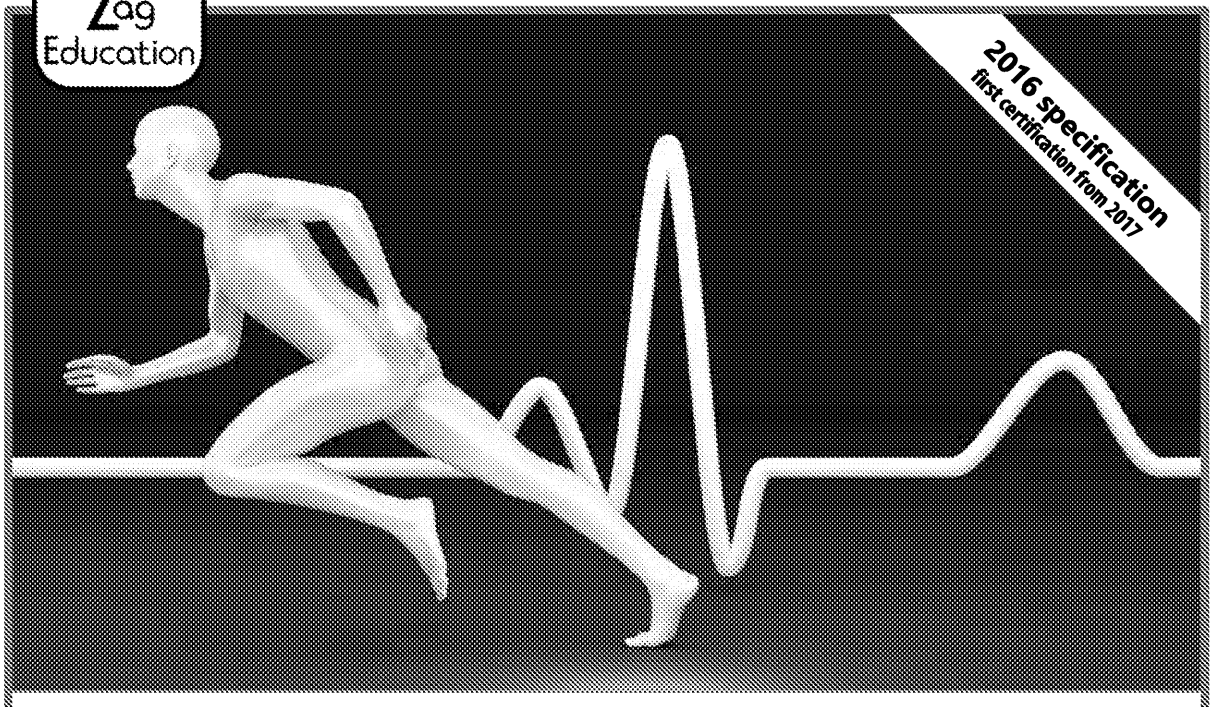
Sport

Pearson BTEC | Level 3 Nationals



Activity Pack for BTEC Nationals in Sport

Unit 1: Anatomy and Physiology

For Pearson BTEC Level 3 National:
Certificate in Sport (603/0458/3)
Extended Certificate in Sport (601/7218/6)
Foundation Diploma in Sport (601/7220/4)
National Diploma in Sport (603/0460/1)
National Extended Diploma in Sport (603/0459/5)
National Diploma in Fitness Services (601/7215/0)

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POD 7060

Contents

Teacher's Introduction

This pack provides activities which can be used to test and aid the learning of information that is delivered in Unit 1 of BTEC Nationals (Level 3) in Sport.

The resource follows the specification in the order provided. The activity cross-reference table provided at the beginning of the resource is a useful tool for locating the learning aims that are covered in each activity and identifying the type of activity that is used.

Remember!
Always check the exam board website for new information, including changes to the specification and sample assessment material.

A range of activities are used in this pack which are designed to be completed individually, in pairs and in large groups/class groups as well as activities which are designed to be completed during practical classes. The type of activity can be identified by the icon in the top right-hand corner of each activity:

 = individual activity

 = pairs activity

 = group activity

Note that some activities are suitable for varying numbers of participants. This information can be found in the activity cross-reference table.

These activities are designed to be completed by the students with little input from the teacher required. However, where relevant, teacher's instructions have been provided in order to aid the delivery of the activity.

Specification Reference Table

Activity No.	Specification Reference	Title	Additional Equipment	Activity Type	Spec reference
1	Structure of skeletal system	Locate the Bone		Pairs	A1
2	Function of skeletal system	Unscramble		Individual	A2
3	Joints	Joint Research		Pairs	A3
4	Structure of the joints	Construction	Cardboard tubes, sticky tape, bottle top, elastic bands, newspaper, string, any other suitable equipment	Group (Practical)	A3
5	Responses and adaptations of the skeletal system to exercise	Health Care Specialist		Threes	A4,5,6
6	Characteristics and function of different types of muscles	Question Time		Individual	B1
7	Major skeletal muscles of the muscular system	Label Up	Sticky labels	Class/Pairs	B2
8	Antagonistic muscle pairs	Analyse the Images		Pairs	B3,4
9	Skeletal muscle contraction	Tick the Twitch		Individual	B5
10	Responses and adaptations of the muscular system to exercise	Brainstorm for Exams		Individual	B6
11	Structure of the respiratory system	Draw and Cut	Scissors	Individual	C1, C2
12	Lung volumes	Practical	Sport equipment of choice	Individual (practical)	C3
13	Control of breathing	Partner's Idea		Pairs	C4
14	Responses and adaptations of the respiratory system to exercise	Draw It	White board	Class	C5,6,7
15	Structure of the cardiovascular system	Annotate		Individual	D1
16	Function of the cardiovascular system	Mind Map		Individual	D2
17	Nervous control of the heart	Order the Stages		Individual	D3
18	Responses and adaptations of the cardiovascular system to exercise	Lung Race	Large floor mats, blue and red bibs, small cones, large cones	Group (practical)	D4,5
19	Additional factors affecting the heart	Newspaper Article		Individual	D6
20	The role of ATP in exercise	Take Note		Individual	E1
21	The energy systems	Filling in the Gaps		Individual	E2,3,4
22	Adaptations of the energy system to exercise	Speed Dating		Pairs / whole class	E5,6

Structure of Skeletal System: Locate the Bone

In pairs you will need to research the structure of the skeletal system. Below are
able to recognise on a skeleton.

1. Research the location of each of these and complete the table by writing a s
of their location and the type of bone it is (long, short, flat, sesamoid or irre
2. After you have done this, test your partner by asking if they can locate each
you. Your partner should point or show you. If your partner guesses correct
a score of 1 in the box, if it takes them two guesses put a score of 2 for that
Take it in turns picking one bone at a time and play until all the bones have
3. Now total up your partner's score. The winner is the person with the lowest
4. For each of the bones can you now label whether it is in the appendicu

Bone		Location	Type of bone
Cr[illegible]n			
C[illegible]			
Ribs			
Sternum			
Scapula			
Humerus			
Radius			
Ulna			
Carpals			
Metacarpals			
Phalanges			
Pelvis			
Vertebral column	Cervical		
	Thoracic		
	Lumbar		
	Sacrum		
	Coccyx		
Femur			
Patella			
[illegible]			
[illegible]			
Tarsals			
Metatarsals			
			Total score

5. Now, try to think of how only four of the bones covered in the previous activity sporting examples of their use.

Bone 1:

Use in sport:

Bone 2:

Use in sport:

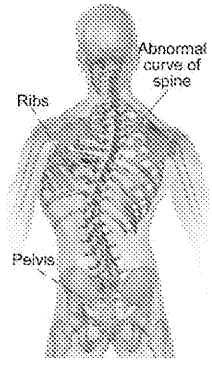
Bone 4:

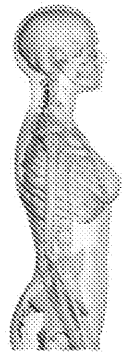
Use in sport:

Bone 3:

Use in sport:

6. Identify the type of spine alignment shown in the following pictures:





a) ..... b) ..... c)

7. Explain the role of the following components of the skeletal system on the

Osteoclasts: .....

.....

Osteoblasts: .....

.....

Epiphyseal plate: .....

.....

Function of Skeletal System: Unscramble

1. Firstly, unscramble each of the words below to find a function of the skeleto
2. Underneath each word, provide an explanation of the functions.

RTPNITEOCO

Explanation: .....

.....

AEREEVLG

Explanation: .....

.....

GEWIH ANIEBG

Explanation: .....

.....

LDOBO LECL NIDUORCPTO

Explanation: .....

.....

RSTOE FO NIMALERS

Explanation: .....

.....

DCUREE NTCIRFOI

Explanation: .....

.....

SPOINGUPRT AFMWKORPE

Explan.....

.....

SMCLUE TCAHEMTNAT

Explanation: .....

.....

3. Now take the letters that are in the black boxes and unscramble these to fi

The function of this bone type is: .....

.....

An example of this bone is the: .....

4. Unscramble the words below to find further types of bones, and provide the each type

GOLN | | | | |

The function of this bone is: .....

.....

An example of this bone is the: .....

RTOSH | | | | | |

The function of this bone is: .....

.....

An example of this bone is the: .....

LATF | | | | |

The function of this bone is: .....

.....

An example of this bone is the: .....

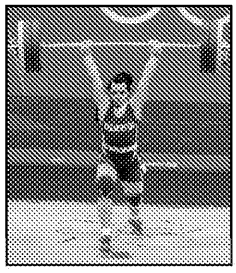
LRAUGRIER | | | | | | | | | |

The function of this bone is: .....

.....

An example of this bone is the: .....

5. Now, use the sporting images below to help you explain how the functions o performers to participate in different sports.



Joints: Joint Research

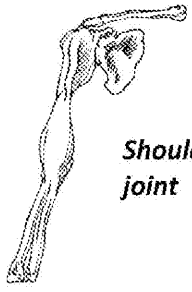
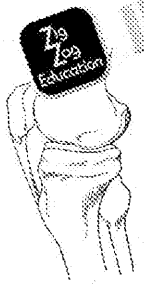
1. In pairs name as many joints of the body as you can in the tables below.

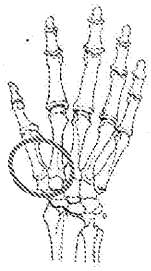
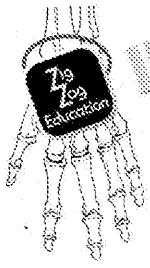
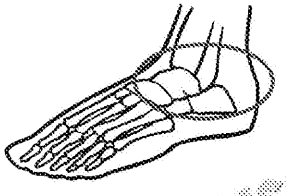
2. Now for each of the joints given, classify the joint as either fibrous (fixed), ca
synovial (freely moveable).

	Upper body joints	
1		
2		
3		
4		
5		

	Lower body joints	
1		
2		
3		
4		
5		
6		

3. Below you will see images with examples of each of the synovial joints. Work v
of synovial joint, name the bones that make up the joint and provide the range

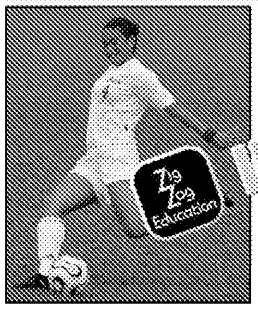
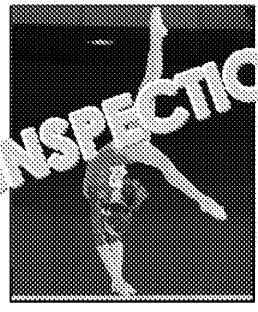
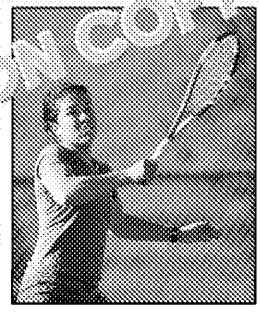
Joint	Type of joint	Bones of joint
 *Shoulder joint*		
 *Knee joint*		
 *Wrist joint*		
 *Cervical vertebrae*		

Joint	Type of joint	Bones of joint
 *Thumb joint*		
 *Intercarpal and intertarsal joints*		
 *Hip joint*		
 *A[illegible]nt*		

Structure of the Joints: Construction

In groups you are to make your own joint out of the materials provided. Your co
key components of a synovial joint. However, first you should plan your joint in t
of a synovial joint and label all its key components. You should also decide what
that component.

Choose a joint from any one of the following:

The knee: Hinge	The hip: Ball and socket	The elbow: Hinge	The shoulde Ball and sock
			

Joint plan

Sketch of your joint:

Joint structure checklist: **Item used for each structure:**

- ☐ ....
- ☐ ....
- ☐ ....
- ☐ ....
- ☐ ....
- ☐ ....
- ☐ ....
- ☐ ....
- ☐ ....
- ☐ ....

You should now present your finished joint to the rest of your class explaining ho
supports movement in sport.

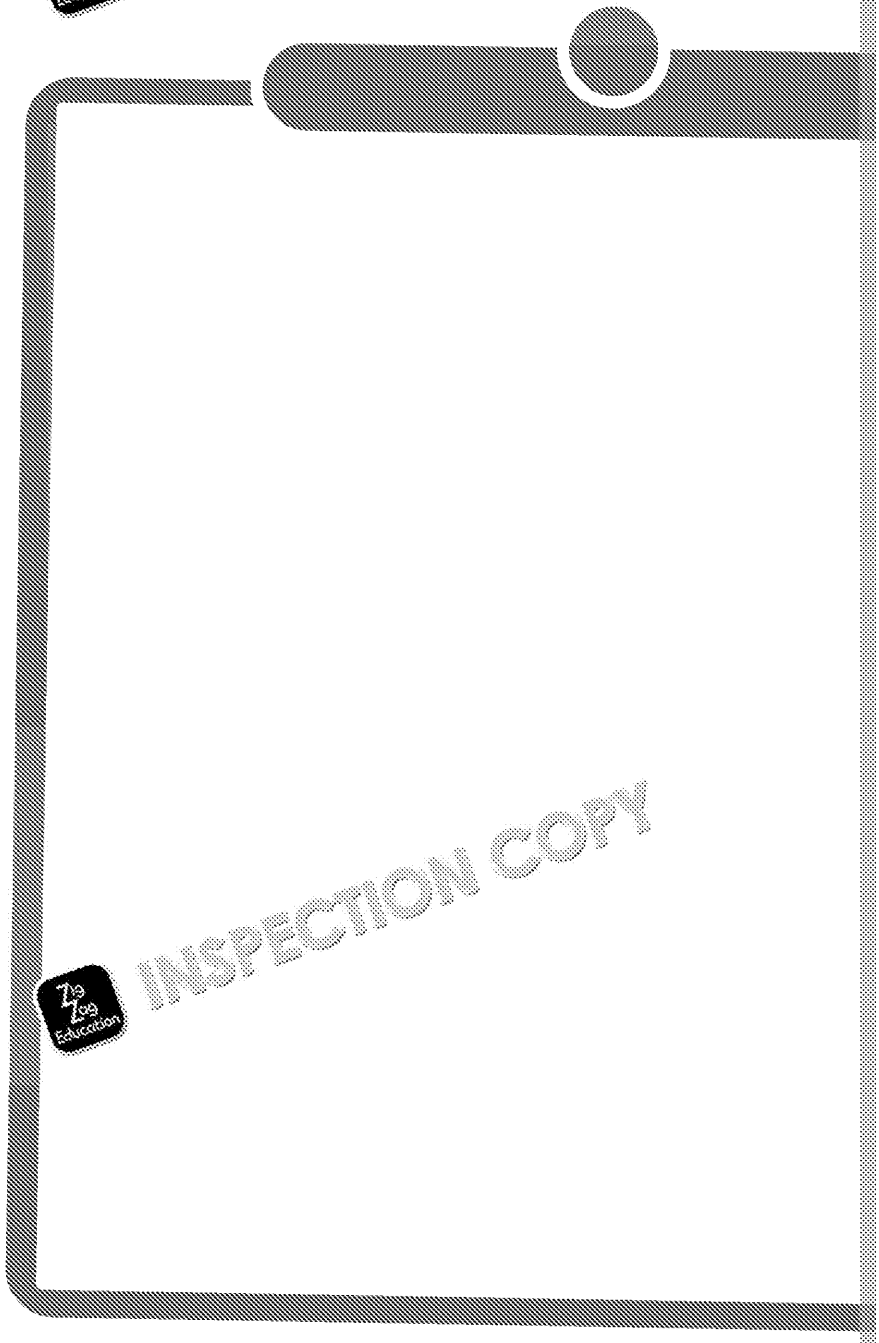
Responses and Adaptations of the Skeletal System to Exercise: Health Care Specialist

Work in threes as a group of healthcare specialists who need to address the skele

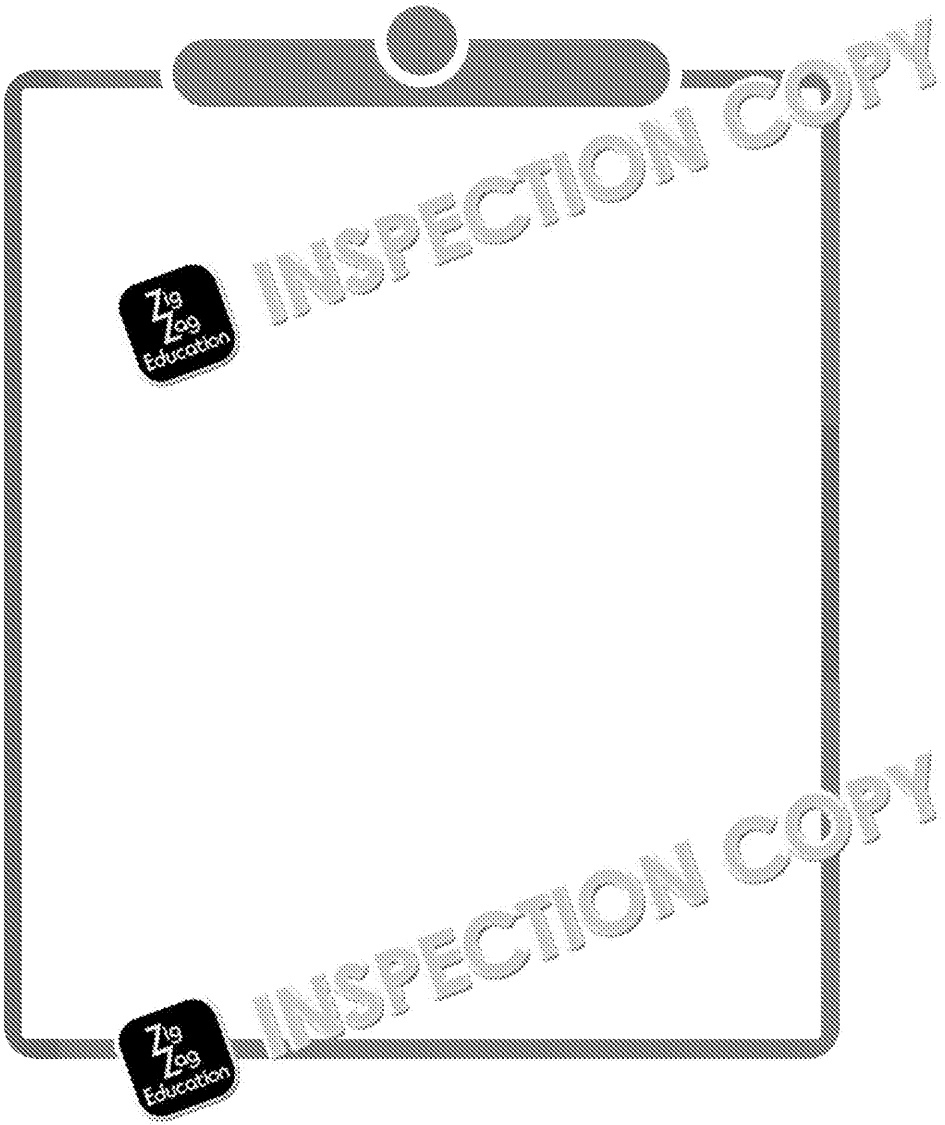
1. Each of you will need to choose one of the following individuals:

Case 1	Case 2
An old-age pensioner with osteoporosis	An obese adult with arthritis

2. Team up with other members of the cla[illegible] who have chosen the same case a[illegible] notes about the following:
   - How this disease/[illegible] could be caused
   - How [illegible] help offset their conditions
   - W[illegible]ponses/adaptations they expect to see if the individual took p[illegible]

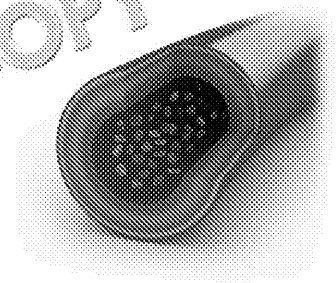


3. Now return to your original group of three and take it in turns to explain the information that you research, take notes about the important information in the notepads below.



Characteristics and Functions of Different Types of Muscles: Question T

1. Identify what type of muscle is found in the parts of the body illustrated in the images below.



i)

ii)

2. Identify the characteristics of each muscle type.

i)

ii)

3. Explain how each of the different types of muscle aid performan[illegible] spo[illegible] of your choice.

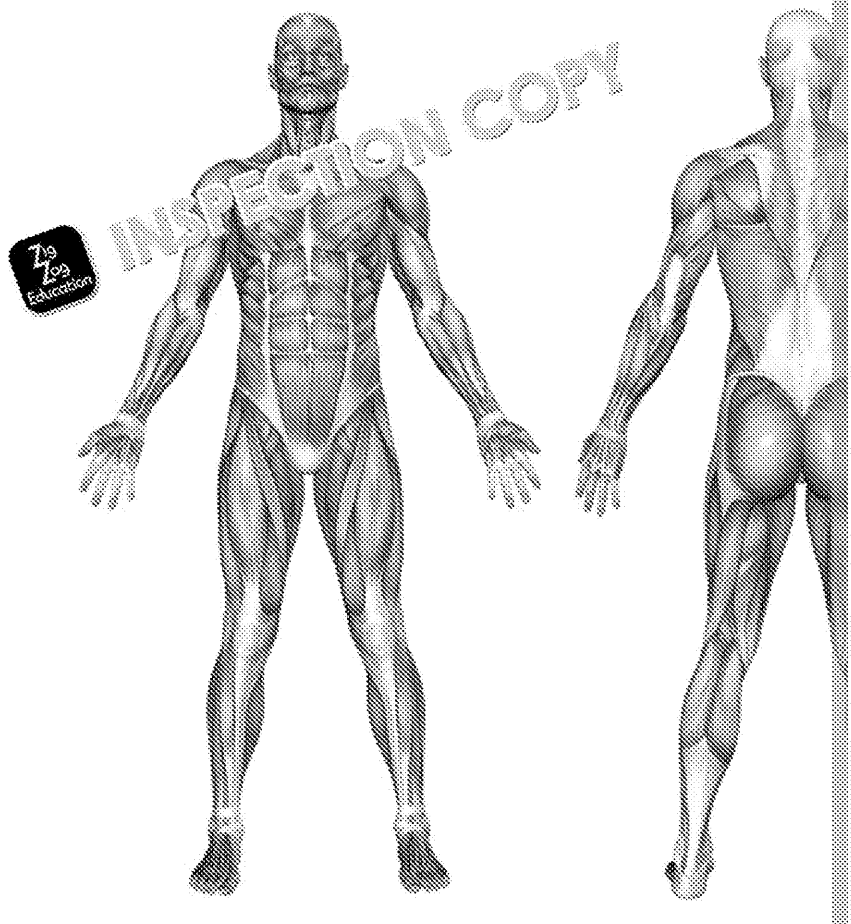
i)

ii)

Major Skeletal Muscles of the Muscular system: Label U

1. On the illustration below, label all of the muscles you can. If you can't think
name you know for now.

2. Now a volunteer should stand at the front of the class. You should take it in
label on the volunteer to show one of the muscles you have labelled below.
You should tick your label below. Remember to tick every label you have co
for the ones that are incorrect.



3. With a partner, choose five skills or sporting actions and then identify the m
that action. You should mime the skills to help you identify all of the muscle

Skill/Action	Muscle

Antagonistic Muscle Pairs: Analyse the Images

1. Explain the terms below to a partner without using the forbidden words. Se identify what type of muscle contraction you are trying to explain.

Keyword	Taboo Words
Agonist	*muscle, shorten, contracts*
Antagonist	*relaxes, lengthens*
Synergist	*assists, agonist*
Fixator	*stabilises, origin, agonist*
Isometric	*length, mo[illegible]n, to, shorten, increase, c*
Concentric	
Eccentric	

2. Work t[illegible]er with your partner to try and create a more accurate definitic contra[illegible]ou can now use the forbidden words!

Agonist:

.....

.....

Antagonist:

.....

.....

Synergist:

.....

.....

Fixator:

.....

.....

Isometric:

.....

.....

Concentric:

.....

.....

Eccentric:

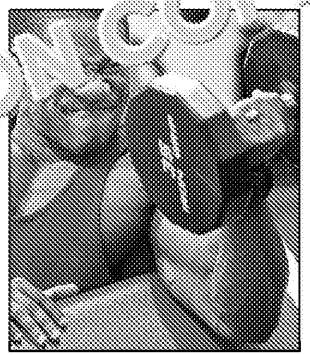
.....

.....

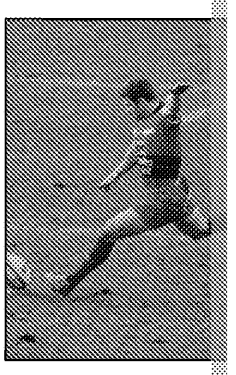
3. The images below show many different sporting movements. For each image, you should identify

a) Performing a pull-up

b) The extension phase of a biceps curl



c) The swing-bac of kicking a rug



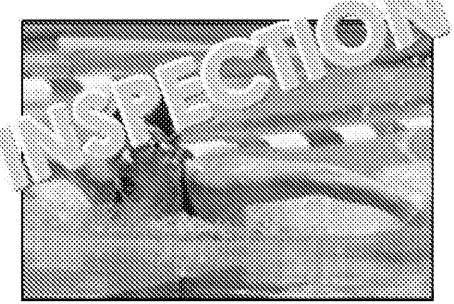
Agonist			
Antagonist			
Synergist			
Fixator			
Type of contraction at the...	agonist	agonist	antagonist

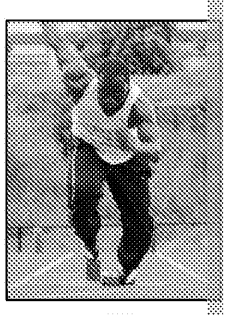
Skeletal Muscle Contraction: Tick the Twitch

1. For each of the images below, tick which muscle fibre type each sport would be predominantly usi muscle fibre type.

a) Long-distance swimming

b) 100 m sprint



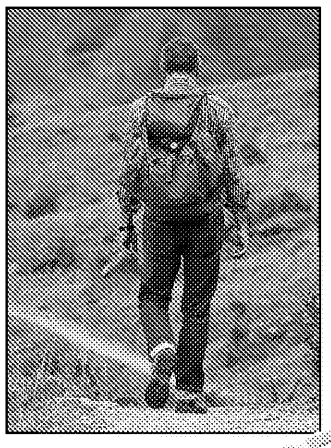


Type I	☐	☐
Type IIa	☐	☐
Type IIx	☐	☐
Explanation		

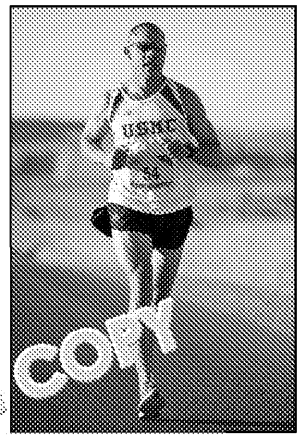
2. Below is a list of characteristics of the different muscle fibre types. For each is a slow twitch (type I), fast oxidative glycotic (type IIa) or fast glycotic (type boxes provided.

Longest time to contract		High capillary density	
Low concentration of mitochondria		Short time to fatigue	
Shortest time to fatig		Medium capillary density	
High oxidative capacity	*and*	High production of force	
Contain medium amounts of myoglobin		Low production of force	
Quick time to contract		Suited for activities which require even more powerful movements	
Long time to fatigue		White in colour	
Low oxidative capacity		Shortest time to fatigue	
Contain large amount of myoglobin		Suited for aerobic/endurance activities	
Medium stores of phosphocreatine and glycogen stores		Red in colour	*and*

3. Describe the 'all or none' law of muscle contraction and explain how it dicta
fibres are recruited when an athlete increases their exercise intensity from



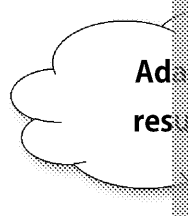
Walking

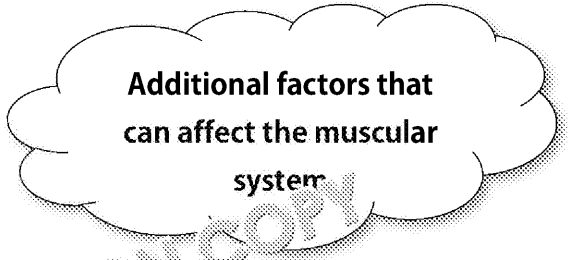


Jogging

Responses and Adaptations of the Muscular System to Exercise: Brainstorm for Exams

- Brainstorm the effects of exercise on the muscular system and the additional muscular system.
- Then answer the three exam questions overleaf.





1. Nina has started playing rugby.

Explain the immediate effects of taking part in a rugby session on the muscu

.....

.....

.....

.....

.....

.....

2. Resistance training can improve the functioning of the muscular system.

a) Explain how resistance training leads to increased muscular strength.

.....

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b) Explain how resistance training could improve sprint performance in th

.....

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3. Explain two factors which can negatively impact on the functioning of the musc

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.....

.....

Structure of the Respiratory System: Draw and Cut

1. Draw and label a diagram of the main components of the respiratory system.

2. Cut out the stages of inspiration and expiration and put the steps in the cor
questions below to explain how the mechanics of breathing change during e

Air enters the lungs	**The thoracic ca**
The external intercostal muscles and diaphragm relax	**The thoracic ca**
The ribs move inwards and downwards, and the diaphragm moves upward	**The air pressure that of th**
Air l lungs	**The air pressure that of th**
The external intercostal muscles and diaphragm contract	**The ribs move and the d**

i) What happens to inspiration and expiration as the intensity of exercise
ii) How does this change occur during inspiration?
iii) How does this change occur during expiration?

3. Decide if the following statements relating to gaseous exchange are true or
any false answers write the correct answer below.

a)	Gas moves from areas of low concentration to areas of high concentrat
b)	Oxygen is transported by haemoglobin
c)	Carbon dioxide cannot be transported by haemoglobin
d)	The alveoli are only one cell thick
e)	The smaller the surface area of the alveoli, the more gas can be exchan
f)	The alveoli are found at the end of arteries and veins
g)	Gaseous exchange occurs at the capillaries
h)	The body can adapt by increasing the number of capillaries in order to efficiency of gaseous exchange
i)	The human body has a long diffusi pa ay for oxygen and other ga
j)	When oxygen combin with noglobin it forms myoglobin

Lung Volumes: Practical

1. Complete the left hand column of the fact file below.
2. Then take part in your physical activity lesson (think about how the lung volu
3. Complete the right hand column of the fact file by indicating how the lung v

Lung Volumes Fact File	
Complete *before* exercise	Compl
What is **tidal volume**?	How did **tidal volume**
What is **vital capacity**?	How did **vital capacit**
What is **residual volume**?	How did **residual vol**
What is **total lung volume**?	How did **total lung v**
What is **pulmonary ventilation**?	How did **pulmonary v** exercise?
Draw a spirometry trace to represent the volumes at **rest**:	Draw a spirometry tr during **exercise**:

Control of Breathing: Partner's Idea

1. Write down as many keywords relating to **neural** and **chemical** control of br

Neural Control	Ch

2. Now swap your list of keywords with a partner and try to write one paragra
breathing and one paragraph about chemical control of breathing using all o

Each sentence should contain at least one key word and you should highligh

Neural control:

.....

.....

.....

.....

.....

.....

.....

Chemical control:

.....

.....

.....

.....

.....

.....

.....

3. Finally, swap your work with a partner and write down any more informatio in their paragraphs if they were using their own keywords to guide them.

Neural Control	Ch

Responses and Adaptations of the Respiratory System to Exercise: Draw It

1. Identify as many responses and adaptations of the respiratory system to exe
other additional factors which can affect the respiratory system when exerc

Response to one session	Adaptations	

2. Work as a class to play a game of Draw It. One member of each the class she
board and draw one of the responses / adaptations / additional factors that
other members of the class should then try to guess the factor. The person
can nominate another student to explain what that factor means.

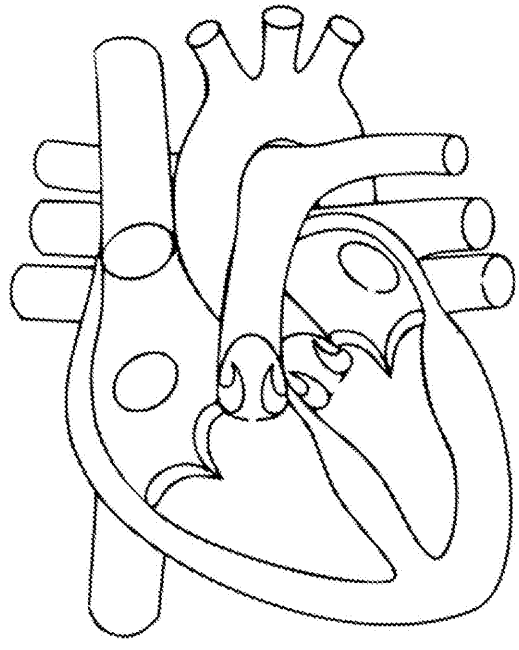
You should also take notes during the game by writing down each of the fac
of the factor in the spaces below:

Drawing was of	Response, adaptation or additional factor?	Exp

Structure of the Cardiovascular System: Annotate

1. **i)** Label the diagram of the heart below with the following structures: atria (right and left), ventricles (right and left), septum, tricuspid valve, b (pulmonary and aortic), aorta, vena cava, pulmonary vein and pulmona

Then, for each of the labels you have identified, outline its role in main



ii) E: he le of the coronary arteries:

.....

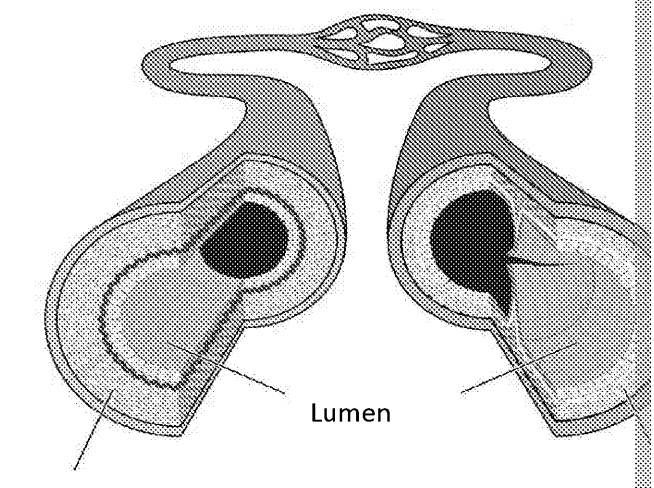
.....

.....

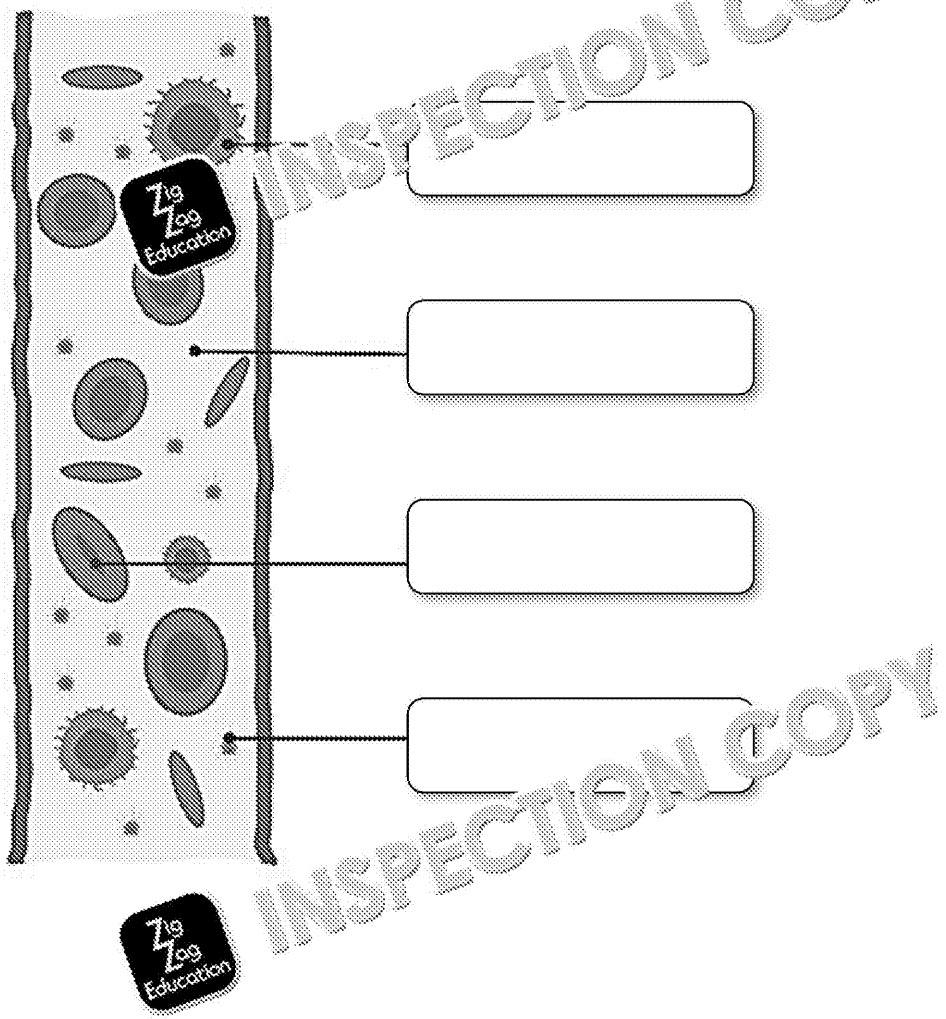
.....

.....

2. Now, identify and annotate each of the blood vessels illustrated in the diagr
structured for its function and how its structure can be affected during exer

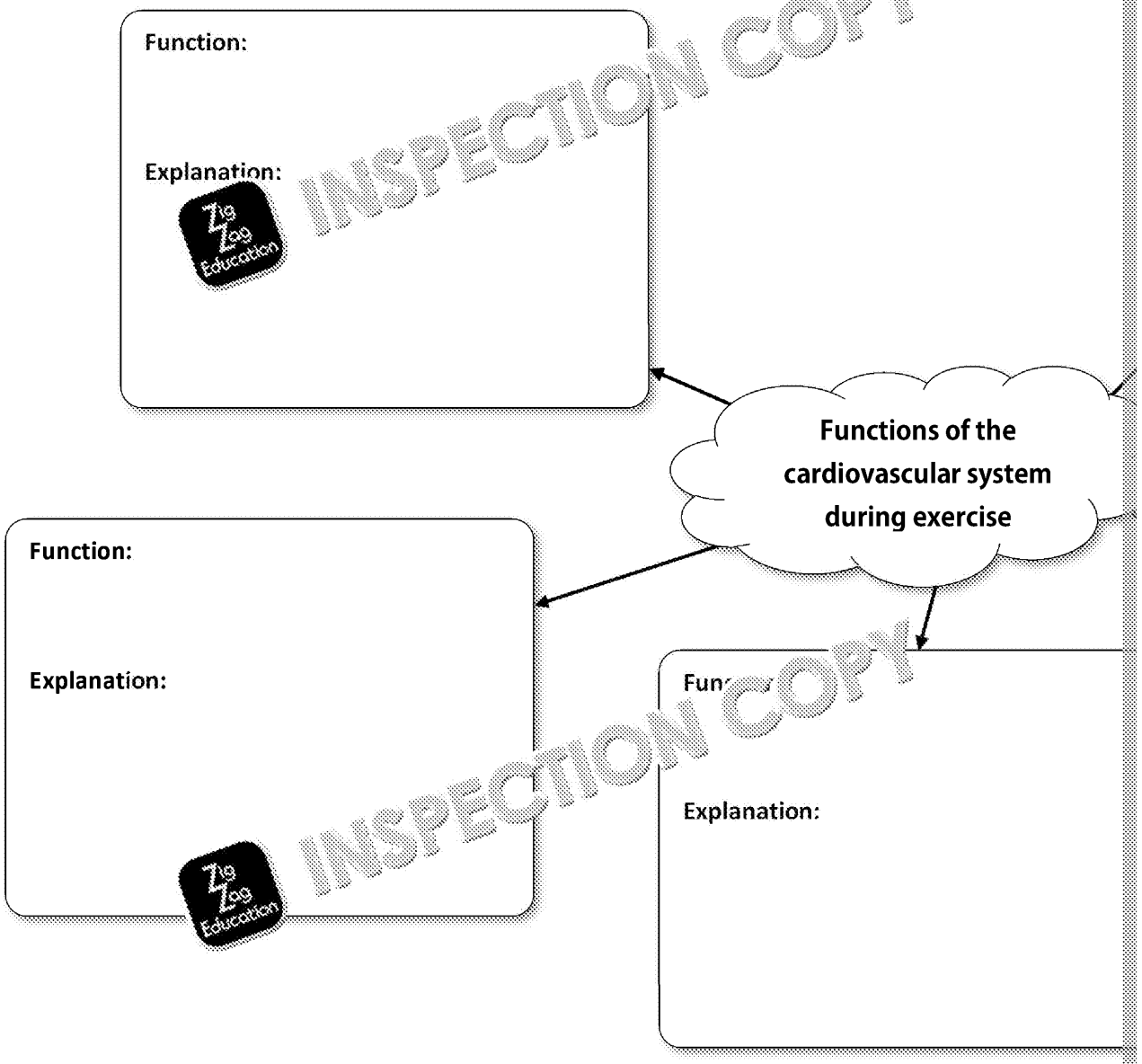


3. Identify the blood cells on the diagram below, and then match up the list of characteristics to each



Functions of the Cardiovascular System: Mind map

Complete the spider diagram below to explain the different functions of the cardiovascular system whe

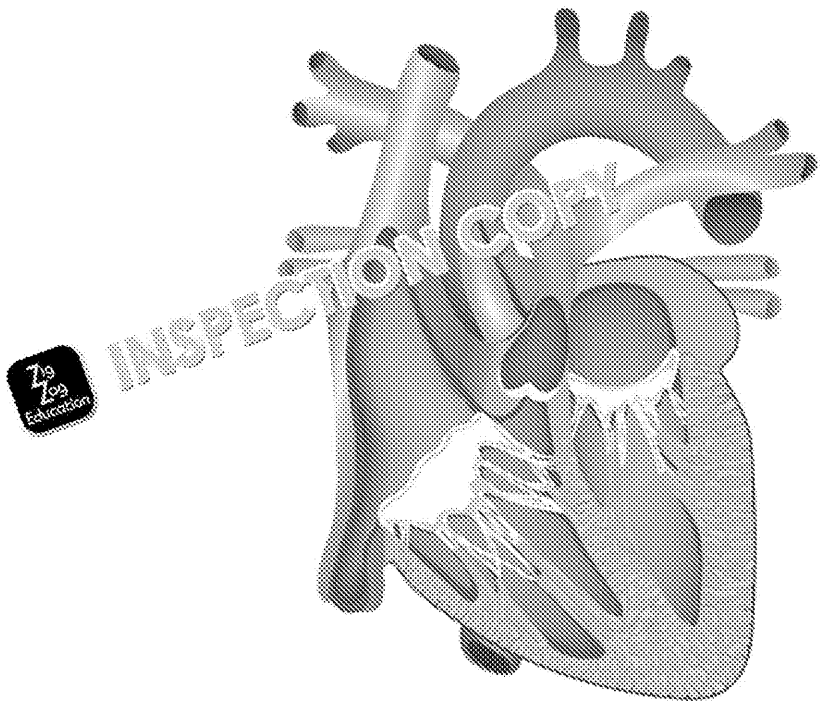


Nervous Control of the Heart: Order the Stages

1. Number the following stages of the cardiac cycle by placing a number next t

The electrical stimulus travels across the muscle cells in the
The atria contract
The stimulus travels dov[illegible]undle of His
[illegible]ricular depolarisation occurs
The ventricles fully fill with blood
The next contraction is delayed
The sino-atrial node (SAN) sends out an electrical stimu
The impulse travels to the atrioventricular node (AVN)
The electrical impulse is conducted to the ventricles
Ventricular contraction occurs
The AV valves close
Atrial depol[illegible]isation occurs
The stimulu[illegible]into the left and right branches of the bun which consist of the Purkyne fibres

2. Now label the diagram of the heart below with the pathway of nervous con
placing the appropriate numbers from activity 1 in the correct positions.



3. Fill in the two boxes below by identifying the differences between the symp
nervous systems:

Sympathetic nervous system:

Para th c nervous system:

Responses and Adaptations of the Cardiovascular system to Exercise: Lung Race

In this practical activity you will be split into teams and race each other around t represented by different groups of cones. You will then evaluate the effects that body and explain the physiological reasons behind them.

Pre-exercise discussion points and questions
In your teams, before starting the exercise discuss the following points regarding cardiovascular system to exercise:

1. Why do heart rate and breathing rate increase during exercise?

2. What waste products are removed from the skeletal muscles during exercis

3. How does the flow of blood around the body change during exercise?

You will now take part in a practical activity!

Practical activity – Teacher's instructions

In this practical activity students will be split into teams and race each other arou
body, as represented by the diagram below. One team will start at the lungs with
team will start at the muscles with blue bibs (deoxygenated). Students will race e
their bibs into the other team's location as quickly as possible and the first team
win the race. However, students must follow the correct route and listen to your
and they should start that transfer again. Make sure they open and close the val
chambers of the heart!

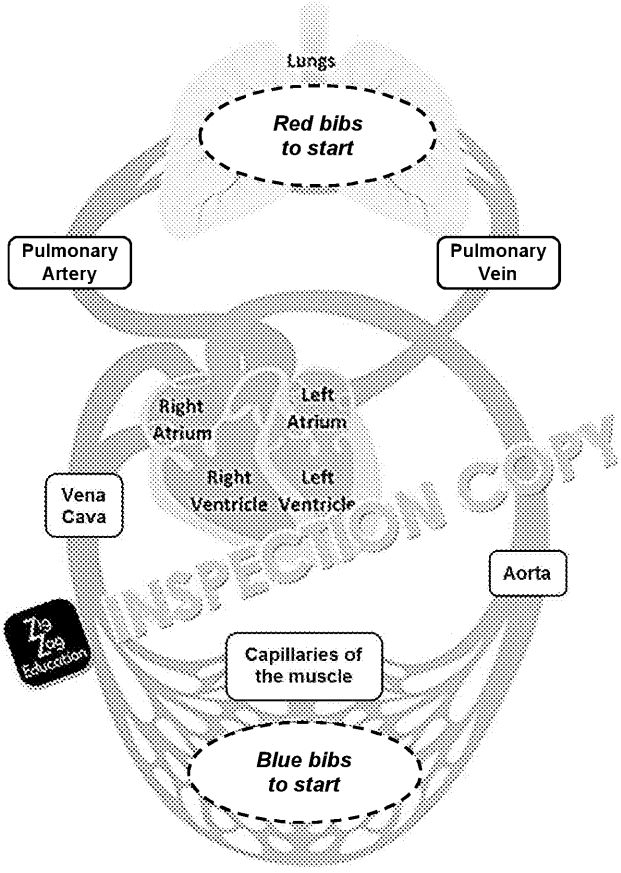
Students will perform a series of races:

- **Race 1:** On your command, the students should race f... their starting zone
course and deposit their bib in the opposition'... ne ... he first team to depos

- **Race 2:** This race should sim... ac function at rest and therefore stud
they don't walk, get ... player to start again.

- **Race 3** ...ould call out different conditions: 'increase/decrease stroke v
rate' or 'increase/decrease cardiac output' at different times during this rac
following rules should apply:
  - Anticipatory increase in heart rate = start with two runners from both t
  - Increase/decrease heart rate = number of runners at one time +/- 1 (d
only 1 person is running)
  - Increase/decrease blood flow = number of bibs that can be carried +/-
  - Increase/decrease cardiac output = number of bibs that can be carried
  - Increase/decrease blood pressure = The width of the track will be incre

Remember: Each team must carry their bib along the correct passage of blood ve



Equipment K...

Part of t...
Chambers ...
Deoxygen...
Oxygena...
Blood ...
Valves o...
Muscle an...

Post-exercise questions

1. a) What is the equation that describes the relationship between heart rate,

b) Describe the influence that the exercise has had on your heart rate and
question 1a, explain how this will in turn affect your stroke volume, car

2. Explain the physiological reasons why after running the race you might feel

3. List th ... adaptations of the cardiovascular system in response to e

Additional Factors Affecting the Heart: Newspaper Artic

Write a newspaper article about the conditions listed below and the impact they
- Sudden arrhythmic death syndrome (SADS)
- Blood pressure
- Hyperthermia/hypothermia

DAILY SPORTS SCIEN

The Role of ATP in Exercise: Take Note

1. Read the passage about ATP below and highlight any information which you

Adenosine triphosphate, more commonly known as ATP is the key source
for this reason that ATP is referred to as life's energy currency and it is st
consists of an adenosine and three phosphates, and when broken down
needed when exercising.

The breakdown and resynthesis of ATP is impo t understand as it a
energy that can be used for muscular con rac . t is particularly impor
of ATP that is stored within th u which highlights the necessity of

It is importan and the equations of ATP breakdown and resyn

ATP down equation:

ATP = ADP + P + Energy

This breakdown of ATP, via the enzyme ATPase, produces the products w
to be provided to the working muscle and muscular contraction.

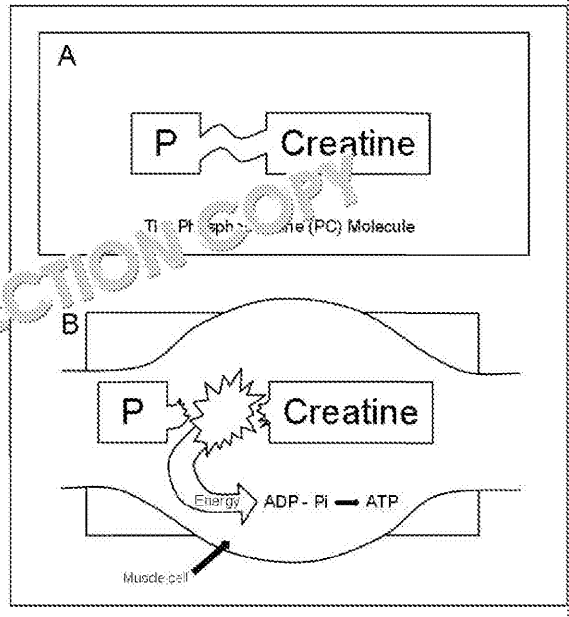
To resynthesise ATP, energy is required. This occurs as a result of part of
involves the breakdown of phosphocreatine (PC). The enzyme creatine k
causes the release of energy. This energy is is the energy used in ATP res

PC = P + C + Energy

This energy is used in the reaction shown by the equation below to resyn
(the breakdown of PC and the resynthesis of ATP) work together, hence

ATP resynthesis equation:

Energy + ADP + P = ATP



The coupled reaction of PC breakdown and ATP resyn

2. Now fill in the revision cards below with important information from the passa

Keep the information on these cards very brief as they should be used to jog
provide all of the information!

3. Finally, create your own fact file about ATP using the information you read o
information that you know.

It is important that you do this from memory, so do not look back at the pas

The Energy Systems: Filling in the Gaps

1. Read and complete the missing sections of the overview of the energy syste

The Energy Systems

ATP-PC

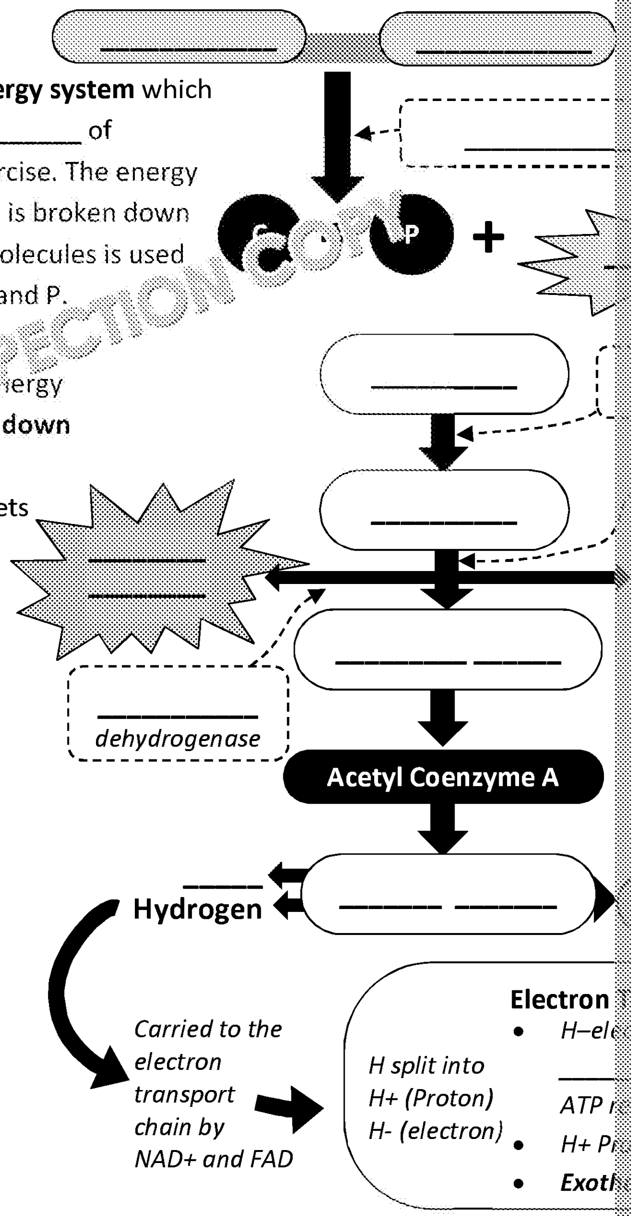
This is an ______________ **energy system** which **provides energy for** ______________ of _______ - _____________ exercise. The energy released when __________ (PC) is broken down into phosphate and creatine molecules is used to resynthesise ATP from ADP and P.

Glycolytic System

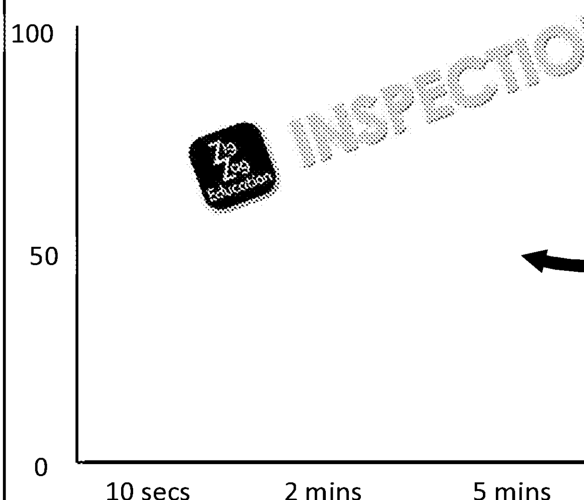
This energy system produces energy in the form of ATP by **breaking down glucose into** ______________ ______________ which then gets converted into the **by-product** ______________________ when oxygen is not available.

Aerobic System

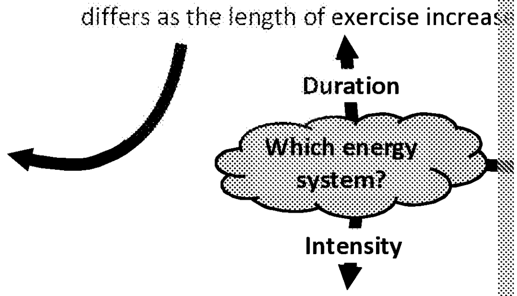
If oxygen is available, the __________ __________ produced through glycolysis is **converted to** __________ __________ A and **enters the** __________ __________ where ATP and hydrogen are produced. The hydrogen then enters the __________ __________ __________.



ATP resynthesis during exercise of differ



Draw a graph to the left of the energy continuum, demonstrating how the predominant energy system being used differs as the length of exercise increas



Low intensity: __________

High intensity: __________

Very high intensity: __________

2. Now complete the summary table, without viewing the previous page.

	ATP-PC System	Glycolytic System
Type of reaction		
Chemical/fuel used		
Controlling enzyme		
ATP yield		
By-products		

Adaptations of the Energy System to Exercise: Speed Da

Teacher's instructions:
Split the class up into pairs and get them to find a seat with their partner sat opp
and cut out the cards below and place them randomly on different tables next to

Students should then spend five minutes discussing the impacts of adaptations o
exercise and sports performance prompted by the card that is in front of them.

As students discuss they should make notes on their worksheets.

After five minutes ring a bell or ask students to now fi er partner, they sh
that is in front of them and then discuss this. Rep at ity, until all students ha
cards.

ATP-PC

Lac

Aerobic energy system

D

Red city of the lact system in children

Student's instructions:
You will be taking part in a speed dating game where you will discuss the adapta
exercise and performance.

For each adaptation you could discuss:

- How is it a useful adaptation?
- Why does this adaptation occur?
- How is this adaptation affected by the type of exercise?

Use the worksheet provided to take notes on your discussion.

Complete notes on all of the impacts of adaptations belo

	Your notes
ATP-P	
Lactate system	
Aerobic energy system	
Diabetes	
Lack of a lactate system in children	

Answers

Activity 1 — Structure of Skeletal System: Locate the Bone

1–4.

Bone		Location	Type
Cranium		The skull	Fla
Clavicle		Collarbone	Sho
Ribs		Ribs	Fla
Sternum		At the centre of the ribs	Fla
Scapula		The shoulder blade	Fla
Humerus		Between the elbow and shoulder	Lon
Radius		Between the elbow and th[illegible] of the wrist	Lon
Ulna		Between the elb[illegible] little finger side of the wrist	Lon
Carpals		The ba[illegible] the wrist	Sho
Metacarpals		A[illegible] carpals	Sho
Pha[illegible]		[illegible]bove the metacarpals (finger tips/ toes)	Lon
P[illegible]		Hip	Fla
Vertebral column:	Cervical	Vertebrae directly under the skull	Irregu
	Thoracic	Between the cervical and lumbar vertebrae	Irregu
	Lumbar	Five vertebrae between the ribs and pelvis	Irregu
	Sacrum	Between the lumbar vertebrae and coccyx	Irregu
	Coccyx	The lowest section of the vertebral column	Irregu
Femur		Thigh bone	Lon
Patella		Knee cap	Sesan
Tibia		The larger shin bone, between the ankle and the patella	Lon
Fibula		Alongside the tibia	Lon
Tarsals		At the top of the foot, closest to the ankle	Sho
Metatarsals		Attached to the tarsals in the middle of the foot	Sho

5. Students could provide examples similar to below:
   - The cranium is used when heading a football.
   - The ribs are used when protecting vital organs during a rugby tackle.
   - The humerus is used when lifting a dumbbell.
   - The radius is used when putting spin on a tennis shot.

6. a) Scoliosis
   b) Neutral
   c) Kyphosis

7. Osteoclasts:
   - These are cells within the human [illegible]
   - Bone tissue becomes dam[illegible] repeated loading when exercising.
   - They perform th[illegible] breaking down damaged bone tissue.
   - Thi[illegible]ys [illegible]e to be laid down in order for the bone to become strong[illegible]

   Osteobl[illegible]
   - These are cells within the human body.
   - They replace damaged bone tissue with new healthy bone tissue.
   - This process allows bones to become stronger.
   - This process allows bones to adapt to the loads that they are placed under.

   Epiphyseal plate:
   - This is a growth plate.
   - It is found at the end of bones.
   - It stimulates growth in children when the cells are broken down by osteoclasts osteoblasts.

Activity 2 — Function of Skeletal System: Unscramble

1-2.
- *Protection*: The skeleton provides protection for internal organs such as the br
- *Leverage*: The skeleton provides a leverage system for muscles to move as the
- *Weight Bearing*: The skeleton allows us to hold our body weight in position.
- *Blood cell production:* The bone marrow of bones is responsible for the produc
- *Store of minerals*: The bones store minerals and ions such as calcium.
- *Reduce friction*: Bone ends contain cartilage which reduces the friction of a joi
- *Supporting framework:* The skeleton provides a framework that gives us our sh
- *Muscle attachment*: The skeleton provides a site for skeletal muscle attachme
occur.

3. **Sesamoid**
Function: They reduce the friction at a joint and a[illegible] joint movement.
Any appropriate example, e.g. Patella

4.
- *Long*: provide lever[illegible] are responsible for blood cell production
Any appropriate example, e.g. tibia
- *Sh*[illegible] oc[illegible]ed with weight bearing
An[illegible]priate example, e.g. carpals
- *Flat:* provide protection for internal organs
Any appropriate example, e.g. scapula
- *Irregular:* varied functions including protection
Any appropriate example, e.g. vertebrae

5. Any appropriate explanations such as:
- It supports the frame of the body in order to stay upright when running.
- It provides protection in order to avoid injury when playing contact sports like
- It provides a site for muscle attachment which allows athletes to produce mov
turning the pedals on a bike.
- It provides leverage which allows weight lifters to move heavy loads.
- It provides weight bearing which allows runners to support their body when ru
the load of their body and the weight that they are lifting.
- It reduces the friction at a joint which reduces the chance of injury when perfo
running and cycling.

Activity 3 — Joints: Joint Research

1-2.

Upper body joints	Classification
1. Shoulder	Synovial
2. Elbow	Synovial
3. Wrist	S[illegible]
4. Cervical verteb[illegible]	Synovial
5. Thoracic vertebrae	Cartilaginous

Lower body j[illegible]
1. Hip
2. Knee
3. Ankle
4. Lumbar ver[illegible]
5. Sacral verte[illegible]
6. Coccygeal vertebrae

3. Shoulder joint:
   - Type of joint: ball and socket joint
   - Bones making up the joint: clavicle, scapula and humerus
   - Range of movement: large range of movements including rotation, extension, flexion, abduction and adduction.

   Knee joint:
   - Type of joint: hinge joint
   - Bones making up the joint: femur, tibia and patella
   - Range of movement: limited to only one plane therefore only permitting exten

   Wrist joint:
   - Type of joint: condyloid joint
   - Bones making up the joint: radius, ulna and carpals
   - Range of movement: movement in two planes i[illegible]g .oduction, flexion an

   Cervical vertebrae:
   - Type of joint: pivot joint
   - Bones making up th[illegible]rvical vertebrae
   - Rang[illegible] only permits rotational movement

   Thumb
   - Typ[illegible]oint: saddle joint
   - Bones making up the joint: carpals and metacarpals
   - Range of movement: movement in two planes including abduction, adduction circumduction

   Intercarpal and intertarsal joints:
   - Type of joint: gliding joint
   - Bones making up the joint: carpals and tarsals
   - Range of movement: large range of movements including rotation, extension a

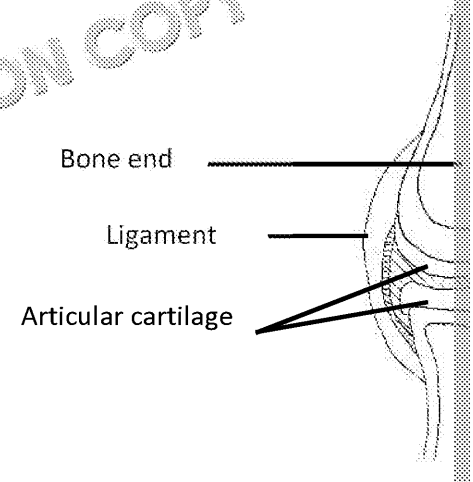
   Hip:
   - Type of joint: ball and socket
   - Bones making up the joint: pelvis and femur
   - Range of movement: large range of movements including rotation, extension, flexion, abduction and adduction.

   Ankle:
   - Type of joint: hinge
   - Bones making up the joint: talus, tibia and fibula
   - Range of movement: plantarflexion, dorsiflexion

Activity 4 — Structure of the Joints: Construction

The following structures should be included:

✓ Bursa
✓ Joint capsule
✓ Synovial membrane
✓ Synovial fluid
✓ Ligaments
✓ Articular cartilage
✓ Bone ends
✓ Tendon



Suggested equipment:
- Cardboard tubes – bone ends
- Elastic bands – tendons
- Thin string – synovial membrane
- Thick string – joint capsule
- Newspaper – synovial fluid
- Sticky tape – ligaments
- Bottle top – bursae
- Paper – articular cartilage

Activity 5 — Responses and Adaptations of the Skeletal System to Exercise: Healt

Students' notes should include the following information plus any other relevant inform
Case 1:

- Osteoporosis is a loss of bone mass.
- Bones become weak and easily damaged.
- Greatly affects the elderly population.
- Can be the result of a lack of loading, e.g. due to leading a sedentary lifestyle.
- Exercise can reduce the impact of osteoporosis.
- Weight-bearing exercise has a positive impact on the skeletal system.
- Weight-bearing exercise includes resistance exercise and body weight exercises.
- Weight-bearing exercise leads to increased mineral uptake in the bones.
- Minerals are required to build bone material.

Case 2:

- Cartilage at the joints becomes
- This leads to weak joi
- Movem th become painful.
- Exercis duce the impact of arthritis.
- Exercise proves joint stability (due to increased tendon and ligament strength).
- Exercise improves joint flexibility.
- Exercise can control weight which reduces the impact on the joints.

Case 3:

- It is normally recommended to avoid resistance exercise at a young age.
- It will put pressure on growth plates.
- It is associated with stunted bone growth.
- It can damage tendons, ligaments and cartilage.
- Young children should perform body weight exercises and other weight-bearing for which will improve bone strength, ligament strength and tendon strength without s

Activity 6 — Characteristics and Functions of Different Types of Muscles: Questio

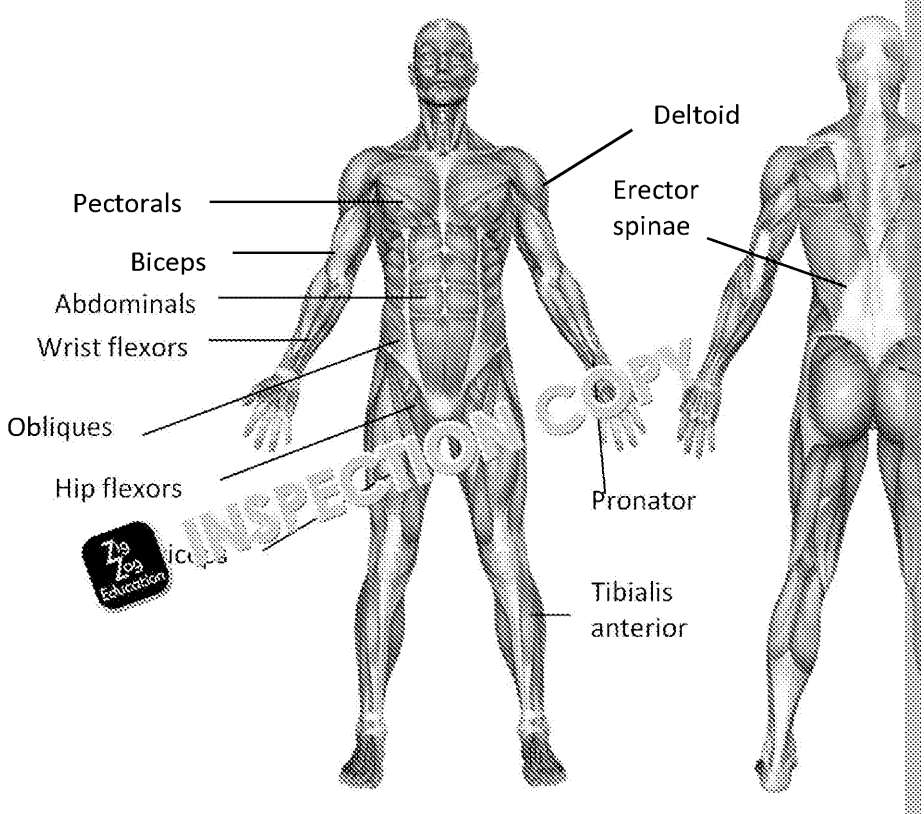
1. i) Cardiac muscle
   ii) Smooth muscle
   iii) Skeletal muscle

2. i) Involuntary, under subconscious control, fatigue resistant, abundant blood su mitochondria
   ii) Involuntary, under subconscious control, can fatigue, rhythmic contractions
   iii) Under conscious control, easily fatigued, different types of muscle fibres for d

3. i) Cardiac muscle is responsible for pumping blood arc e heart and out of t the lungs where it can accept oxygen and to vc ng muscles where it can products such as carbon dioxide.
   ii) Smooth muscle within the is able to contract and relax during va allows the amount ng transported to certain areas of the body to meet e d exercise, i.e. the blood vessels supplying the working mu
   iii) Sk uscle is responsible for movement during physical activity. By contra mo body by pulling the limbs at a joint.

Activity 7 — Major Skeletal Muscles of the Muscular system: Label up

1.



3. Students could use movements such as:

Skill/Action	Muscles
Rugby conversion	Hamstrings, quadriceps, hip flexors, abdominals, tibialis
Tennis forehand	Abdominals, deltoids, biceps, triceps, supinators, prona
Sit-up	Abdominals, obliques, erector spinae, latissimus dorsi
Basketball shot	Biceps, triceps, trapezius, deltoids, pectorals
100 m sprint start	Soleus, tibialis anterior, quadriceps, hamstrings, gluteals

Activity 8 — Antagonistic Muscle Pairs: Analyse the Images

1. Students should provide an accurate definition for each type of contraction withou
movement, no, shorten, increase and opposite). Example answers are given below:
   - **Agonist** – This is responsible for producing movement when it pulls two bones
   - **Antagonist** – This is responsible for controlling the movement of the agonist b
   - **Synergist** – This works in unison with the prime mover to produce a movemer
   - **Fixator** – This provides control to the movement by supporting the attachmen
   - **Isometric** – This is a muscular contraction which occurs without the distance b
   changing.
   - **Concentric** – This is a muscular contraction which results in a reduction in the
   distal attachment of the muscle.
   - **Eccentric** – This is a muscular contraction which resu a greater distance b
   attachment of the muscle.

2. Students should provide an acc ion for each type of contraction. Examp
   - **Agonist** – This m ts and shortens to produce movement at a joint
   - **Ant ist** – uscle relaxes and lengthens to oppose the desired movem
   - **Sy** – his is a muscle that assists the movement produced by the agonis
   - **Fix** This muscle stabilises the origin of the agonist allowing it to function
   - **Isometric** – This is a muscular contraction which results in no change in the le
   - **Concentric** – This is a muscular contraction which results in the length of the m
   - **Eccentric** – This is a muscular contraction which results in the length of the mu

3. a) **Agonist**: Latissimus dorsi
   Antagonist: Pectorals/Deltoids
   Synergist: Biceps
   Fixator: Triceps
   Type of muscle contraction: Concentric

   b) **Agonist**: Biceps
   Antagonist: Biceps
   Synergist: Brachialis
   Fixator: Rotator cuff muscles
   Type of muscle contraction: Eccentric

   c) **Agonist**: Hamstrings
   Antagonist: Quadriceps
   Synergist: Hip abductors
   Fixator: Gluteus maximus
   Type of muscle contraction: Concentric

   d) **Agonist**: Triceps
   Antagonist: Biceps
   Synergist: Pectorals
   Fixator: Latissimus dorsi
   Type of muscle contraction: C m

   e) **Agonist**: Delto
   A st. mus dorsi
   Sy Biceps
   Fix: Rotator cuff muscles
   Type of muscle contraction: Isometric

Activity 9 — Skeletal Muscle Contraction: Tick the Twitch

1. a) **Type I**
Explanation: This muscle fibre type has a high aerobic capacity so would be th
long-duration, low intensity exercise such as long-distance swimming.

b) **Type IIx**
Explanation: This muscle fibre type has a good anaerobic capacity and would t
type used during explosive, high intensity exercise such as sprinting.

c) **Type IIa**
Explanation: This muscle fibre can use either aerobic or anaerobic metabolism
therefore be the predominant muscle fibre used duri oderate intensity ex
running.

2.

Slow Twitch Fibres – Type I	Fast Oxidative Glycolytic Fibres – Type IIa	
• L ime to contract • Hi xidative capacity • Long time to fatigue • Low glycolytic capacity • Suited for aerobic/endurance activities • Small stores of phosphocreatine and glycogen stores • High capillary density • Low production of force • Contain large amounts of myoglobin • Red in colour • High concentration of mitochondria	• Quick time to contract • High oxidative capacity • Short time to fatigue • High glycolytic capacity • Suited for activities which require powerful movements • Medium stores of phosphocreatine and glycogen stores • Medium capillary density • High production of force • Contain medium amounts of myoglobin • Red in colour • High concentration of mitochondria	•

3.
- The 'all or none' law of muscle contraction describes how if a motor unit is sti
activation, then all of the muscle fibres contained within that motor unit will c
- This influences the way that muscle fibres are recruited during varying intensit
fibres can't alter how powerfully they contract and instead either contract or r
- Therefore in order to generate more muscle power when increasing exercise i
more motor units and their associated fibres are recruited.
- This means during low intensity exercises such as walking only a small proport
muscle will be recruited compared to during high intensity exercise, such as sp
muscle fibres are recruited

Activity 10 — Responses and Adaptations of the Muscular System to Exercise: Br

Brainstorm to include the following points:
Response to single exercise session:

- Greater blood supply to the muscles
- Higher muscle temperature
- Greater muscle pliability
- Lactate production during high intensity exercise
- Microtears as a result of resistance exercise

Adaptations as a result of exercise:

- Muscle hypertrophy
- Greater tendon strength
- Greater myoglobin stores
- Greater number of mitochondria
- Increased mitochondria size
- Greater glycogen sto
- Greater
- Greate tolerance

Additional factors that can affect the muscular system:

- Greater loss of muscle mass as a result of ageing
- Sustained maximal muscular contractions as a result of cramp

Exam style questions:

1. Award a maximum of **three** marks for explaining the effect that exercise can have o
   Movement of the body can increase the blood supply to the muscles (1) which will
   temperatures (1). This will increase the pliability of the muscles (1).
   Accept other appropriate responses.

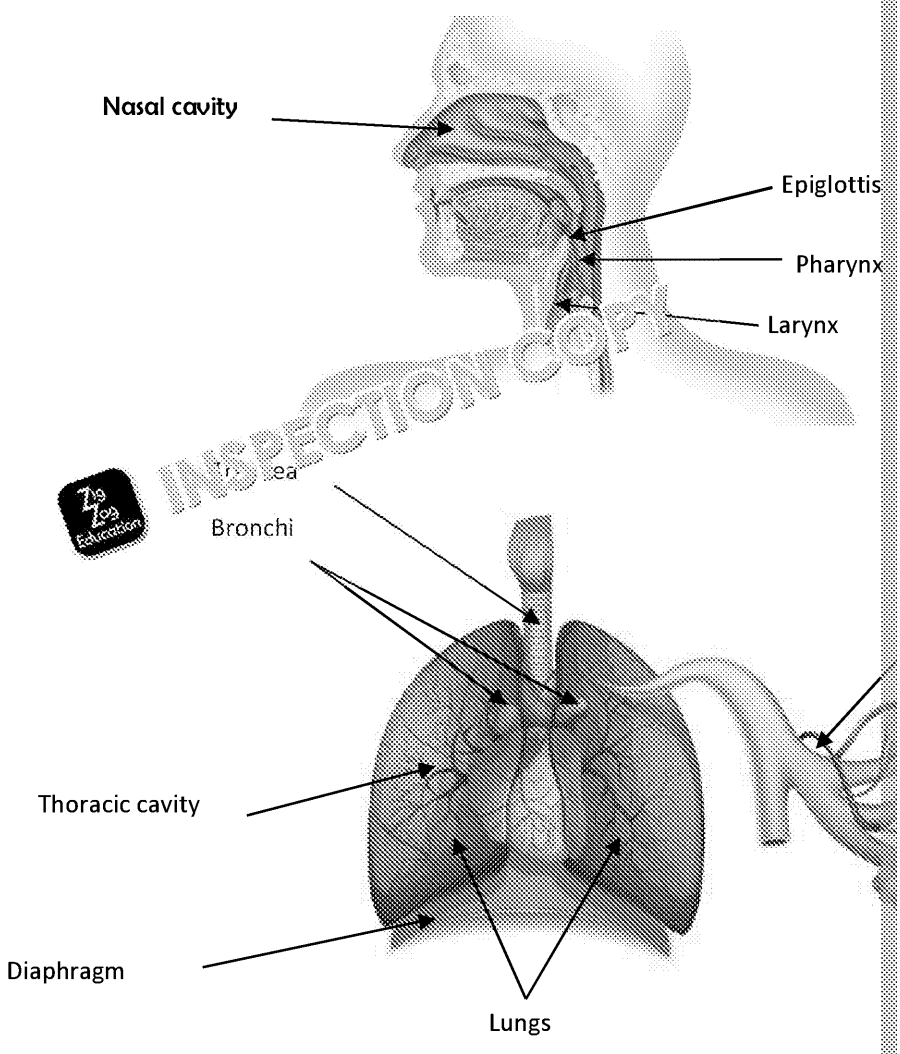
2. a) Award a maximum of **two** marks for explaining how resistance training leads t
   Forceful muscular contractions lead to microtears within the muscle (1) which
   strength (1).

   b) Award a maximum of **four** marks for explaining how resistance training can im
   It results in hypertrophy (1) which leads to a greater force of contraction. It al
   size of the mitochondria (1), increased myoglobin stores (1) and increased tol
   increase muscular endurance.

3. Award a maximum of **four** marks for explaining how the muscular system can be ne
   Ageing can reduce muscular functioning (1) due to a loss of muscle mass which is a
   Cramps can reduce muscular functioning (1) due to a sustain contraction which pre
   intended function (1).

Activity 11 — Structure of the Respiratory System: Draw and Cut

1. Students' images may vary, but should include the following components drawn an



2.

	Inspiration		
1.	The external intercostal muscles and diaphragm contract	1.	The external inte relax
2.	The ribs move upwards and outwards, and the diaphragm flattens	2.	The ribs move in diaphragm move
3.	The thoracic cavity increases in volume	3.	The thoracic cav
4.	The lungs' air pressure is lower than that of the atmospheric air	4.	The lungs' air pr atmospheric air
5.	Air enters the lungs	5.	Air leaves the lu

i) The forcefulness of inspiration and expiration is increased.
ii) The [illegible] deltoid and the pectoralis minor contract in order to further
iii) The [illegible]al intercostal muscles and the rectus abdominis contract in order to

3. a) False – Gas moves from areas of high concentration to areas of low concentra
   b) True
   c) False – Carbon dioxide can be transported by haemoglobin.
   d) True
   e) False – The larger the surface area of the alveoli, the more gas can be exchang
   f) False – The alveoli are found within the lungs.
   g) True
   h) True
   i) False – The human body has a short diffusion pathway for oxygen and other g
   j) False – When oxygen combines with haemoglobin it forms oxyhaemoglobin.

Activity 12 — Lung Volumes: Practical

What is tidal volume?
The amount of air breathed in and out during a normal breath

How did tidal volume change during exercise?
It increased

What is vital capacity?
The upper limit of air that can be breathed out after breathing in as much air as possible

How did vital capacity change during exercise?
It was unchanged

What is residual volume?
The amount of air left in the lungs after maximal expiration

How did residual volume change during exercise?
It was unchanged

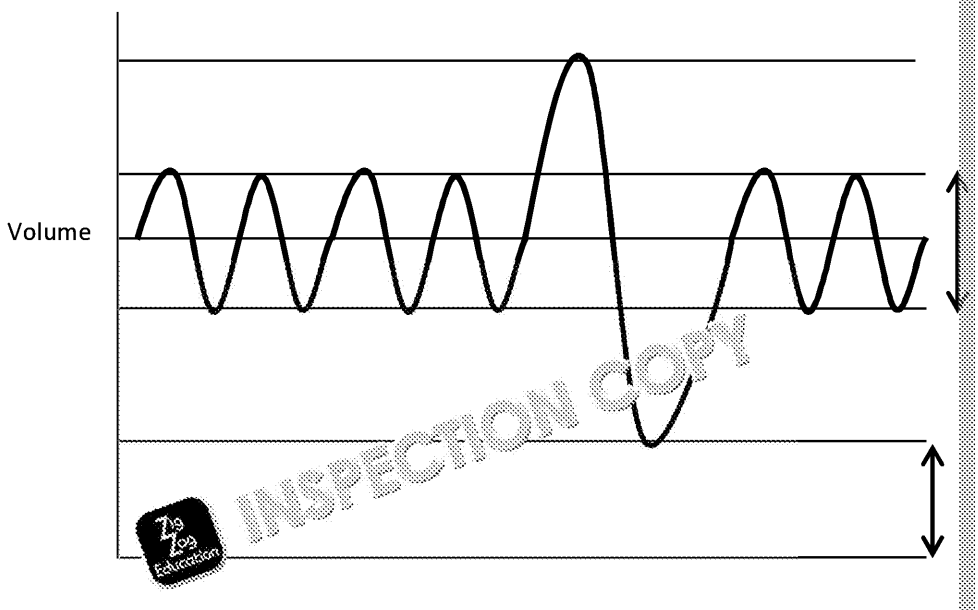
What is total lung volume?
The maximum amount of air that can be taken into the lungs

How did total lung volume change during exercise?
It is unchanged

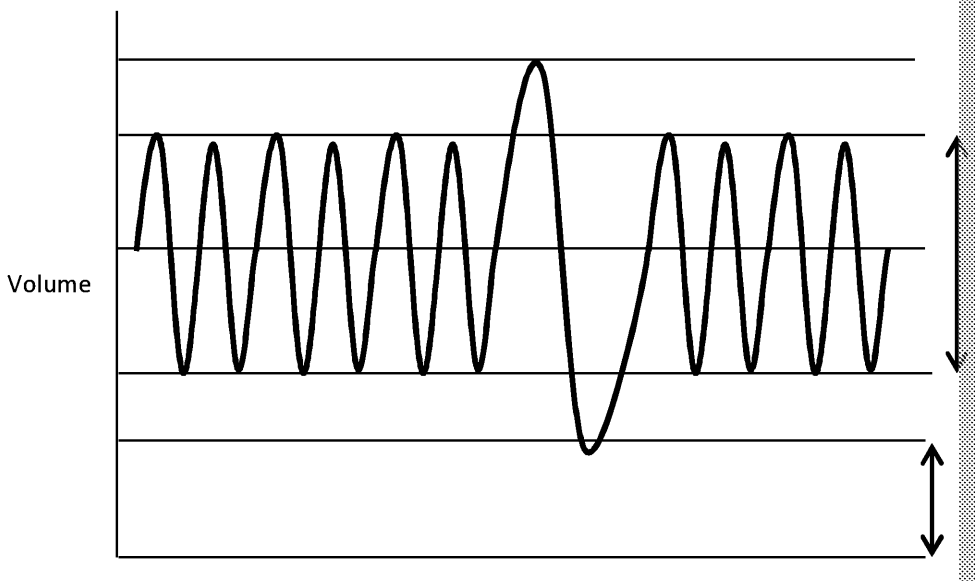
What is pulmonary ventilation?
The process of inspiration and expiration

How did pulmonary ventilation change during exercise?
The depth and rate of pulmonary ventilation is increased

Students should provide a spirometer trace similar to below for rest:



Students should provide a spirometer trace similar to below for during exercise:



Activity 13 — Control of Breathing: Partner's Idea

1. Below is an example of the appropriate keywords that could be provided.
   Neural control:
   - Medulla oblongata
   - Brain
   - Respiratory centre
   - Expiratory
   - IC
   - EC
   - Breathing
   - Oxygen
   - Blood
   - Partial pressure
   - Respiratory muscles
   - Rate
   - Impulse
   - Increase
   - Diaphragm

Chemical control:

- Chemoreceptors
- Blood
- Carbon dioxide
- Concentration
- pH
- Acidity
- Medulla oblongata
- Brain
- Partial pressure
- Oxygen
- Breathing rate
- Increase
- Depth

2. Below is an example of the paragraph that could be created from the key words pr

Neural control:
The res control centres, inspiratory and expiratory control centres, or ICC/E oblonga pond to changes in the partial pressure of oxygen in the blood. They s increase the rate of breathing by carrying an impulse to the diaphragm to affect the

Chemical control:
The chemical regulation of breathing is controlled via the chemoreceptors, found ir receptor detects changes in blood pH levels. This change is a result of an increased the blood. As this increase in carbon dioxide reduces the partial pressure of oxygen increase in breathing rate and depth to increase the partial pressure of oxygen.

Activity 14 — Responses and Adaptations of the Respiratory System to Exercise: D

Students to draw an accurate representation of the following points and offer a similar e
Response of the respiratory system to exercise:

- Breathing rate increases – the number of breaths in a minute increases in order to s more oxygen and remove the carbon dioxide that is being produced at the muscles
- Tidal volume increases – the amount of air breathed in and out with each inhalatio supply the working muscles with more oxygen and remove the carbon dioxide that

Adaptations to the respiratory system as a result of exercise:

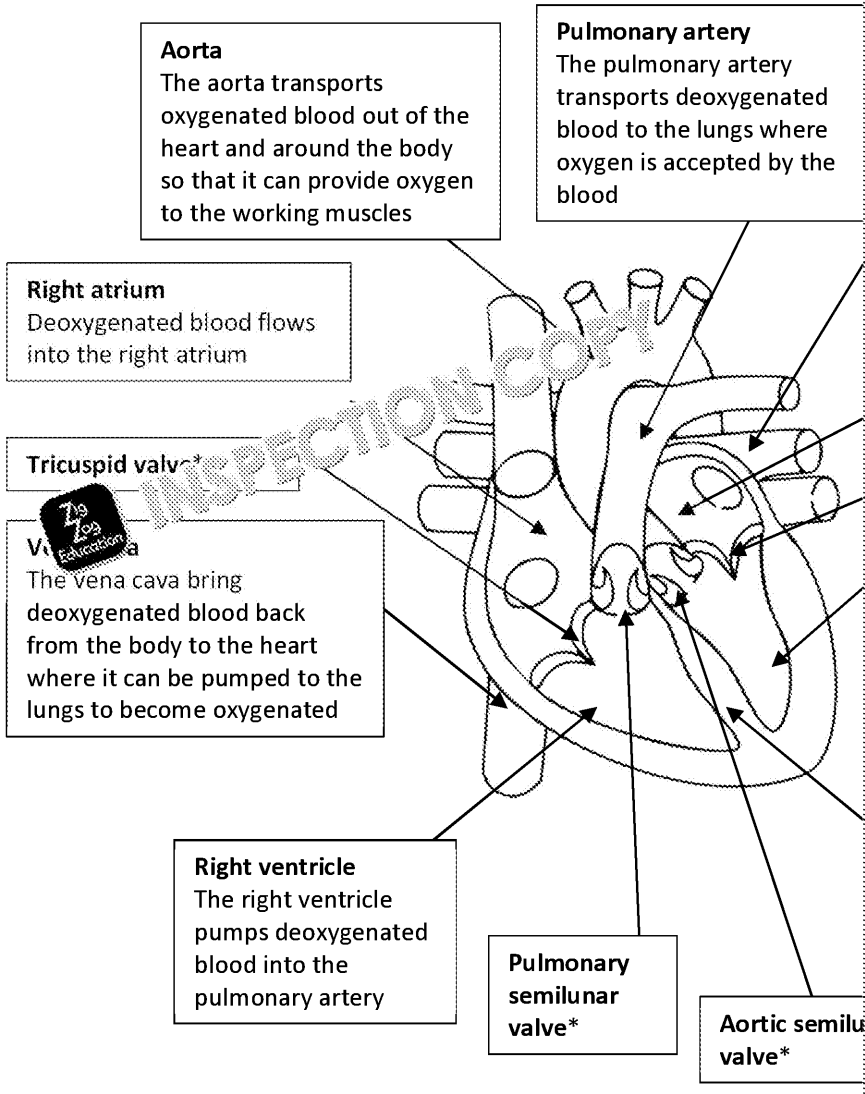
- Vital capacity increases – Physical activity exercises the respiratory system and lead force production in the intercostal muscles which allows more air to be expelled aft
- The respiratory muscles can contract with more force – The respiratory muscles ca fact that they are being used more frequently and need to meet greater oxygen de them adapting to meet this demand.
- The rate of diffusion of oxygen and carbon dioxid e s – he density of alveol ends of the arteries increases with regular e which increases the total surface to diffuse across.

Other factors affecting the respiratory system:

- Asthm is a constriction of the airways due to swelling which makes it difficu triggere vironmental causes and exercise. It will reduce the level of exercise the athlete to stop exercising if they cannot control it with an inhaler.
- Exercise at altitude – The partial pressure of oxygen is lower at altitude. This makes gradient between the lungs and the outside environment will be lower than at sea system must work harder when exercising at altitude which would reduce exercise

Activity 15 — Structure of the Cardiovascular System: Annotate

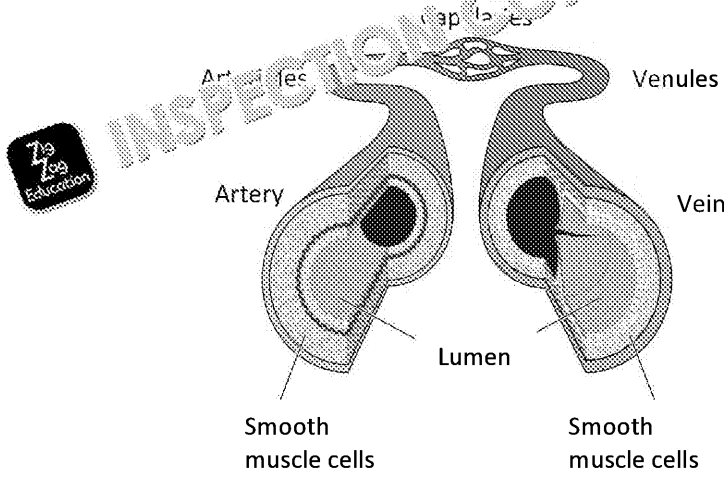
1. i)



Valves* – Prevent blood from flowing backwards and, therefore, ensure bloo
correct direction

ii) Coronary arteries supply the heart with blood. The cardiac muscle requires ox
any other muscle of the body.

2. Students should correctly identify the blood vessels and d the characteristics



Blood Vessel	Size/Diameter of Lumen	Wall Thickness
Arteries	The diameter of the arteries is smaller to ensure that blood pressure is elevated.	The walls of the arteries are thicker than v order to withstand the high blood pressu ensures that blood can be pumped aroun The walls also allow vasodilation (widenin vasoconstriction (narrowing) to occur in c redistribute the blood flow during exercis
Arterioles	The diameter of the arterioles is smaller than that of the arteries.	The walls of the arterioles are very thin to that oxygen and carbon dioxide can easily of them and into the capillaries.
Capillaries	The capillaries have a large surface a order t or gaseous change.	The wa capillaries are very thin te xygen and carbon dioxide can easily nto and out of the blood vessel. The wall vasodilation (widening) and vasoconstrict (narrowing) to occur in order to redistribu blood flow during exercise.
Venules	Venules are the blood vessels with the smallest lumen diameter	The walls of the venules are very thin to e oxygen and carbon dioxide can easily diff them from the capillaries.
Veins	Veins have larger diameters as they are required to carry a greater volume of blood than the arteries.	The walls of the veins are smaller than the as blood does not need to be under highe pressure in these blood vessels.

3. Students should correctly match up the annotations to the following blood cells:

Red blood cells:
- Responsible for oxygen delivery
- Contain haemoglobin
- They account for 40–45% of total blood volume

White blood cells:
- They form part of the immune system
- They account for 1% of total blood volume
- They respond to infections

Platelets:
- Responsible for clotting the blood
- Important for preventing blood loss

Plasma:
- Accounts for 55 ot blood volume and is, therefore, the largest compone
- M ac or water
- Th blood cells are suspended in it

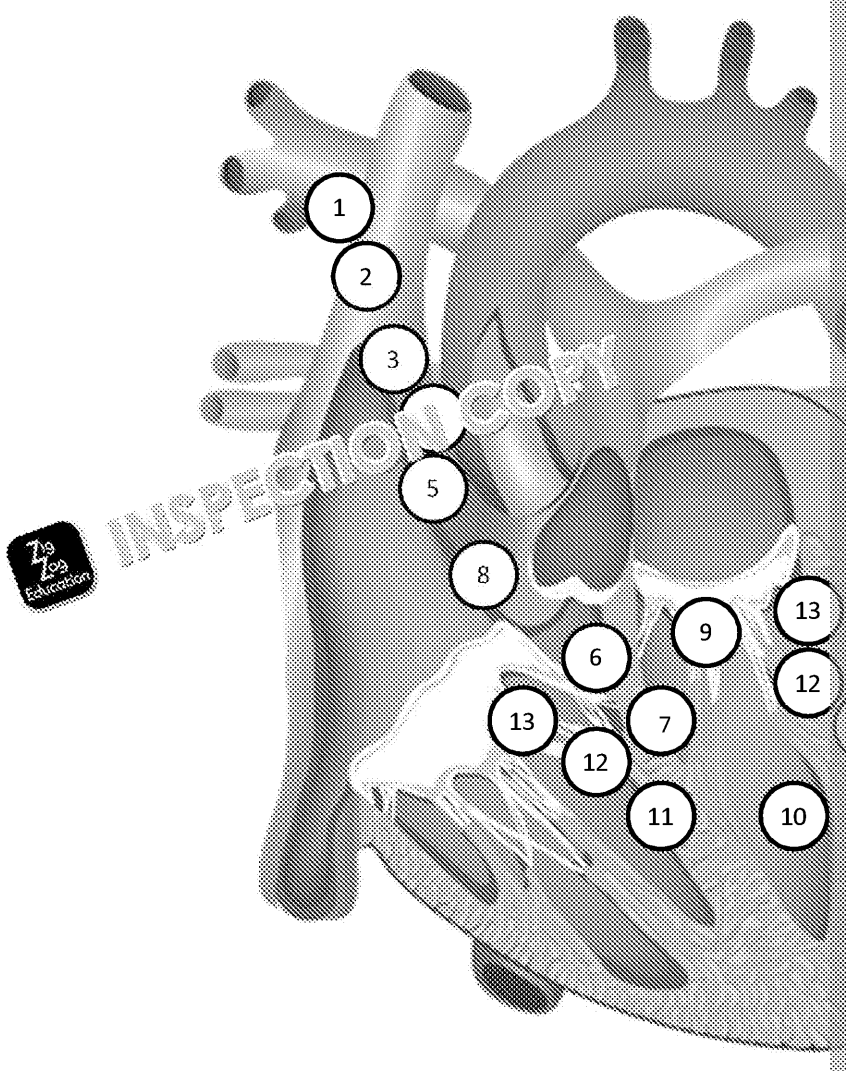
Activity 16 — Functions of the Cardiovascular System: Mind Map

Function	Explanation
Delivers oxygen and nutrients to the different body systems	The cardiovascular system pumps and transports blood aro oxygen and nutrients, such as glucose, that are needed for a
Thermoregulation	The arteries of the cardiovascular system can undergo vasoc to redistribute blood to different areas of the body. This mec thermoregulation to increase or decrease blood flow to the s
Removes waste products of metabolism	Waste products such as carbon dioxide and lactic acid are pr substances are toxic to the body if they accumulate and so a the cardiovascular system in order for excreted or broken
Fights infection	Blood contains white blood cells that function to fight infec response when injury. This helps the body to stay healt
Blood clotting	Our blood clots when we are cut in order to prevent excess proteins coagulation factors such as platelets and clotting p when we are cut.

Activity 17 — Nervous Control of the Heart: Order the Stages

1. Students should put the statements into the following order:
   1) The sino-atrial node (SAN) sends out an electrical stimulus.
   2) The electrical stimulus travels across the muscle cells in the atria.
   3) Atrial depolarisation occurs.
   4) The atria contract.
   5) The impulse travels to the atrioventricular node (AVN).
   6) The next contraction is delayed.
   7) The ventricles fully fill with blood.
   8) The AV valves close.
   9) The stimulus travels down the bundle of His.
   10) The stimulus passes into the left and right branches of the bundle of His which
   11) The electrical impulse is conducted to the ventricles.
   12) Ventricular depolarisation occurs.
   13) Ventricular contraction occurs.

2. Students should annotate the diagram of the heart in a similar way to below:



3. Students should provide points similar to those below:

Sympathetic:

- It is working when an athlete becomes aroused.
- It is responsible for the anticipatory rise.
- It increases the heart rate.
- It releases adrenaline.
- It releases noradrenaline.

Parasympathetic nervous system:

- It slows down the heart rate.
- It is working during the cool down after exercise.
- It releases acetylcholine.

Pre-exercise questions

1. Students can make the following points:
   - To increase blood flow to the lungs in order to oxygenate the blood
   - To increase oxygen supply to the working muscles
   - To remove carbon dioxide from the working muscles
   - To remove lactate from the blood

2. The following waste products are removed from the muscles:
   - Lactate
   - Carbon dioxide

3. Students can make the following points
   - The flow is diverted away from ce as.
   - Blood supply to the organ
   - The flow is divert ne working muscles.
   - It is te m the central areas by vasoconstriction.
   - It ed towards the working muscles by vasodilation.

Post-exercise questions

1 a) Cardiac output = stroke volume x heart rate

b)
- The sprinting exercise increased your heart rate, as the body required mor skeletal muscles for energy production.
- Stroke volume would have also increased as the heart pumps more force increased venous return.
- An increased heart rate and stroke volume would have caused your carc
- Therefore blood pressure would have also increased as more blood bein increased force being exerted on to their walls.

2.
- During exercise blood is redistributed to the skeletal muscles and skin as the a body undergo vasodilation.
- Blood flow is reduced to the areas of the body associated with digestion by ar
- Increased blood flow to the skin improves heat loss helping to maintain an op
- Sweating is another type of thermoregulation that occurs during exercise and evaporation.

3.
- Increased stroke volume at rest and during exercise
- Cardiac hypertrophy of the ventricle walls
- Decreased resting heart rate
- Capillarisation of skeletal muscle and alveoli
- Increased blood volume
- Lower resting blood pressure
- Reduced heart rate recovery time after exercise

Activity 19 — Additional Factors Affecting the Heart: Newspaper Article

The newspaper articles should include the following main points:

Sudden arrhythmic death syndrome (SADS):
- This is a sudden death caused by failure of the heart.
- The failure of the heart can occur either due to heart disease or without heart disea
- It is caused by the misfiring of electrical impulses which leads to the heart beating t carry out its function.
- Heart screening should be performed before undertaking unaccustomed strenuous a history of heart disease.
- Exercise can lead to SADS if the individual has a pre-existing heart condition.

High blood pressure:
- High blood pressure can be the result of lifestyle choices and can be caused by lead exercise.
- It puts the cardiovascular system under a lot of pressure and can lead to heart attac
- It is diagnosed as having a systolic blood pressure over 140mm Hg and a diastolic pr
- Regular exercise can reduce resting blood pressure levels.

Low blood pressure:
- Healthy individuals can have a low blood pressure and function well.
- It can be the result of leading an active lifestyle.
- It may lead to dizziness and fainting if it is extremely low.
- It is diagnosed as having a systolic blood pressure under 90mm Hg and a diastolic p

Hyperthermia:
- It is diagnosed as having a core body temperature which is above 37.5 °C .
- Exercising in hot conditions can lead to hyperthermia.
- Hyperthermia is an increase in the body's core temperature.
- The body's core temperature can rise as a result of an inability to cool the body dow (e.g. due to exercise) and a high environmental temperature.
- Hyperthermia puts a strain on the cardiovascular system.

Hypothermia:
- It is diagnosed as having a core body temperature which is below 35 °C.
- Exercising in cold conditions can lead to hypothermia.
- It leads to a reduced heart rate which in turn can lead to heart failure.

Activity 20 — The Role of ATP in Exercise: Take Note

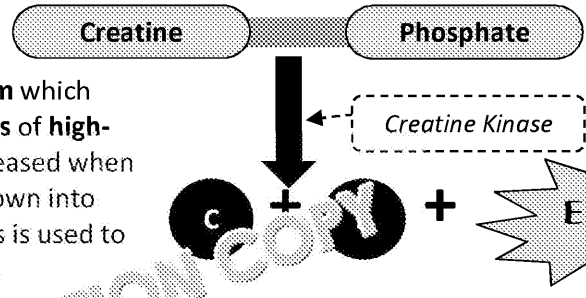
Students should:
- Highlight the important information in the passage provid
- Fill in the flash cards with relevant information fr m the passage.
- Create their own passage about ATP wh tains all of the important informatio

1. Students should complete the missing gaps:

The Energy Systems

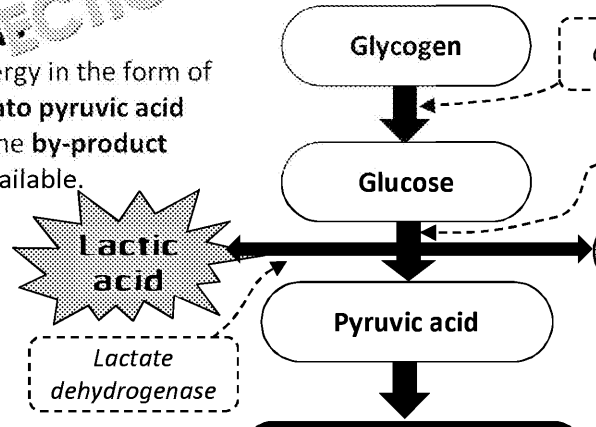
ATP-PC

This is an **anaerobic energy system** which **provides energy for 10-15 seconds** of **high-intensity** exercise. The energy released when phosphocreatine (PC) is broken down into phosphate and creatine molecules is used to resynthesise ATP from ADP and P.



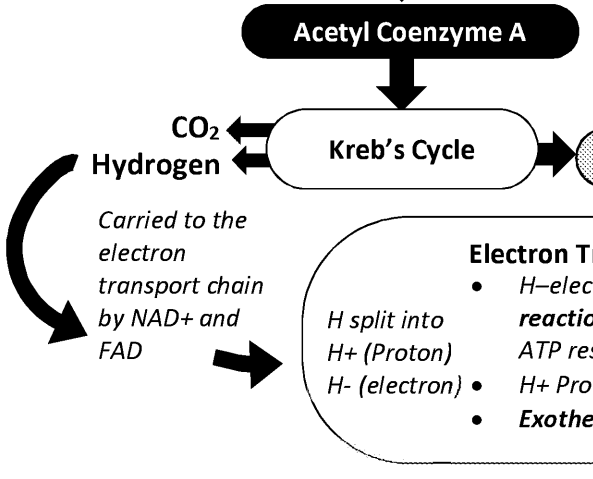
Glycolytic System

This energy system produces energy in the form of ATP by **breaking down glucose into pyruvic acid** which then gets converted into the **by-product lactic acid** when oxygen is not available.

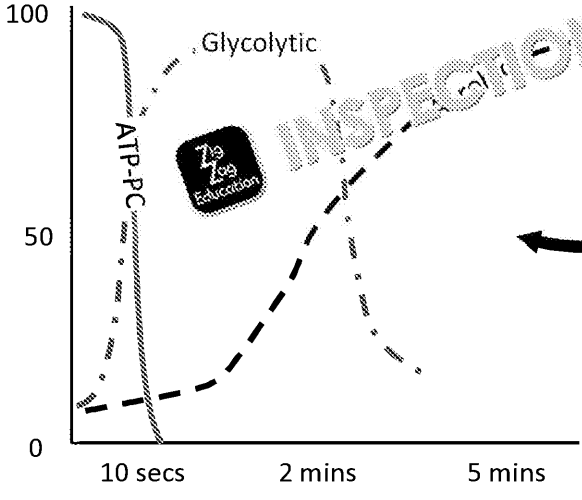


Aerobic System

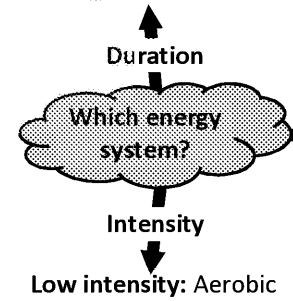
If oxygen is available, the **pyruvic acid** produced through glycolysis is **converted to aceytl coenzyme A** and **enters the Kreb's cycle** where ATP and hydrogen are produced. The hydrogen then enters the electron transport chain.



ATP resynthesis during exercise of differen



to the left is of the ene
ntinuum, demonstrating how t
predominant energy system being
differs as the length of exercise incr



Low intensity: Aerobic
High intensity: Glycolytic
Very high intensity: ATP-P

2.

	ATP-PC System	Glycolytic System
Type of reaction	Anaerobic	O_2 present (Aerobic) No O_2 present (Anaerobic)
Chemical /fuel used	Phosphocreatine (PC)	Glucose
Site	Sarcoplasm	Sarcoplasm
Controlling enzyme	Creatine kinase	Phosphofructokinase (PFK) Glycogen phosphorylase (GP) Lactate dehydrogenase (LDH)
ATP yield	1	2
By-products	ATP + Pi	NADH

Activity 22 — Adaptations of the [illegible] System to Exercise: Speed Dating

Students' discussions should include the following points

ATP-PC:

- Increased creatine stores
- Supports high intensity exercise
- Provides greater energy at the start of exercise
- Allows the athlete to sprint for longer at the beginning of exercise
- Increases recovery rates
- Faster restoration of ATP

Lactate system:

- Increases the body's tolerance to lactate
- Supports anaerobic performance
- Reduces the effects of fatigue during mixed intensity exercise, e.g. team sports
- Allows anaerobic exercise to continue for longer
- Allows exercise intensity to be maintained for longer
- Improved recovery from exercise

Aerobic energy system:

- Increased use of fats as an energy source
- Increased storage of glycogen
- Increased numbers of mitochondria
- Increased energy production within the muscle
- Improved blood supply to the muscles
- Improved oxygen supply to the muscles
- Greater duration of exercise can be maintained
- Greater intensity of exercise can be supported before working anaerobically

Diabetes:

- People suffering from diabetes are susceptible to hypoglycaemic attacks.
- Hypoglycaemia occurs when blood sugar levels are too low.
- Hypoglycaemia can occur after prolonged exercise.
- Hypoglycaemia can affect exercise capacity.
- Hypoglycaemia can affect skill performance.
- It can lead to loss of concentration.
- It can cause confusion.
- It can cause dizziness.
- It can result in fainting.

Lack of lactate system in children:

- Children's lactate system is not fully developed.
- This can reduce their ability to work anaerobically.
- Children should therefore focus on aerobic exercise.
- Anaerobic exercise will lead to a large build-up of lactic acid.
- The ability to remove lactic acid is reduced in children.
- Anaerobic exercise will have a greater fatiguing effect on children.