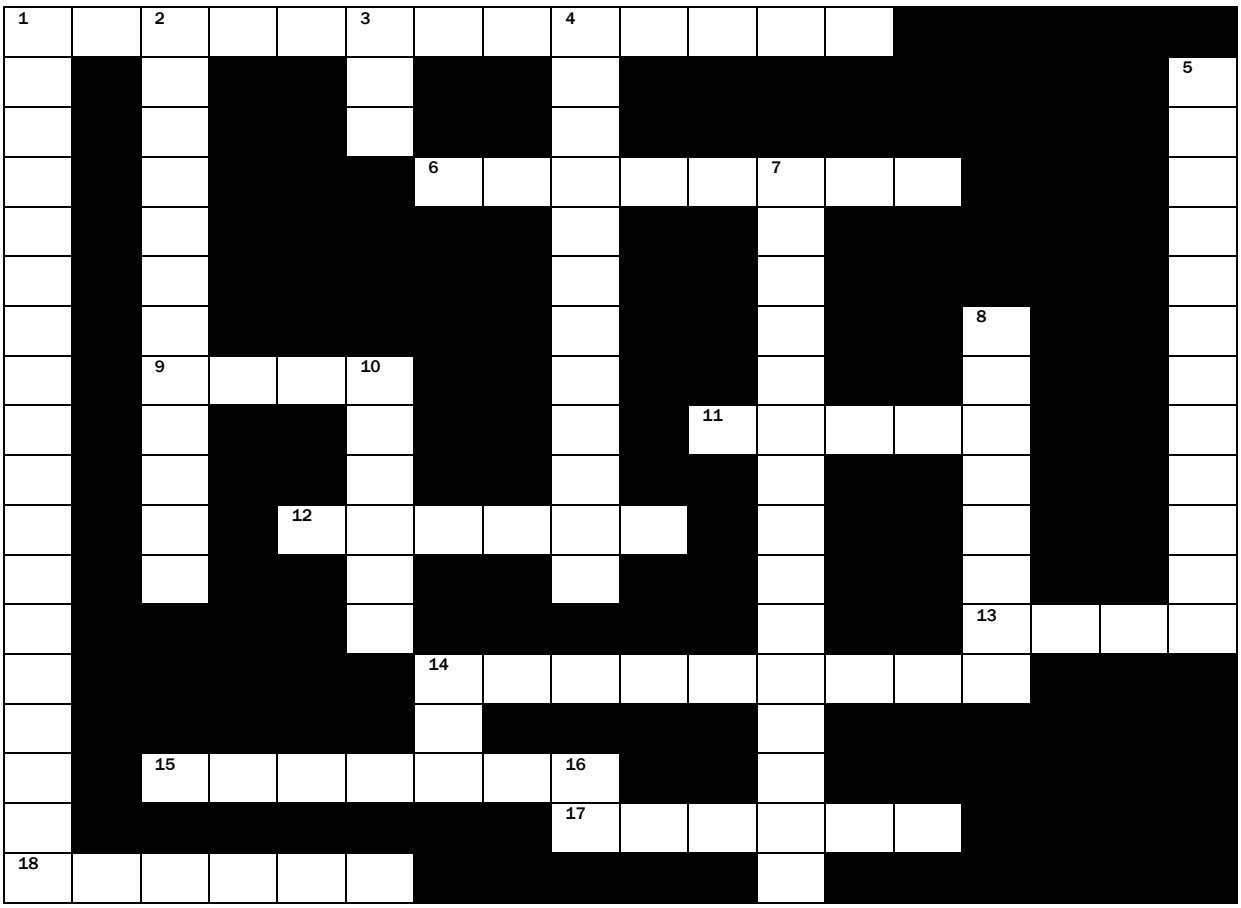
Clues

Across		Down	
1	The degree to which body is balanced, steady and difficult to move (9)	1	Force can alter this (5)
4	Motion along a straight line (6)	2	The width of this affects stability (4-2-7)
6	Linear and angular motion combined (7)	3	If this is within the base of support the body is stable (4-2-7)
8	A push or pull that can alter the state of motion of a body (5)	4	Newton's second L of M (3-2-12)
10	This affects stability of a body (4)	5	Caused by an eccentric or off-centre force. It can be medial or lateral (8)
12	A body continues in a state of rest or uniform velocity until an external force is applied. Which law? (3)	7	To increase stability the centre of mass will be this (5)
13	Force can make a body _____ (4)	9	The point at which the body is balanced in all directions (6-2-4)
16	The greater the ____ of force applied the greater the change in momentum (4)	11	Newton's first law of motion. Law of (7)
17	Newton's third law (8)	14	He investigated effects of motion and gravity (6)
18	Amy Williams creates linear motion with this (3–8)	15	Angular motion causes rotation around this fixed point (4)

Solution puzzle 2: Motion and Movement

1S	T	A	2B	I	3L	I	T	Y			4L	I	N	E	A	5R
H			A		I						A					O
A			S		N						W					T
P		6G	E	N	E	R	A	7L		8F	O	R	9C	E		A
E			O		O			O			F		E			T
			F		F			W			A		N			I
10M	A	S	S		G			E			C		T			O
			U		R			R			C		R			N
			P		A						E		E			
			P		V			11I			L		O			
			O		I		12O	N	E		E		F			
			R		T			E			R		13M	O	V	E
			T		Y			R		14N	A		A			
								T		E	T		S			
			15A					I		W	I		16S	I	Z	E
			X			17R	E	A	C	T	I	O	N			
			I							O		N				
18B	O	B	S	K	E	L	E	T	O	N						

Quick puzzle 3: Cardiovascular System



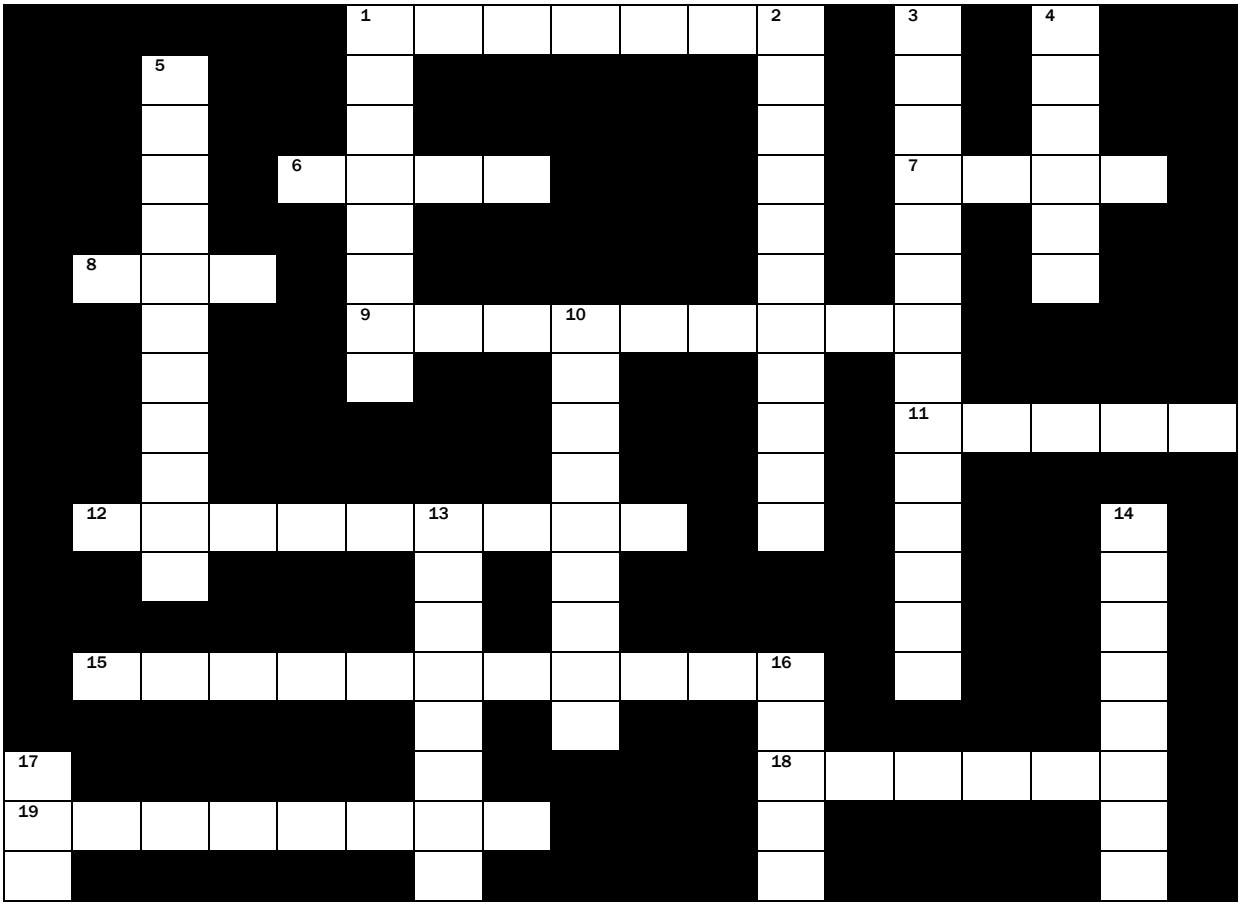
Clues

Across		Down	
1	Redistribution of blood flow from rest to exercise (11-7)	1	Contraction of the lower chambers of the heart (11-7)
6	Blockages in this type of artery can cause heart attack (8)	2	Volume of blood ejected from the left ventricle per heart beat (6-6)
9	Point at which lactic acid accumulates in the blood stream (4)	3	These deposit cholesterol on arterial walls and increase risk of atherosclerosis (1,1,1)
11	Vessel that carries blood away from the heart to the muscles & organs (5)	4	This states that stroke volume is dependent on venous return (9-3)
12	Type of control using the chemo-, proprio- and baro-receptors (6)	5	Chronic high blood pressure (12)
13	The vena cava is an example (4)	7	Condition where fatty plaques are deposited in arteries (15)
14	The number of times the heart ventricles contract per minute (5-4)	8	A lifestyle in danger of developing CHD (8)
15	These are sited between the capillaries and vein (7)	10	A blood vessel that usually carries oxygenated blood (6)
17	A partial blockage of a coronary artery causing chest pain (6)	14	'Scavengers' that remove cholesterol from the arterial walls (1,1,1)
18	A protein produced to catalyse a reactio (6)	16	This node or 'pacemaker' initiates the cardiac impulse (1,1)

Solution puzzle 3: Cardiovascular System

1V	A	2S	C	U	3L	A	R	4S	H	U	N	T						
E		T			D			T										5H
N		R			L			A										Y
T		O				6C	O	R	O	N	7A	R	Y					P
R		K						L			T							E
I		E						I			H							R
C		V						N			E			8I				T
U		9O	B	L	10A			G			R			N				E
L		L			R			S		11A	O	R	T	A				N
A		U			T			L			S			C				S
R		M		12N	E	U	R	A	L		C			T				I
S		E			R			W			L			I				O
Y					Y						E			13V	E	I	N	
S						14H	E	A	R	T	R	A	T	E				
T						D					O							
O		15V	E	N	U	L	E	16S			S							
L								17A	N	G	I	N	A					
18E	N	Z	Y	M	E						S							

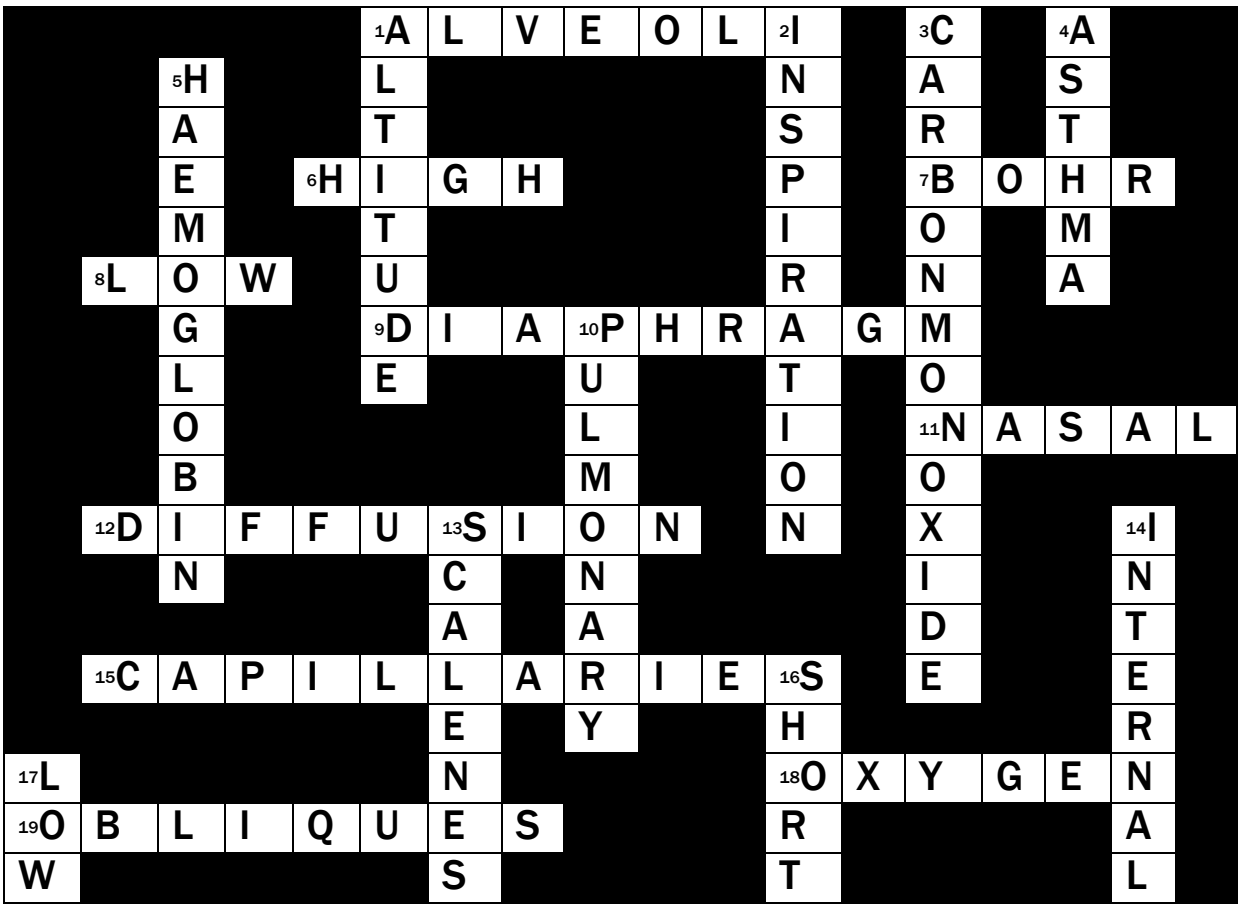
Quick puzzle 4: Respiratory System



Clues

Across		Down	
1	Cluster of tiny air sacs (7)	1	Training area above 1500m (8)
6	The partial pressure of oxygen in the atmospheric air (4)	2	Brought about by the scalenes and pectolaris major (11)
7	Effect/shift caused by increased acidity (4)	3	Poisonous gas inhaled when smoking (6-8)
8	The partial pressure of oxygen in muscle tissues (3)	4	Condition causing temporary narrowing of the bronchioles (6)
9	This thin muscle actively contracts and passively relaxes (9)	5	The transporter of gases in the bloodstream (11)
11	Cavity in which air is inspired, warmed and moistened (5)	10	Respiration at the lung site (9)
12	The movement of gases across a membrane (9)	13	Extra muscles of inspiration (8)
15	Blood vessels that are one cell thick (11)	14	Gaseous exchange between the capillaries and muscle tissue (8)
18	Gas used aerobically to generate energy (6)	16	This describes the diffusion path between the alveoli and capillaries (5)
19	Group of additional expiratory muscles (8)	17	Partial pressure of carbon dioxide in atmospheric air (3)

Solution puzzle 4: Respiratory System



Extended/10 mark questions - (not endorsed by any examining body)

1. Musculoskeletal System

Using a practical example of a sports performance of your choice carry out a movement analysis of either the hip joint **or** the shoulder joint. Critically evaluate the impact of a pre-exercise warm-up on the performer's muscle and connective tissue.

2. Motion and Movement

In a named sport of your choice discuss how a performer uses knowledge of stability and motion to enhance their performance.

3. Cardiovascular System

For a performer in a sport of your choice explain the response of heart rate to a 30 minute training run followed by a 10 minute recovery period. Include an explanation of the role of neural, intrinsic and hormonal control mechanisms in your answer.

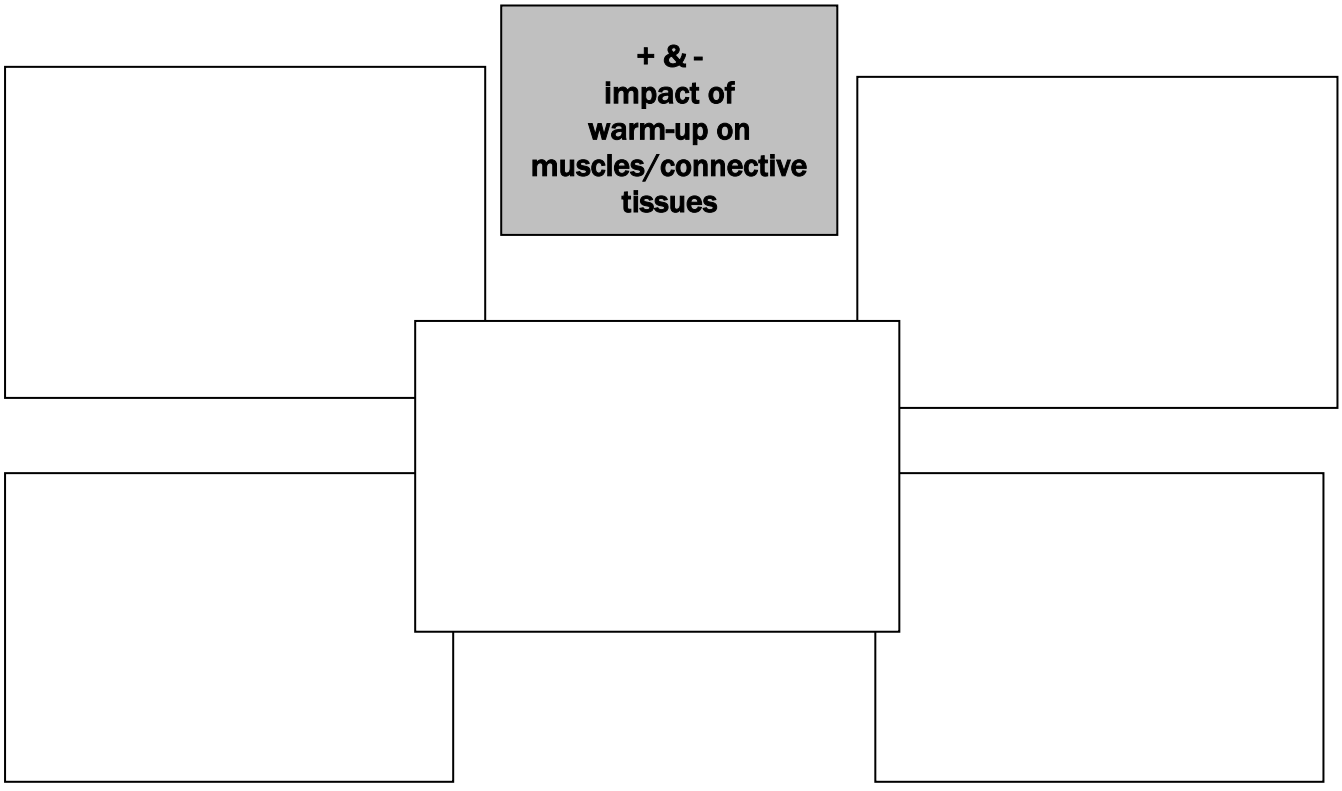
4. Respiratory System

Critically evaluate the effects of altitude exposure and a period of altitude training on the respiratory system and performance of an endurance athlete.

1: Musculoskeletal System - Answer Plan

Using a practical example of a sports performance of your choice carry out a movement analysis of either the hip joint or the shoulder joint. Critically evaluate the impact of a pre-exercise warm-up on the performer's muscle and connective tissue.

Hip joint/shoulder joint (delete as necessary): Joint type _____			Articulating bones _____		
movement	agonist	contraction type	antagonist	contraction type	sporting application



1: Musculoskeletal System - Outline answer scheme (not endorsed by any examining body)

Using a practical example for a sports performer of your choice carry out a movement analysis on either the hip joint or shoulder joint. Critically evaluate the need for a warm-up prior to exercise on the sport performer's muscle and connective tissue.

Numbered points - indicative content that candidates are likely to include
Indented points - possible developmental points
NB - Relevant points made that are not on answer scheme will gain credit

Hip	Indicative content			Possible development points
1	Ball and socket joint			Deep socket / large range of motion
2	(Head) femur & (acetabulum) pelvic girdle			Articular cartilage to prevent wear and tear / friction-free movement
	Indicative content			Possible development points
	Movement	Agonist	Antagonist	
3	Flexion	Iliopsoas	Gluteus maximus	e.g. execution phase of striking a football
4	Extension	Gluteus maximus	Iliopsoas	e.g. preparation phase drawing back the leg to strike a football
5	Abduction	Gluteus medius & minimus	Adductor longus/magnus/ brevis	e.g. outward phase of a star jump to warm-up
6	Adduction	Adductor longus/magnus/ brevis	Gluteus medius & minimus	e.g. inward phase of a star jump to warm-up
7	Rotation (lateral)	Gluteus maximus	Gluteus minimus	e.g. twisting the leg outwards to show the instep to the ball

Shoulder	Indicative content			Possible development points
8	Ball and socket joint			Shallow socket/unstable/dislocation
9	(Head) humerus (Glenoid cavity) scapula			Articular cartilage to prevent wear and tear / friction-free movement
	Indicative content			Possible development points
	Movement	Agonist	Antagonist	
10	Flexion	Anterior deltoid	Posterior deltoid	e.g. execution of a ball toss in tennis
11	Extension	Posterior deltoid	Anterior deltoid	e.g. drawback of the racquet on a tennis serve
12	Abduction	Middle deltoid	Latissimus dorsi	e.g. outward phase of a star jump to warm-up
13	Adduction	Latissimus dorsi	Middle deltoid	e.g. inward phase of a star jump to warm-up
14	Horizontal flexion	Pectorlaris major	Trapezius	e.g. recovery phase of a groundstroke in tennis bringing raquet across chest
15	Horizontal extension	Trapezius	Pectorlaris major	e.g. preparation for a groundstroke in tennis
16	Rotation (lateral)	Teres minor & infraspinatus	Teres major & subscapularis	& supraspinalis = rotator cuff which assist stability of the shoulder

Additional points

17. When acting as the agonist the muscle concentrically contracts

    Shortens under tension / isotonic contraction

18. When acting as the antagonist the muscle eccentrically contracts

    Lengthens under tension / isotonic contraction

19. Any suitable reference to fixator muscles

    Isometric contraction / same length under tension

Impact of warm-up

20. Warm-up essential to all performers (novice or elite)

21. An increase in muscle temperature:

    allows greater stretch in the muscles/tendons/ligaments/ increased elasticity

    allows greater range of movement at a joint

    e.g. gymnastics full range of movement important for muscular efficiency and aesthetics

22. Decreases risk of injury/prevents injury

    e.g. common hamstring strains during maximal performance common on football pitch/ athletics stadium

23. Nerve impulse conduction is quicker

    Improves muscle contraction speed/faster reaction time

    e.g. essential when making an interception in netball/ contraction speed of the triceps brachii to extend the elbow

24. Decreased muscle viscocity

    improved co-ordination of antagonistic pairs

25. Increased enzyme activity/hormonal activity

    More energy available in muscles

2: Motion and Movement - Answer Plan

In a named sport of your choice discuss how a performer uses knowledge of stability and motion to enhance their performance.

Chosen sport _____

		Describe and explain a **stable** situation	Describe and explain an **unstable** situation
Factors that affect stability			

Effects of force				

Newton's Law 1	Newton's Law 2	Newton's Law 3
Effect on performance	**Effect on performance**	**Effect on performance**

Conclusion:

2: Motion and Movement - Outline answer scheme (not endorsed by any examining body)

In a named sport of your choice discuss how a performer uses knowledge of stability and motion to enhance their performance.

Numbered points - indicative content that candidates are likely to include
Indented points - possible developmental points
NB - Relevant points made that are not on answer scheme will gain credit

Stability – factors affecting

1. The lower the centre of mass (or gravity) the more stable the body

    Bending knees / small stature e.g. hockey players crouch

2. The wider the base of support the more stable the body / the greater the number of points of contact, the more stable the body

    e.g. coaching point 'feet shoulder width apart'/e.g. bridge more stable than a handstand in gymnastics

3. Line of gravity should fall within the base of support for stability

    e.g. vertical jump take-off position / serve in badminton

4. The larger the mass the more stable the body

    e.g. rugby back row / sumo wrestling

Stability enhances performance when:

5. Preparation phase / balancing situations

    e.g. balance beam in gymnastics

6. Defensive situations / lean into oncoming force

    e.g. rugby tackles

Instability enhances performance when:

7. The body rotates / swerves / line of gravity falls outside the base of support

    e.g. somersaults in gymnastics / side steps in rugby

8. The body changes direction at speed / changes state of motion / overbalances

    e.g. dodging in netball / moving about the court in badminton

Force

9. (Newton's 1st law) a body will remain at rest / in a state of constant velocity until acted upon by an external force

10. An external force can create motion / get an object moving

    e.g. football penalty, football will remain at rest until a force is applied by the footballer's foot

11. An external force can change the direction of an object

e.g. one touch in football changing direction of the ball

12. An external force can create acceleration / increase speed of an object

e.g. a greater external force will be applied by a goalkeeper performing a goal kick than a centre-mid passing to a striker

13. An external force can decelerate / decrease the speed of an object

e.g. the foot can cushion the ball

14. (Newton's 2nd law) the rate of change in momentum is proportional to the size of the force applied

e.g. the footballer will generate a large force when performing a penalty to accelerate the ball faster

15. The direction the force is applied will determine the direction of the object

e.g. the footballer applies a force behind the ball to accelerate it forwards towards the net

16. If the force is applied through the centre of mass (gravity) linear motion is created

e.g. football at take-off when jumping for a header

17. If the force is applied outside the centre of mass (gravity) angular motion / rotation is created

e.g. free kick over a wall / corner kick into the box

18. (Newton's 3rd law) for every action force applied there is an equal and opposite reaction force

e.g. to change direction the footballer pushes down and back and the ground equally pushes up and forward

3: Cardiovascular System - Answer Plan

For a performer in a sport of your choice explain the response of heart rate to a 30 minute training run followed by a 10 minute recovery period. Include an explanation of the role of neural, intrinsic and hormonal control mechanisms in your answer.

Anticipatory rise:
30 minute training run:
10 minute recovery:

		HR (exercise)	HR (recovery)
Neural control	Chemoreceptors		
	Proprioreceptors		
	Baroreceptors		
	Send sensory information to the cardiac control centre (CCC) in the medulla oblongata		
	Response:		

		HR (exercise)	HR (recovery)
Intrinsic control	Thermoreceptors		
	Send sensory information to the cardiac control centre (CCC) in the medulla oblongata		
	Response:		
	Venous return		

Hormonal control:
(exercise)

(recovery)

3: Cardiovascular system - Outline answer scheme (not endorsed by any examining body)

For a performer in a sport of your choice explain the response of heart rate to a 30 minute training run and a 10 minute recovery. Include an explanation of the role of neural, intrinsic and hormonal control mechanisms in your answer.

Numbered points - indicative content that candidates are likely to include
Indented points - possible developmental points
NB - Relevant points made that are not on answer scheme will gain credit

Heart rate

1. At rest 60-75bpm
2. Prior to exercise increase in heart rate/ anticipatory rise
3. During exercise HR increases in line with exercise intensity
   - Sub-maximal / aerobic performance: HR will plateau (130-160bpm)
   - i.e. 30 minute training run
4. During recovery HR decreases rapidly
5. Then slower decline to resting value

Neural control During 30 minute training run

6. Chemoreceptors detect decrease in O_2/ blood pH/ increase in acidity/ CO_2
7. Proprioreceptors detect movement
8. Baroreceptors detect increase in blood pressure
9. Messages are sent to the cardiac control centre (CCC) in the medulla oblongata
10. SA node stimulated to increase heart rate
    - via the accelerator nerve
    - via sympathetic nervous system

Neural control During recovery

11. Chemoreceptors detect increase in the O_2/ blood pH/ decrease in acidity/ CO_2
12. Proprioreceptors detect decrease in movement
13. Baroreceptors detect decrease in blood pressure
14. Messages are sent to the cardiac control centre (CCC)
15. SA node reduces stimulation decreasing heart rate
    - via the vagus nerve
    - via the parasympathetic nervous system

Intrinsic control During 30 minute training run

16. Thermoreceptors detect increase in temperature

    Increase the speed of nerve impulse/ transmission

17. Increased venous return

    Increased end diastolic volume (EDV)

    stretch in the wall of the right atria/ stroke volume/ SV/ Starling's Law

18. Messages sent to the cardiac control centre (CCC)

19. SA node stimulated to increase heart rate

Intrinsic control During recovery period

20. Thermoreceptors detect decrease in temperature

    decreases the speed of nerve impulse/ transmission

21. Decreased venous return

    decreased end diastolic volume (EDV)

    less stretch in the wall of the right atria/ stroke volume (SV)

22. Messages sent to the cardiac control centre (CCC)

23. SA node reduces stimulation to decrease heart rate

Hormonal control

24. Prior to exercise and during exercise

25. Release of adrenaline/ epinephrine/ noradrenaline

    from the adrenal glands/ into the blood stream

26. Direct stimulation of the SA node to increase heart rate

    bypass medulla oblongata (CCC)

4: Respiratory System - Answer Plan

Critically evaluate the effects of altitude exposure and a period of altitude training on the respiratory system and performance of an endurance athlete.

	Effects of altitude exposure on the respiratory system (immediate effects)	

Effect on performance at altitude:

	Effects of altitude training on the respiratory system (longer term effects)	

Effect on performance at sea level:

4: Respiratory System - Outline answer scheme (not endorsed by any examining body)

Critically evaluate the effects of altitude exposure and a period of altitude training on the respiratory system and the performance of an endurance athlete.

Numbered points - indicative content that candidates are likely to include
Indented points - possible developmental points
NB - Relevant points made that are not on answer scheme will gain credit

Altitude exposure/immediate effects

Effects on the respiratory system

1. Decrease in atmospheric pressure causes an increase in frequency of breathing
2. Partial pressure of oxygen alveoli is lower than at sea level
    e.g. Kenya / Alps training camps
3. Decreased diffusion gradient of oxygen between the alveoli and blood
    all gases move from an area of high to low partial pressure
    the steeper the diffusion gradient the greater volume of gas diffused
4. Less oxygen diffuses into the capillary blood
5. Less oxygen is transported in the blood
    lower oxy-haemoglobin association or saturation
6. Decreased diffusion gradient of oxygen between blood and muscle tissue
7. Less oxygen diffuses into the muscle tissue or myoglobin
8. Less oxygen available for (aerobic) respiration
    less energy for muscular contraction
9. Hypoxic conditions at high altitude

Effects on performance

10. Performance decreases at altitude
    performer fatigues more quickly
    decrease in VO_2max
    accelerated OBLA
    e.g. slower running/ cycling speeds
12. Performer may hyperventilate decreasing performance
13. Hypoxia can cause causes poor co-ordination/poor perceptions/ dizziness

Altitude training/longer term effects

14. 2-4 weeks at an area above 1500m
    e.g. high altitude training for England football team ahead of the world cup
15. Several different methods
    train high live low/ live high train low/ live high train high
16. Alternatives
    hypoxic tents or rooms/ inspiratory muscle training
    e.g. power breathe

Effects on the respiratory system

17. Increased production of erythropoietin (EPO)
    stimulates red blood cell production
    leads to higher volumes of haemoglobin
    Increased carrying capacity of oxygen in the blood steam
18. Capillarisation
    increased capacity for diffusion into bloodstream/ muscle tissue
19. Increased strength, power and endurance of respiratory muscles
    e.g. scalenes (or other suitable example)

Effects on performance

20. Acclimatisation
21. Increased VO_2max
    increased lactate threshold/ time to OBLA
22. Aerobic performance increases at higher intensities or less effort needed at sub-maximal/ low-moderate intensities
    increasing duration of performance
23. Results controversial/ short-term adaptations only

Introductory or revision lesson

Objectives:	**Learning Outcomes:**
To understand key aspects of the AS Anatomy and Physiology specification	**Must**: know what the course entails **Should**: be able to engage with the tasks **Could**: see the link between the three tasks
Context:	**Key Words/cognitive demand:**
Revision or introductory carousel lesson for AS Anatomy and Physiology (can be adapted with more challenging tasks).	Describe / Analyse / Evaluate

Preparation: three tables set up – each with a different activity

Whole group: Discussion on what students think anatomy and physiology may include (if introductory lesson). Quick recap discussion of main parts of the A&P course (if used as revision lesson).

Lesson Structure:

Teacher Input: PowerPoint presentation briefly explaining AS A&P (if intro lesson) or de-briefing on year (if revision lesson) (10 mins)

Table 1: Key word matching task–key word card strips that students will have come across should be matched to correct explanation (10-15 mins)
Table 2: Analysis of balanced active healthy lifestyles – who leads one? (10-15 mins)
Table 3: Long-term endurance training – working towards a critical evaluation. Identifying and then developing key points with examples as needed for the 10-mark questions (10-15 mins).

Whole group: Analysis and evaluation of key aspects learned or revised. Questions. Summary (10 mins)

Differentiation (lower ability):	**Differentiation** (stretch and challenge):

Follow-up work:

Table 1a: Place each key word strip (table 1b) next to correct description:

Structural changes in response to aerobic training, for example: increased mitochondrial density
A partial blockage of a coronary artery causing chest pain
Training in areas >1500m above sea level for 4-6 weeks
Two muscles that work together to provide co-ordinated movement: as one muscle lengthens the opposing muscle shortens
An increase in the size of the heart muscle
General term for all diseases relating to the coronary blood vessels and heart muscle
The difference in partial pressures across a membrane which allows gaseous exchange
A push or pull that can alter the state of motion of a body, measured in Newtons
A red blood cell (protein molecule) that transports gases in the bloodstream
Links between the bones in the skeleton. Depending on structural factors these can be classified as ball and socket, hinge, pivot, condyloid or gliding
The process of moving air into and out of the lungs that involves muscles, movement, thoracic cavity volume, lung air pressure, inspiration and expiration
The study of a movement pattern including; joint type, articulating bones, movement patterns, agonist muscle, antagonist muscle and contraction types
Due to loss of articular cartilage at the ends of long bones this results in painful, swollen joints which severely limits involvement in physical activity
An inactive existence with little or no physical activity
The return of deoxygenated blood to the heart
The largest amount of oxygen an individual's body can transport and use during exercise – indicating cardiovascular efficiency

Table 1b: Key words/phrases

(laminate/cut-into strips and place next to correct description on Table 1a)

AEROBIC ADAPTATION
ANGINA
ALTITUDE TRAINING
ANTAGONISTIC MUSCLE ACTION
CARDIAC HYPERTROPHY
CORONARY HEART DISEASE
DIFFUSION GRADIENT
FORCE
HAEMOGLOBIN
JOINT
MECHANICS OF BREATHING
MOVEMENT ANALYSIS
OSTEOARTHRITIS
SEDENTARY LIFESTYLE
VENOUS RETURN
VO_2 max

Table 2: Balanced, active and healthy lifestyles – who leads one?

Task - Consider each of the following students in terms of:

- Positive aspects of their lifestyle (with evidence)
- Negative aspects of their lifestyle (with evidence)
- Any potential risk factors (explain)
- Recommendations for improvement

In shaded box 4 describe the lifestyle of a student which could be described as healthy, balanced and active

1. Maria – 9 years old

- Trains for gymnastics three evenings a week plus Saturday mornings. Training is intensive and includes sessions on flexibility and strength
- Maria's favourite piece of apparatus/discipline is the floor and she also loves tumbling
- Maria eats lots of vegetables and loves to drink milk. She has a very sweet tooth and regularly eats crisps and sweets
- Maria competes regularly at weekends and often struggles to find time to do her homework

Comments:

2. Nimesh – 14 years old

- Nimesh wants to be a boxer and goes to the sparring club twice a week. He also jogs to and from school each day (15 minutes away)
- Nimesh is very annoyed at his father who won't let him start weight training until he is 16
- Nimesh has a love for fast food and regularly eats burgers, pizzas and chips with plenty of salt and vinegar
- Nimesh is very tired at weekends and regularly sleeps in

Comments:

3. Greg – 18 years old

- Greg loves being active and plays cricket and football with friends. He is a member of the local gym and weight trains several times a week plus goes for an occasional relaxing swim
- Greg is a vegetarian, loves fruit and hates fast food. He takes creatine and protein supplements to give him energy in the gym

Comments:

4. Describe the lifestyle of a student's which could be classed as balanced, active and healthy

Table 3: Long-term endurance training – a critical evaluation

It is widely accepted that long-term endurance training is beneficial to the cardio-vascular system

Consider/discuss/make brief notes on the following:

- What is endurance training?
- How many times a week would you participate in endurance training?
- What kinds of activities would you include?
- How may your **heart** adapt to endurance training?
- How may your **blood vessels** adapt to endurance training?
- How may your **blood** adapt to endurance training?
- Can endurance training have any **preventative health benefits**?
- What can happen if you **don't participate** in endurance training?
- What can happen if a person is **old, unfit or has coronary heart disease**?
- How might this endurance training be adapted to maintain a balanced, active and healthy lifestyle?

Stretch and Challenge 1: The Musculoskeletal System

For each of the situations/examples below:

1. Identify the main concern re **skeletal and muscular system** (consider osteoporosis, growth place disorder, posture and alignment, osteoarthritis, joint stability))
2. Outline **potential risks** to participating **excessively** (more than five times per week) in each activity
3. Are there any **benefits** to participation in each activity? If so, what are they?
4. What **recommendations** would you make for safe, healthy participation in each activity?

Contact sports e.g. rugby

Main concern:

Potential risks re excessive participation:

Benefits:

Recommendations for safe, healthy participation:

Vigorous, high impact sports e.g. gymnastics

Main concern:

Potential risks re excessive participation:

Benefits:

Recommendations for safe, healthy participation:

Activities involving repetitive actions e.g. long distance running

Main concern:

Potential risks re excessive participation:

Benefits:

Recommendations for safe, healthy participation:

Non-weight bearing activities e.g. swimming

Main concern:

Potential risks re excessive participation:

Benefits:

Recommendations for safe, healthy participation:

Working at a desk 9am-5pm and a sedentary lifestyle outside of work

Main concern:

Potential risks re excessive participation:

Benefits:

Recommendations for safe, healthy participation:

Stretch and Challenge 2: Motion and Movement

Work in groups:
For one of Newton's three laws of motion each group should prepare a short documentary including the following :

- An explanation of the law
- Several sporting applications of the law
- An easy way to remember the law

Newton's first law of motion: Inertia *'A body continues in a state of rest or uniform velocity unless acted upon by an external force'* (**Inertia** = the resistance of a body to change its state of motion)
Newton's second law of motion: Acceleration *'The rate of change in momentum experienced by an object is directly proportional to the size of the force applied and takes place in the same direction as the force applied'* (**Acceleration** = the rate of change in velocity)
Newton's third law of motion: Reaction *'For every action force there is an equal and opposite reaction force'*

- Return to show all groups the movie clips
- Answer the following exam-style question:

Using a serve in tennis, explain Newton's three laws of motion

[5 marks]

Stretch and Challenge 3: Cardiovascular System

Working in groups –from the British Heart Foundation website (www.bhf.org.uk) find answers to the following questions:

- What is coronary heart disease (CHD)?
-
- What are the related **conditions** of CHD?
-
-
-

List/categorise CHD **risk factors** below:'	
Factors that I can change	Factors that I can't change

- Bearing in mind the risk factors that can be changed - how can coronary heart disease be prevented?

- What kind of physical activity is best to prevent coronary heart disease?

- If helping to prevent coronary heart disease really interests me what potential career paths could I follow?

Stretch and Challenge 4: Respiratory System

On graph paper draw the oxygen dissociation curve using the data in table 1 below. Remember :

- Horizontal axis = partial pressure of O_2
- Vertical axis = Percent O_2 saturation of haemoglobin
- Draw a line of best fit to connect the points

Table 1: Oxygen-Haemoglobin dissociation curve at REST											
Percent O_2 saturation of haemoglobin	0	12	35	60	75	85	92	95	98	99	100
Partial pressure of O_2 (mmHg)	0	10	20	30	40	50	60	70	80	90	100

Plot the following points and describe the relationship between partial pressure of oxygen and percent saturation of haemoglobin:

Lung PPO_2 = 100 mmHg

Muscle tissue PPO_2 = 40 mmHg

At rest what percentage of total O_2 being carried by the haemoglobin has been released to the muscle tissue (difference between lung and muscle %)?

On same graph draw the line of best fit to connect points for data during exercise:

Table 2 Oxygen-Haemoglobin dissociation curve during EXERCISE											
Percent O_2 saturation of haemoglobin	0	8	18	33	50	68	80	88	95	98	100
Partial pressure of O_2 (mmHg)	0	10	20	30	40	50	60	70	80	90	100

Plot the following point and describe the relationship between partial pressure of oxygen and percent saturation of haemoglobin:

Lung PPO_2 = 100 mmHg

What is the difference to rest?

Muscle tissue PPO_2 = 20 mmHg

What is the difference to rest?

During exercise what percentage of total O_2 being carried by the haemoglobin has been released to the muscle tissue (difference between lung and muscle %)?

How does this help performance?

What causes this shift of the oxygen-haemoglobin curve to the right from rest to exercise?

1.
2.
3.
4.

Stretch and Challenge activities 1-4: Answers

Answers are a brief guide rather than a comprehensive analysis of these four extension activities

Stretch and Challenge 1: The Musculoskeletal System – brief answers

Contact sports e.g. rugby

Main concern: Muscular and skeletal system: joint stability

Potential risks re excessive participation: e.g. strain, sprain, dislocation from poor or dangerous tackles

Benefits: e.g. team game with varied strain on bones helps development and maintenance of bone density

Recommendations for safe, healthy participation: e.g. strengthen connective tissue/use an effective warm-up before exercise

Vigorous, high impact sports e.g. gymnastics

Main concern: Skeletal system: growth plate disorders

Potential risks re excessive participation: e.g. premature closure of the growth plate

Benefits: e.g. stimulation of calcium salt deposition helps development of peak bone mineral density

Recommendations for safe, healthy participation: e.g. recommended maximum 3 sessions per week with an age related limit on excessive impact

Activities involving repetitive actions e.g. long distance running

Main concern: Skeletal system: osteoarthritis/
muscular system: repetitive strain injuries

Potential risks re excessive participation: e.g. wear and tear of articular cartilage leading to bone spurs, painful and swollen joint with reduced mobility

Benefits: e.g. stimulation of joint capsule to secrete synovial fluid to lubricate joint

Recommendations for safe, healthy participation: e.g. limit frequency of performance to 3 times per week / include different activities to vary line of stress placed on bones

Non-weight bearing activities e.g. swimming

Main concern: Skeletal system: osteoporosis

Potential risks re excessive participation: e.g. due to lack of impact, bone turnover is reduced potentially decreasing bone density more quickly after adulthood is reached

Benefits: e.g. weight management/prevention of obesity or coronary heart disease

Recommendations for safe, healthy participation: e.g. include some weight bearing activities at least once a week

Working at a desk 9am-5pm and a sedentary lifestyle outside of work

Main concern: Muscular and skeletal system: overweight/obesity

Potential risks re excessive participation: e.g. high blood lipid and LDL cholesterol leading to atherosclerosis

Benefits: No health related benefits / possibly reduced risk of sports related injuries

Recommendations for safe, healthy participation: e.g. government guidelines for adults: BAHL possible through 30 mins x 3 per week/moderate level/feel breathless

Stretch and Challenge 2: Motion and Movement - brief answers

- An explanation of the law

1: an object (e.g. a ball) will not move from a stationary position (e.g. the penalty spot) until an external force is applied. Equally an object (e.g. a ball) will continue to travel with constant velocity until an external force is applied (e.g. goalkeepers hands)
2: The greater the external force applied to an object the greater the acceleration in the same direction as the force is applied
3: When an action force is applied to an object there is an equal and opposite reaction force

- Sporting applications of the law (e.g.)

1: A football will remain at rest on the penalty spot until an external force is applied from the foot
2: To make the ball travel faster and therefore further (e.g. goalkick) a larger external force is applied. If the goalkeeper applies the external force to the back of the football it travels in a forward direction
3: If the goalkeeper wants to dive to the top right hand corner of the goal they will apply an action force/push down into the ground to the left, the ground will provide an equal and opposite reaction force up and to the right

- An easy way to remember the law
- Return to show all groups the movie clips
- Answer the following exam-style question:

Using a serve in tennis, explain Newton's three laws of motion

[5 marks]

Newton's first law of motion: Inertia *'A body continues in a state of rest or uniform velocity unless acted upon by an external force'* (**Inertia** = the resistance of a body to change its state of motion)
Newton's second law of motion: Acceleration *'The rate of change in momentum experienced by an object is directly proportional to the size of the force applied and takes place in the same direction as the force applied'* (**Acceleration** = the rate of change in velocity)
Newton's third law of motion: Reaction *'For every action force there is an equal and opposite reaction force'*

Stretch and Challenge 3: Cardiovascular System – brief answers

Working in groups –from the British Heart Foundation website (www.bhf.org.uk) find answers to the following questions:

- What is coronary heart disease (CHD)?
- General term for all diseases relating to the coronary blood vessels and heart muscle
- What are the related **conditions** of CHD? (e.g.)
- Arteriosclerosis
- Atherosclerosis
- Angina
- Heart attack
- Hypertension

List/categorise CHD **risk factors** below:'	
Factors that I can change	Factors that I can't change
Level of exercise Poor diet (high salt/fat/cholesterol intake) Amount of stress Smoking / alcohol consumption Weight / body composition	Genetic make-up / hereditary factors

- Bearing in mind the risk factors that can be changed - how can coronary heart disease be prevented? (e.g.)

Healthy balanced diet / low cholesterol / low saturated fat / low salt
Regular exercise
Low alcohol consumption / no smoking
Low stress lifestyle
Healthy weight in relation to height (body mass index)

- What kind of physical activity is best to prevent coronary heart disease?

Aerobic / sub-maximal / heart rate raising activities lasting 30minutes or more

- If helping to prevent coronary heart disease really interests me what potential career paths could I follow? (e.g.)

Dietician / Nutritionalist / Personal trainer / Health worker / Nurse / Doctor / Cardiac rehabilitation specialist

Stretch and Challenge 4: Respiratory System

On graph paper draw the oxygen dissociation curve using the data in table 1 below. Remember :

- Horizontal axis = partial pressure of O_2
- Vertical axis = Percent O_2 saturation of haemoglobin
- Draw a line of best fit to connect the points

Table 1: Oxygen-Haemoglobin dissociation curve at REST											
Percent O_2 saturation of haemoglobin	0	12	35	60	75	85	92	95	98	99	100
Partial pressure of O_2 (mmHg)	0	10	20	30	40	50	60	70	80	90	100

See pp.111, Fig.3.3.9a (Heinemann PE for OCR student textbook)

Plot the following points and describe the relationship between partial pressure of oxygen and percent saturation of haemoglobin:

Lung PPO_2 = 100 mmHg

At a PPO_2 of 100mmHg the saturation of haemoglobin with O_2 would be 98-100%

i.e. The blood travelling past the lungs would become maximally oxygenated

Muscle tissue PPO_2 = 40 mmHg

At a PPO_2 of 40mmHg the saturation of haemoglobin with O_2 would be approximately 75%

i.e. The blood travelling past the muscle tissue would offload/dissociate approximately 25% of the oxygen being carried (for diffusion into the muscle cell)

At rest what percentage of total O_2 being carried by the haemoglobin has been released to the muscle tissue (difference between lung and muscle %)?

Approximately 25%

On same graph draw the line of best fit to connect points for data during exercise:

Table 2 Oxygen-Haemoglobin dissociation curve during EXERCISE											
Percent O_2 saturation of haemoglobin	0	8	18	33	50	68	80	88	95	98	100
Partial pressure of O_2 (mmHg)	0	10	20	30	40	50	60	70	80	90	100

See pp.111, Fig.3.3.9b (Heinemann PE for OCR student textbook)

Plot the following point and describe the relationship between partial pressure of oxygen and percent saturation of haemoglobin:

Lung PPO_2 = 100 mmHg

At a PPO_2 of 100mmHg the saturation of haemoglobin with O_2 would be 98-100%

i.e. The blood travelling past the lungs would become maximally oxygenated

What is the difference to rest?

No difference: the blood travelling past the lungs would become maximally oxygenated

Muscle tissue PPO_2 = 20 mmHg

At a PPO_2 of 20mmHg the saturation of haemoglobin with O_2 would be approximately 20%

i.e. The blood travelling past the muscle tissue would offload/dissociate approximately 80% of the oxygen being carried (for diffusion into the muscle cell)

What is the difference to rest?

The percentage saturation of haemoglobin with O_2 around the muscle tissue has dramatically decreased from approximately 75% in resting conditions to approximately 20% during exercise

i.e. The blood travelling past the muscle tissue would offload/dissociate approximately 55% more oxygen during exercise

During exercise what percentage of total O_2 being carried by the haemoglobin has been released to the muscle tissue (difference between lung and muscle %)?

Approximately 80%

How does this help performance?

A larger volume of oxygen is available for diffusion into the muscle cell for aerobic respiration. This increases the energy produced aerobically therefore can increase aerobic performance and recovery

What causes this shift of the oxygen-haemoglobin curve to the right from rest to exercise?

-an increase in blood and muscle temperature

-a decrease in PPO_2 within the muscle cell (increasing the diffusion gradient)

-an increase in $PPCO_2$ within the muscle cell and blood capillaries (increasing the diffusion gradient)

-a decrease in pH (increase in acidity, known as the Bohr effect)

These factors increase oxygen dissociation from haemoglobin in the blood capillaries for diffusion into the muscle cell during exercise