my revision notes

AQA A-level

PE

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Get the most from this book

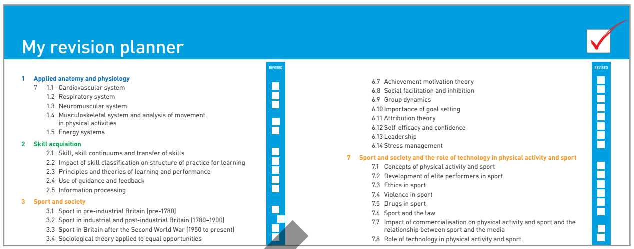
Everyone has to decide his or her own revision strategy, but it is essential to review your work, learn it and test your understanding. These Revision Notes will help you to do that in a planned way, topic by topic. Use this book as the cornerstone of your revision and don't hesitate to write in it – personalise your notes and check your progress by ticking off each section as you revise.

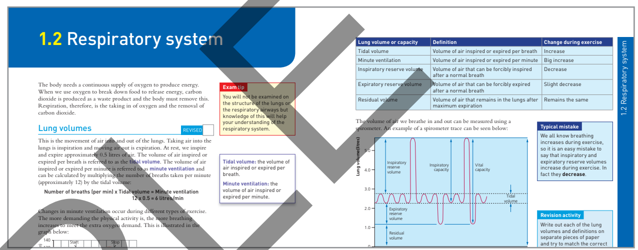
Tick to track your progress

Use the revision planner on pages 4 and 5 to plan your revision, topic by topic. Tick each box when you have:

- revised and understood a topic
- tested yourself
- practised the exam questions and gone online to check your answers and complete the quick quizzes.

You can also keep track of your revision by ticking off each topic heading in the book. You may find it helpful to add your own notes as you work through each topic.


My revision planner


1.2 Respiratory system

Features to help you succeed

Exam tips

Expert tips are given throughout the book to help you polish your exam technique and maximise your chances in the exam.

Typical mistakes

The author identifies the typical mistakes candidates make and explains how you can avoid them.

Now test yourself

These short, knowledge-based questions provide the first step in testing your learning. Answers are online.

Definitions and key words

Clear, concise definitions of essential key terms are provided where they first appear.

Key words from the specification are highlighted in bold throughout the book.

Revision activities

These activities will help you to understand each topic in an interactive way.

Exam practice

Practice exam questions are provided for each topic. Use them to consolidate your revision and practise your exam skills.

Summaries

The summaries provide a quick-check bullet list for each topic.

Online

Go online to check your answers to the exam questions and try out the extra quick quizzes at **www.hoddereducation.co.uk/myrevisionnotes**

My revision planner

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Countdown to my exams

6–8 weeks to go

- Start by looking at the specification — make sure you know exactly what material you need to revise and the style of the exam. Use the revision planner on pages 4 and 5 to familiarise yourself with the topics.
- Organise your notes, making sure you have covered everything on the specification. The revision planner will help you to group your notes into topics.
- Work out a realistic revision plan that will allow you time for relaxation. Set aside days and times for all the subjects that you need to study, and stick to your timetable.
- Set yourself sensible targets. Break your revision down into focused sessions of around 40 minutes, divided by breaks. These Revision Notes organise the basic facts into short, memorable sections to make revising easier.

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2–6 weeks to go

- Read through the relevant sections of this book and refer to the exam tips, exam summaries, typical mistakes and key terms. Tick off the topics as you feel confident about them. Highlight those topics you find difficult and look at them again in detail.
- Test your understanding of each topic by working through the 'Now test yourself' questions in the book. Check your answers online.
- Make a note of any problem areas as you revise, and ask your teacher to go over these in class.
- Look at exemplar papers. They are one of the best ways to revise and practise your exam skills. Write or prepare planned answers to the exam practice questions provided in this book. Check your answers online and try out the extra quick quizzes at **www.hoddereducation.co.uk/myrevisionnotes**
- Use the revision activities provided in the book to try out different revision methods. For example, you can make notes using mind maps, spider diagrams or flash cards.
- Track your progress using the revision planner and give yourself a reward when you have achieved your target.

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One week to go

- Try to fit in at least one more timed practice of an entire past paper and seek feedback from your teacher, comparing your work closely with the mark scheme.
- Check the revision planner to make sure you haven't missed out any topics. Brush up on any areas of difficulty by talking them over with a friend or getting help from your teacher.
- Attend any revision classes put on by your teacher. Remember, he or she is an expert at preparing people for exams.

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The day before the exam

- Flick through these Revision Notes for useful reminders, for example the exam tips, exam summaries, typical mistakes and key terms.
- Check the time and place of your examination.
- Make sure you have everything you need — extra pens and pencils, tissues, a watch, bottled water, sweets.
- Allow some time to relax and have an early night to ensure you are fresh and alert for the exam.

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My exams

AS PE Paper 1 (7581)

Date:..

Time: ....

Location: ....

A-Level PE Paper 1 (7582/1)

Date:..

Time: ....

Location: ....

A-Level PE Paper 2 (7582/2)

Date:..

Time: ....

Location: ....

1.1 Cardiovascular system

The cardiovascular system is the body's transport system. It includes the heart and the blood vessels. During exercise, an efficient cardiovascular system is extremely important, as the heart works to pump blood through the various blood vessels to deliver oxygen and nutrients to the working muscles and gather waste products such as carbon dioxide.

Exam tip

While structure is not tested in the exam, a good grasp of how the components of the cardiovascular system are arranged and organised will enable you to better understand how the system functions.

Cardiac conduction system

REVISED

When the heart beats, the blood needs to flow through it in a controlled manner – in through the atria and out through the ventricles. Heart muscle is described as being **myogenic** as the beat starts in the heart muscle itself with an electrical signal in the **sinoatrial node (SAN)**. This electrical signal then spreads through the heart in what is often described as a wave of excitation (similar to a Mexican wave) in the following order:

- From the SAN, the electrical impulse spreads through the walls of the atria, causing them to contract (atrial systole).
- The impulse then passes through the **atrioventricular node (AVN)**, where it is delayed for approximately 0.1 seconds to enable the atria to contract fully before ventricular systole begins.
- The impulse then travels through the bundle of His, which branches into two bundle branches, and into the Purkinje fibres, which spread throughout the ventricles, causing them to contract (ventricular systole).

Myogenic: originating in muscle tissue.

Sinoatrial node (SAN): a small mass of cardiac muscle found in the wall of the right atrium that generates the heartbeat. It is more commonly called the pacemaker.

Atrioventricular node (AVN): relays the impulse between the upper and lower sections of the heart.

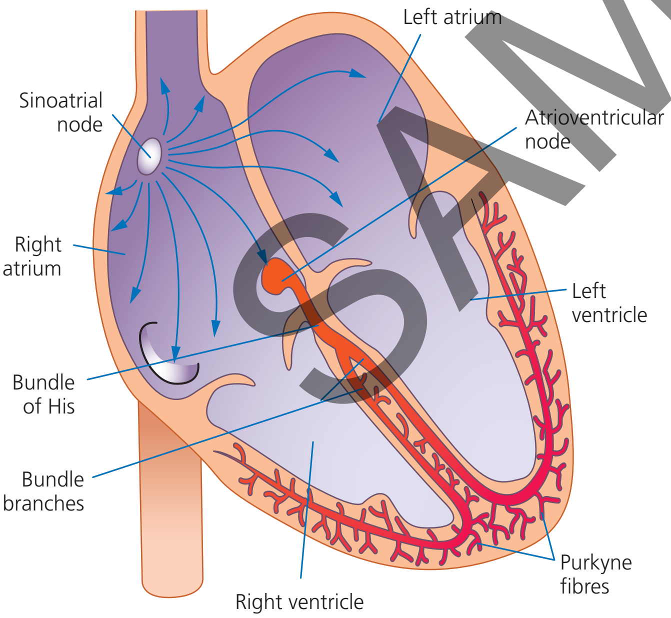


Figure 1.1a The cardiac conduction system

Now test yourself

TESTED

1 Identify the order in which a cardiac impulse travels.

Answer online

Factors affecting the change in rate of the conduction system

The conduction system ensures that heart rate increases during exercise to allow the working muscles to receive more oxygen. As discussed on the previous page, the heart generates its own impulses from the SAN, but the rate at which these cardiac impulses are fired can be controlled by the mechanisms outlined below.

Neural control mechanism

This involves the sympathetic nervous system, which stimulates the heart to beat faster, and the parasympathetic nervous system, which returns the heart to its resting level. These two systems are co-ordinated by the cardiac control centre located in the **medulla oblongata** of the brain.

The cardiac control centre is stimulated by chemoreceptors, baroreceptors and proprioceptors and will then send an impulse through either the sympathetic system to the SAN to increase heart rate or the parasympathetic system to the SAN to decrease heart rate:

Chemoreceptors → detect increase in blood carbon dioxide → cardiac control centre → sympathetic system → SAN increases heart rate

Baroreceptors → detect increase in blood pressure → cardiac control centre → parasympathetic system → SAN decreases heart rate

Proprioceptors → detect increase in muscle movement → cardiac control centre → sympathetic system → SAN increases heart rate

Medulla oblongata: the most important part of the brain as it regulates processes that keep us alive.

Typical mistake

Don't be vague, tell the examiner what the receptors detect. For example, chemoreceptors detect an increase in carbon dioxide during exercise – don't just say chemical changes!

Now test yourself TESTED

2 Identify and explain the role of chemoreceptors and proprioceptors in increasing heart rate.

Answer online

Hormonal control mechanism

Hormones can also have an effect on heart rate. The release of adrenaline during exercise is known as hormonal control. Adrenaline is a stress hormone that is released by the sympathetic nerves and cardiac nerve during exercise. It stimulates the SAN (pacemaker), which results in an increase in both the speed and force of contraction, therefore increasing cardiac output. This results in more blood being pumped to the working muscles so they can receive more oxygen for the energy they need.

Impact of physical activity and sport on stroke volume, heart rate and cardiac output

Stroke volume

This is the volume of blood pumped out by the heart ventricles in each contraction. On average, the resting stroke volume is approximately 70 ml.

Stroke volume depends upon the following:

- **Venous return** – when this increases, stroke volume will also increase.
- The elasticity of cardiac fibres – this is concerned with the degree of stretch of cardiac tissue during the diastole phase (when the heart is relaxed) of the cardiac cycle. The more the cardiac fibres can stretch, the greater the force of contraction. A greater force of contraction can increase the **ejection fraction**. This is called Starling's law.

Ejection fraction: the percentage of blood pumped out by the left ventricle per beat.

Venous return: the return of blood to the right side of the heart via the vena cava.

- The contractility of cardiac tissue (myocardium) – the greater the contractility of cardiac tissue, the greater the force of contraction. This results in an increase in stroke volume as well as the ejection fraction.

Stroke volume in response to exercise

Stroke volume increases as exercise intensity increases. However, this is only the case for up to 40–60 per cent of maximum effort. Once a performer reaches this point, stroke volume plateaus as the ventricles simply do not have as much time to fill up with blood and so cannot pump as much out.

Heart rate

This is the number of times the heart beats per minute. On average, the resting heart rate is approximately 72 beats per minute.

Heart rate range in response to exercise

Heart rate increases with exercise, but how much it increases is dependent on the intensity of the exercise. Heart rate will increase in direct proportion to exercise intensity: the higher the intensity, the higher the heart rate. Heart rate does eventually reach a maximum. Maximum heart rate can be calculated by subtracting your age from 220. An 18-year-old will have a maximum heart rate of 202 beats per minute:

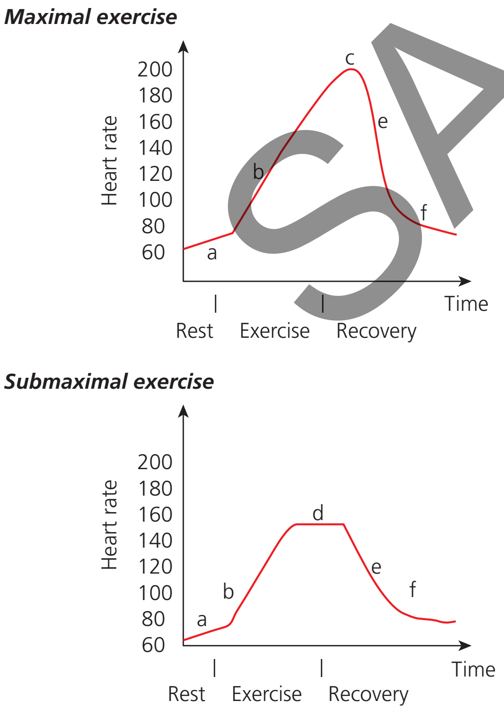
220 – 18 = 202

A trained performer has a greater heart rate range because their resting heart rate is lower and their maximum heart rate increases.

The following graphs illustrate what happens to heart rate during maximal exercise such as sprinting and submaximal exercise such as jogging.

Exam tip

Starling's law → increased venous return → greater diastolic filling of the heart → cardiac muscle stretched → more force of contraction → increased ejection fraction



a = *Anticipatory rise* due to hormonal action of adrenaline which causes the SAN to increase heart rate

b = *Sharp rise in* heart rate due mainly to anaerobic work

c = Heart rate continues to rise due to maximal workloads stressing the anaerobic systems

d = *Steady state* as the athlete is able to meet the oxygen demand with the oxygen supply

e = *Rapid decline* in heart rate as soon as the exercise stops

f = *Slower recovery* as body systems return to resting levels; heart rate needs to remain elevated to rid the body of waste products, for example lactic acid

Figure 1.1b Heart rate responses to maximal and submaximal exercise

Regular aerobic training will result in more cardiac muscle. When the cardiac muscle becomes bigger and stronger, this is known as **cardiac hypertrophy**. Consequently, a bigger, stronger heart will enable more blood to be pumped out per beat (i.e. stroke volume), which means the heart does not have to pump as often. This is known as **bradycardia** and when this occurs, oxygen delivery to the muscles improves as there is less oxygen needed for contractions of the heart.

Cardiac hypertrophy: when the heart becomes bigger and stronger due to a thickening of the muscular wall.

Bradycardia: when there is a decrease in resting heart rate to below 60 beats per minute.

Cardiac output

This is the volume of blood pumped out by the heart ventricles per minute. It can be calculated using the following equation:

Cardiac output (Q) = Stroke volume (SV) x Heart rate (HR)

Q = 70 x 72

Q = 5040 ml (5.04 l)

It can be seen from this calculation that if heart rate or stroke volume increases, then cardiac output will also increase.

Exam tip

Maximum heart rate is calculated as 220 minus your age.

Cardiac output in response to exercise

During exercise, there is a large increase in cardiac output due to an increase in heart rate and an increase in stroke volume. Cardiac output will increase as the intensity of exercise increases until maximum intensity is reached. Then it plateaus (evens out).

The following table shows the differences in cardiac output in a trained and an untrained individual, both at rest and during exercise. The individuals in this example are both aged 18, so their maximum heart rate will be 202 beats per minute.

	Stroke volume x Heart rate = Cardiac output (SV x HR = Q)
Exercise untrained	120 ml x 202 = 24.24 litres
Exercise trained	170 ml x 202 = 34.34 litres

	Stroke volume x Heart rate = Cardiac output (SV x HR = Q)
Rest untrained	70 ml x 72 = 5.04 litres
Rest trained	84 ml x 60 = 5.04 litres

During exercise, the increase in maximum cardiac output will have huge benefits for the trained performer as they will be able to transport more blood to the working muscles and therefore more oxygen.

Typical mistake

At rest, cardiac output for both the trained and untrained performer stays the same. It is *maximum* cardiac output that changes.

Now test yourself

TESTED

3 (a) Define the terms 'cardiac output' and 'stroke volume' and explain the relationship between them.
(b) Explain how training affects cardiac output and its components.

Answers online

Impact of physical activity and sport on the health of the individual

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Heart disease

Coronary heart disease (CHD) is the leading cause of death both in the UK and around the world. It occurs when your coronary arteries, which supply the heart muscle with oxygenated blood, become blocked or start to narrow by a gradual build-up of fatty deposits. This process is called **atherosclerosis** and the fatty deposits are called atheroma. High blood pressure, high levels of cholesterol, lack of exercise and smoking can all cause atherosclerosis.

Atherosclerosis: when arteries harden and narrow and become clogged up by fatty deposits.

High blood pressure

Blood pressure is the force exerted by the blood against the blood vessel wall. This pressure comes from the heart as it pumps the blood around the body. High blood pressure puts extra strain on the arteries and heart and if left untreated increases the risk of heart attack, heart failure, kidney disease, stroke or dementia. Regular aerobic exercise can reduce blood pressure. It lowers both systolic and diastolic pressure by up to 5–10 mmHg, which reduces the risk of a heart attack by up to 20 per cent.

Cholesterol levels

There are two types of cholesterol:

- LDL (low-density lipoproteins) transport cholesterol in the blood to the tissues and are classed as 'bad' cholesterol since they are linked to an increased risk of heart disease.
- HDL (high-density lipoproteins) transport excess cholesterol in the blood back to the liver where it is broken down. These are classed as 'good' cholesterol since they lower the risk of developing heart disease.

Regular physical activity lowers bad LDL cholesterol levels. At the same time, it significantly increases good HDL cholesterol levels.

Stroke

The brain needs a constant supply of oxygenated blood and nutrients to maintain its function. The energy to work all the time is provided by oxygen delivered to the brain in the blood. A stroke occurs when the blood supply to part of the brain is cut off, causing damage to brain cells so they start to die. This can lead to brain injury, disability and sometimes death. There are two main types of stroke:

- Ischaemic strokes are the most common form and occur when a blood clot stops the blood supply.
- Haemorrhagic strokes occur when a weakened blood vessel supplying the brain bursts.

Research has shown that regular exercise can help to lower your blood pressure and help you maintain a healthy weight, which can reduce your risk of stroke by 27 per cent.

Now test yourself

TESTED

4 What effect does regular physical activity have on blood pressure and cholesterol levels?

Answer online

Revision activity

Create a table to summarise how physical activity can have an effect on heart disease, high blood pressure, cholesterol levels and strokes.

Cardiovascular drift

REVISED

Cardiovascular drift is characterised by a progressive decrease in stroke volume and arterial blood pressure, together with a progressive rise in heart rate. It occurs during prolonged exercise in a warm environment, despite the intensity of the exercise remaining the same. A reduction in plasma volume occurs from the increased sweating response of the body and this reduces venous return and stroke volume. Heart rate then increases to compensate and maintain cardiac output.

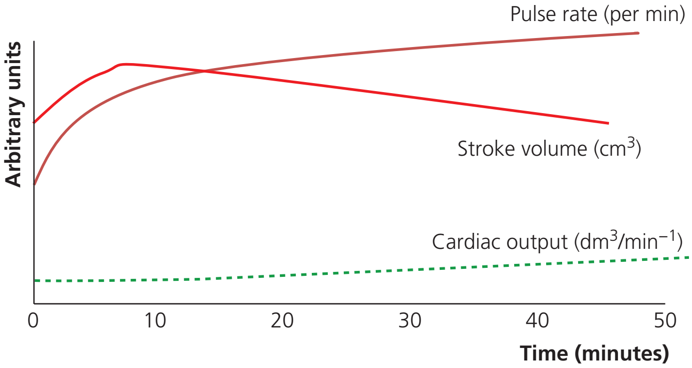

Figure 1.1c Graph to show cardiovascular drift

Exam tip

Cardiovascular drift → HR increases and stroke volume decreases → occurs after 10 minutes in warm conditions → caused by reduced plasma volume → reduced venous return → cardiac output increases due to more energy needed to cool the body/sweat

Blood vessels

REVISED

Several different blood vessels carry blood from the heart, distribute it round the body, then return it back to the heart (systemic circulation) and transport deoxygenated blood from the heart to the lungs and oxygenated blood back to the heart (pulmonary circulation).

Each blood vessel is slightly different in structure:

- Veins transport deoxygenated blood back to the heart (with the exception of the pulmonary vein), have thinner muscle/elastic tissue layers, blood is at low pressure and they have valves and a wider lumen.
- Arteries transport oxygenated blood around the body (with the exception of the pulmonary artery), and have the highest pressure, thick and elastic outer walls and thick layers of muscle, a smaller lumen and a smooth inner layer.
- Capillaries are only wide enough to allow one red blood cell to pass through at a given time. This slows down blood flow and allows the exchange of nutrients with the tissues to take place by diffusion.

Revision activity

Create a spider diagram to highlight the key structures of arteries, veins and capillaries.

Now test yourself

TESTED

5 Explain why arteries have the highest pressure.

Answer online

Blood pressure

REVISED

Blood pressure is the force exerted by the blood against the blood vessel wall and is often referred to as:

Blood flow x Resistance

During exercise, the heart contracts with more force so that blood leaves the heart under high pressure in order for the muscles to receive the extra oxygen they require. This is the **systolic** pressure or pressure of contraction. The lower pressure as the ventricles relax is the **diastolic** pressure.

Systolic: when the ventricles are contracting.

Diastolic: when the ventricles are relaxing.

Blood pressure is measured at the brachial artery in the upper arm. A typical reading at rest is:

$\frac{120}{80}$ mmHg (millimetres of mercury)

Blood pressure is different in the various blood vessels and is largely dependent on the distance of the blood vessel from the heart.

Exam tip

It is easy to remember that blood pressure increases during exercise but make sure you can explain why.

Now test yourself

TESTED

6 Give an average blood pressure reading and identify what happens to blood pressure during exercise.

Answer online

Venous return mechanisms

REVISED

Venous return is the return of blood to the right side of the heart via the vena cava. Up to 70 per cent of the total volume of blood is contained in the veins at rest. This means that a large amount of blood can be returned to the heart when needed. During exercise, the amount of blood returning to the heart (venous return) increases.

Active mechanisms are needed to help venous return:

- The skeletal muscle pump – when muscles contract and relax, they change shape. This change in shape means that the muscles press on the nearby veins and cause a pumping effect and squeeze the blood towards the heart.
- The respiratory pump – when muscles contract and relax during breathing in and breathing out, pressure changes occur in the thoracic (chest) and abdominal (stomach) cavities. These pressure changes compress the nearby veins and assist blood to return to the heart.
- Pocket valves – it is important that blood in the veins only flows in one direction. The presence of valves ensures that this happens. This is because once the blood has passed through the valves, they close to prevent the blood flowing back.
- There is a very thin layer of smooth muscle in the walls of the veins. This helps squeeze blood back towards the heart.
- Gravity helps the blood return to the heart from the upper body.

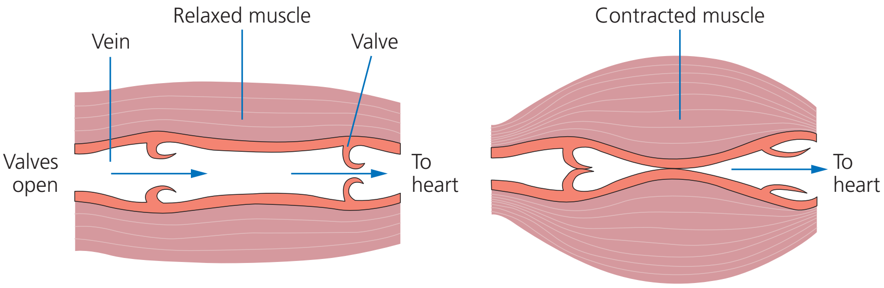

Figure 1.1d The skeletal muscle pump

Exam tip

Questions on venous return mechanisms will want you to identify the mechanism, for example skeletal muscle pump, and also explain what it does.

Impact of blood pressure on venous return

When systolic blood pressure increases, there is also an increase in venous return as the pressure in the blood vessels is higher so the blood travels quicker. When systolic blood pressure decreases, there is a decrease in venous return as the pressure in the various blood vessels has dropped so blood flow slows down.

Venous return is also determined by a pressure gradient:

$$\frac{\text{Venous pressure } (P_V) - \text{Right atrial pressure } (P_{RA})}{\text{Venous vascular resistance } R_V}$$

To simplify this, increasing right atrial pressure decreases venous return and decreasing right atrial pressure increases venous return.

Transportation of oxygen

REVISED

Oxygen can be transported as follows:

- 3 per cent dissolves into plasma
- 97 per cent combines with haemoglobin to form oxyhaemoglobin.

At the tissues, oxygen is released from oxyhaemoglobin due to the lower pressure of oxygen that exists there. The release of oxygen from oxyhaemoglobin to the tissues is referred to as oxyhaemoglobin dissociation. In the muscle, oxygen is stored by **myoglobin**. This has a higher affinity for oxygen and will store the oxygen for the **mitochondria** until it is used by the muscles.

Myoglobin: often called 'muscle haemoglobin'. It is an iron-containing muscle pigment in slow twitch muscle fibres which has a higher affinity for oxygen than haemoglobin. It stores the oxygen in the muscle fibres which can be used quickly when exercise begins.

Mitochondria: often referred to as the 'powerhouse' of the cell, as respiration and energy production occur there.

Oxyhaemoglobin dissociation curve

The oxyhaemoglobin dissociation curve helps us to understand how haemoglobin in our blood carries and releases oxygen. The curve represents the relationship between oxygen and haemoglobin.

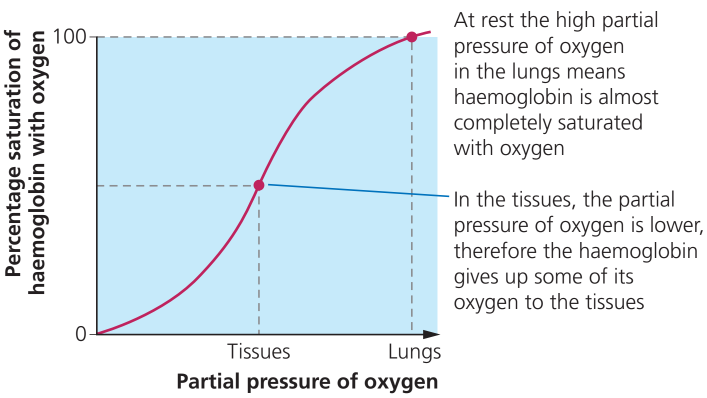

Figure 1.1e The oxyhaemoglobin dissociation curve

From this curve you can see that in the lungs there is almost full saturation (concentration) of haemoglobin but at the tissues the partial pressure of oxygen is lower.

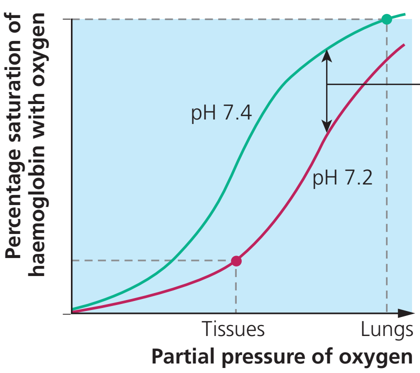

Figure 1.1f The effect of changing acidity on the oxyhaemoglobin dissociation curve

During exercise, this S-shaped curve shifts to the right. This is because when muscles require more oxygen, the dissociation of oxygen from haemoglobin in the blood capillaries to the muscle tissue occurs more readily. This shift is known as the **Bohr shift**.

Three factors are responsible for this increase in the dissociation of oxygen from haemoglobin, which results in more oxygen being available for use by the working muscles:

- Increase in blood temperature – when blood and muscle temperature increases during exercise, oxygen will dissociate from haemoglobin more readily.
- Partial pressure of blood carbon dioxide increases – as the level of blood carbon dioxide rises during exercise, oxygen will dissociate quicker from haemoglobin.
- Blood pH – more carbon dioxide will lower the pH in the body. A drop in pH will cause oxygen to dissociate from haemoglobin more quickly (Bohr shift).

Bohr shift: when an increase in blood carbon dioxide and a decrease in blood pH results in a reduction of the affinity of haemoglobin for oxygen.

Typical mistake

When giving the causes of the Bohr shift, don't forget the word 'blood'. (*Blood* pH, *blood* carbon dioxide levels, *blood* temperature).

Now test yourself

TESTED

7 During exercise, the oxyhaemoglobin curve shifts to the right. Explain why this happens and the effect that this change has on oxygen delivery to the muscles.

Answer online

Redistribution of blood

REVISED

The distribution of blood flow is different at rest compared to during exercise. During exercise, the skeletal muscles require more oxygen, so more blood needs to be redirected to them in order to meet this increase in oxygen demand. The redirecting of blood flow to the areas where it is most needed is known as shunting or the **vascular shunt mechanism** and is important to ensure:

- More blood goes to the heart, because the heart muscle needs oxygen to beat faster and with more force.
- More blood goes to the muscles, as they need more oxygen for energy and more blood is needed to remove waste products such as carbon dioxide and lactic acid.

Vascular shunt mechanism: the redistribution of cardiac output.

- More blood goes to the skin, because energy is needed to cool the body down.
- Blood flow to the brain remains constant, as it needs oxygen for energy to maintain function.

It is also important to ensure the gut is empty, as a full gut would result in more blood being directed to the stomach instead of the working muscles. This would have a detrimental effect on performance, as less oxygen is being made available.

Control of blood flow

Both blood pressure and blood flow are controlled by the vasomotor centre, located in the medulla oblongata of the brain. During exercise, chemical changes – such as increases in carbon dioxide and lactic acid – are detected by chemoreceptors. These receptors stimulate the vasomotor centre which then redistributes blood flow through **vasodilation** and **vasoconstriction**. Vasodilation is when the blood vessel widens to increase blood flow into the capillaries, and vasoconstriction is when the blood vessel narrows to decrease blood flow. In exercise, more oxygen is needed at the working muscles, so vasodilation will occur in the arterioles supplying these muscles, increasing blood flow and bringing in the much-needed oxygen, whereas vasoconstriction will occur in the arterioles supplying non-essential organs such as the intestines and liver.

Pre-capillary sphincters also aid blood redistribution. They are tiny rings of muscle located at the opening of capillaries. When they contract, blood flow is restricted through the capillary and when they relax blood flow is increased.

Vasodilation: the widening of the blood vessels to increase blood flow into the capillaries.

Vasoconstriction: the narrowing of the blood vessels to reduce blood flow into the capillaries.

Exam tip

During exercise, the muscles require more oxygen so we have to direct more blood to them.

Now test yourself

TESTED

8 (a) Why does blood flow to the skin and heart increase during exercise?
(b) Explain why there is a need for an increase in blood flow to the skeletal muscles during exercise and how this is achieved.

Answers online

Arterio-venous difference (A-VO_2 diff)

REVISED

This is the difference between the oxygen content of the arterial blood arriving at the muscles and the venous blood leaving the muscles. At rest, the **arterio-venous difference** is low, as not much oxygen is required by the muscles. But during exercise much more oxygen is needed from the blood for the muscles, so the arterio-venous difference is high. This increase will affect gaseous exchange at the alveoli, so more oxygen is taken in and more carbon dioxide is removed. Training also increases the arterio-venous difference, as trained performers can extract a greater amount of oxygen from the blood.

Arterio-venous difference (A-VO_2 diff): the difference between the oxygen content of the arterial blood arriving at the muscles and the venous blood leaving the muscles.

Now test yourself

TESTED

9 What do you understand by the term 'arterio-venous difference' and what happens to this during exercise?

Answer online

Exam practice

1 During a game, a defender will work at various intensities. Describe how cardiac output increases when a defender is working at a higher intensity. [3]
2 Heart rate can be controlled by the heart itself. Explain how this occurs. [3]
3 What are the effects of cardiac hypertrophy and bradycardia on the heart during exercise? [3]
4 What factors determine blood pressure in blood vessels? [3]
5 Where is myoglobin found in the body and what is its role during exercise? [2]
6 How would performing a cool-down help venous return? [2]

Answers and quick quizzes online

ONLINE

Summary

You should now be able to:

- describe the cardiac conduction system
- explain the hormonal, neural and chemical regulation of responses during physical activity and sport
- describe the role of chemoreceptors, baroreceptors and proprioceptors in regulation of responses during physical activity
- understand the impact of physical activity and sport on cardiac output, stroke volume and heart rate, and explain the relationship between them in trained/untrained individuals and maximal/submaximal exercise
- understand Starling's law
- identify how physical activity can affect heart disease, high blood pressure, cholesterol levels and strokes
- explain cardiovascular drift
- understand the venous return mechanisms
- explain blood pressure using the terms 'systolic' and 'diastolic' and identify the relationship venous return has with blood pressure
- describe the transportation of oxygen and be able to explain the roles of haemoglobin and myoglobin
- understand the oxyhaemoglobin dissociation curve
- explain the Bohr shift
- explain how blood is redistributed during exercise through vasoconstriction and vasodilation
- explain arterio-venous oxygen difference (A-VO_2 diff).