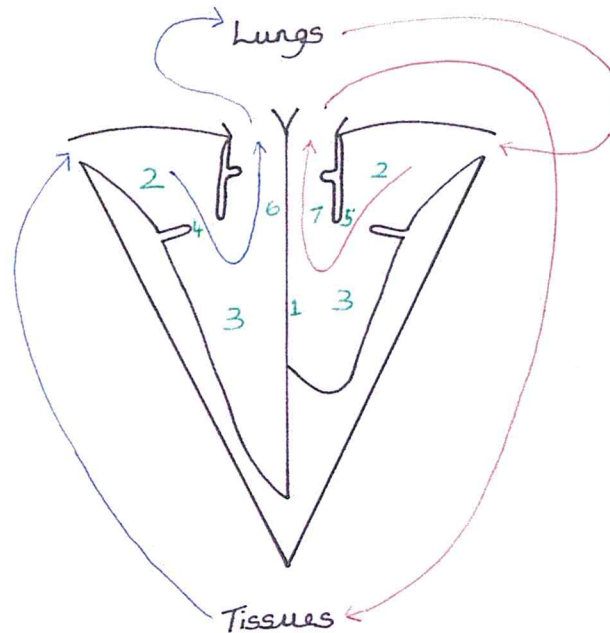


THE CARDIOVASCULAR (HEART) SYSTEM

THE AEROBIC SYSTEM REVIEW

- Aerobic → a process taking place in presence of oxygen
- An athlete's aerobic capacity is limited by the heart/vascular/respiratory systems
- If an athlete has a low aerobic capacity they are less able to supply sufficient oxygen to muscles
- The aerobic system aims to supply the muscles with an adequate supply of oxygen during prolonged performance



1. **SEPTUM** – separates the two pumps of the heart

2. **ATRIA:**

- The upper chambers of the heart
- They are low-pressure with thin muscular walls
- They collect and store blood before pumping it into the ventricles

3. **VENTRICLES:**

- The lower chambers of the heart
- They are high-pressure with thick muscular walls
- The left ventricles have a thicker wall as it pumps blood around the whole body whilst the right ventricle pumps blood to the lungs

VALVES:

- Control the forward direction of blood flow through the heart
- Prevent the backflow of blood within the heart chambers

ATRIOVENTRICULAR (AV) VALVES:

4. **TRICUSPID VALVE**

5. **BICUSPID VALVE**

SEMILUNAR (SL) VALVES:

6. **PULMONARY VALVE**

7. **AORTIC VALVE**

8. **SUPERIOR/INFERIOR VENA CAVA** – brings deoxygenated blood from the body to the right atrium

9. **PULMONARY ARTERY** – brings deoxygenated blood from the right ventricle to the lungs

10. **PULMONARY VEINS (x4)** – brings oxygenated blood from the lungs to the left atrium

11. **AORTA** – brings oxygenated blood from the left ventricle to the whole body

CORONARY ARTERIES – the right and left branches from the aorta which encircle the heart and supply it with oxygen and glucose

CORONARY VEINS – work with the coronary arteries draining deoxygenated blood back to the right atrium via the coronary sinus

THE CARDIOVASCULAR (HEART) SYSTEM QUESTIONS

1. What does aerobic mean?
2. What are the characteristics of the atria?
3. What are the characteristics of the ventricles?
4. What are the two jobs of valves?
5. What are the two atrioventricular valves called?
6. What are the two semilunar valves called?
7. What does the superior/inferior vena cava do?
8. What does the pulmonary artery do?
9. What do the pulmonary veins do?
10. What does the aorta do?

The Conduction System

1. Cardiac Impulse is initiated from the SA Node – which is located in the posterior wall of the right atrium
And is often termed the pacemaker
2. The impulse travels through the left and right atrial walls, causing the atria to contract. The ventricles are insulated from the atria thus cannot be stimulated.
3. The impulse arrives at the AV Node in the right atrium which passes the impulse down the bundle of His which is located in the septum of the heart.
4. The AV Node helps to delay the impulse so that the atria can finish contracting
5. The impulse goes down the left and right bundles of his to the bottom of the heart and along the purkyne fibres, causing the ventricles to contract fully and expel all blood.

g z m x t z f t g u k k s z r n x b
s a h r v b x z t n y e v o g u o t
w y a m z g y n g k l x s x s b m u
n e s a l o k w k c h s w z i e o c
h e g t s z a k i d z n w g h m r n
a a c a o y p r d d l y b q f g y v
i e i s t l t b b d i a s t o l e y
r e p g x n e z i q f v w j e h z l
t e v u e c l t j u n l r p l n l q
a t d v x s e d o n a s r u d x j e
y b w o e t g l f i t k g r n b l b
d w q p n q f l w o y w a k u e g z
u l t x y v i c n q z a g y b y p t
k u s x i r a j z i b l k n g u t e
m d s k f i r i z l k c i e z k o r
q i k n g l k u x j e z d f b g s r
m t f r h f h b m b z q c i e n o c
n l z h o t b j x h t n a s t d t y

atria
avnode
bundleofhis
diastole
heart
purkyne
sanode
septum
svstole

Conduction System & the Cardiac Cycle

1. SA node initiates / sends an impulse (myogenic) ↓
2. Causing atrial systole / depolarisation / contraction ↓
3. Blood is forced / pushed / flows from atria to ventricles
— or out of atria through AV valves ↓
4. Impulse travels to / received by AV node / AV node sends impulse ↓
5. Impulse continues down Bundle of His & Purkinje Fibres. ↓
6. Causing ventricular systole / depolarisation / contraction ↓
7. Blood is ejected from ventricles

a	d	l	m	n	w	u	s	j	c	d	f	m	a	b	a
j	h	o	z	x	p	q	l	t	z	y	x	p	a	d	t
i	o	k	m	t	v	i	m	u	s	e	n	p	e	n	r
s	l	z	o	y	a	h	v	d	g	k	w	o	n	s	i
k	j	y	g	h	i	v	s	g	j	k	l	g	e	d	o
g	e	t	o	z	r	x	a	g	e	a	k	f	r	g	v
x	v	o	n	i	j	e	n	g	r	e	x	f	i	b	f
v	r	k	o	z	i	y	o	p	i	e	m	z	p	h	i
n	i	e	y	w	g	t	s	r	e	a	z	v	h	w	i
s	o	z	i	v	g	t	a	d	c	b	l	a	v	x	z
y	b	x	t	s	i	o	n	h	t	j	u	k	g	j	p
s	u	k	h	o	j	b	i	o	a	r	k	i	n	j	i
f	o	j	n	g	l	m	p	u	r	k	i	n	j	e	z
o	e	d	p	a	q	f	x	w	n	t	g	r	d	s	a
i	n	g	f	k	a	e	c	b	u	r	v	p	e	i	h
e	k	z	l	r	m	i	a	i	r	t	a	o	n	i	s

1. systole

2. depolarisation

3. myogenic

4. impulse

5. sinoatrial

6. Purkinje

7. atrioventricular

Impact of different types of physical activity on the Cardiovascular System.

Common Cardiovascular Diseases.
 Single largest cause of death in the western world caused by sedentary lifestyle.
Arteriosclerosis.

Relates to loss of elasticity / thickening of arteries that reduces their efficiency to vasodilate and contract. Therefore increases blood pressure and the vascular shunt mechanism.

Smoking accelerates the atherosclerotic and narrowing arteries.

Remaining the Risk.
 Physical activities can:

- Improve heart-hypertension
- Improve pumping capacity
- Reduce circulation; vascular - increase capacity / size of coronary circulation.

Decreases blood fibrinogen, increases blood clotting and decreases blood viscosity, improving blood flow to the coronary circulation.

Reduces obesity, controlling body weight which helps regulate hypertension and control of diabetes.

ATHEROSCLEROSIS.

- Form of Arteriosclerosis that involves changes in the lining of arteries.
 - High level of cholesterol and fatty deposits form accumulate within the artery wall forming fatty plaques of calcium narrowing of the artery.

- Increases the chance of blood clots happening.

- Can restrict blood flow and to high blood pressure (hypertension).

- Decreases blood lipids which can be deposited on arterial walls leading to Arteriosclerosis and Atherosclerosis.

- Alleviate tension/stress helping reduce hypertension.

Net effect - Reduce arterial damage
 Reduce arterial damage (decrease which in turn reduces risk of arterial heart attack)

Heart attack.
 - A sudden restriction of O₂ (blood supply) to a part of the heart muscle will usually cause permanent damage.

- Death can result if the damaged area is large enough to prevent the remaining heart muscle wall from providing the sufficient right amount of cardiac output.

- More likely to occur during physical activity (exercise) as the heart requires more O₂ and the arteries can't supply.

- Decreases low density lipoproteins (LDL), high in cholesterol that are deposited on vessel walls.

Heart Angina.
 - Is the partial blockage of coronary artery.

- Causes an intense pain in the chest which occurs when an inadequate O₂/blood supply to the heart muscle wall.

- More likely to occur during physical activity (exercise) as the heart requires more O₂ and the arteries can't supply.

V	X	L	B	F	A	K	E	Z	H	C	I	D	Y	E	S	S	H	T	Y	U	Z
W	A	U	K	P	T	E	Z	H	C	B	I	X	D	E	S	I	S	M	H	V	X
M	R	P	T	E	Z	H	C	B	I	X	D	E	S	I	S	E	Q	V	E	A	T
U	K	P	T	E	Z	H	C	B	I	X	D	E	S	I	S	O	I	U	N	A	S
T	M	Y	I	H	O	Q	P	Q	A	M	C	Y	A	L	V	U	U	T	O	C	
H	I	P	M	H	V	B	I	K	C	I	E	L	A	P	D	Q	U	S	T	D	A
J	E	M	C	D	W	B	J	Q	I	H	I	W	X	V	V	T	Q	A	I	F	
M	S	T	O	P	F	H	J	I	C	M	S	T	X	T	X	W	J	M	I	T	
I	L	K	Z	I	A	L	S	M	B	P	Q	T	I	W	Z	X	L	Q	A	B	
A	M	T	E	Z	H	C	B	I	X	D	E	S	I	S	O	C	O	S	T	F	W
K	F	O	Q	B	C	I	O	F	N	P	A	O	P	W	T	Q	S	V	M	E	X
J	K	P	C	A	T	B	D	D	F	T	V	Q	I	Y	E	Q	D	U	A	Y	Z
P	O	H	N	E	L	O	M	O	H	E	A	T	A	T	A	T	A	C	K	A	Y
Q	L	Y	T	W	O	R	C	A	T	D	I	A	C	O	U	T	P	U	T	Y	Z
M	V	T	U	I	H	D	E	D	E	C	J	U	B	L	N	U	V	B	W	O	X
N	A	K	B	T	X	A	Q	F	A	S	T	A	N	S	I	O	N	C	B	D	A
F	A	Y	Z	E	B	D	Y	O	I	S	O	M	T	V	P	X	F	Z	Q	A	Z

- Atherosclerosis
- Arteriosclerosis
- Hypertrophy
- Heart attack
- Heart angina.
- Cardiac output.
- Unconstricted
- Vasodilate.
- blood fibrinogen.

The **Medulla Oblongata** in the brain contains the cardiac control centre, which is responsible for regulating heart rate via the stimulation of the SA node.

The CCC is controlled by the **autonomic nervous system** (ANS controls the body's involuntary internal functions) meaning that it is under involuntary control and consists of sensory and motor nerves from either the sympathetic or parasympathetic nervous system.

Receptors:

Detect changes to the body's status e.g. chemo/ proprioceptors.

Sensory nerves:

Transmit information detected by receptors towards the central nervous system e.g. Chemoreceptors about pp O2 and pp CO2.

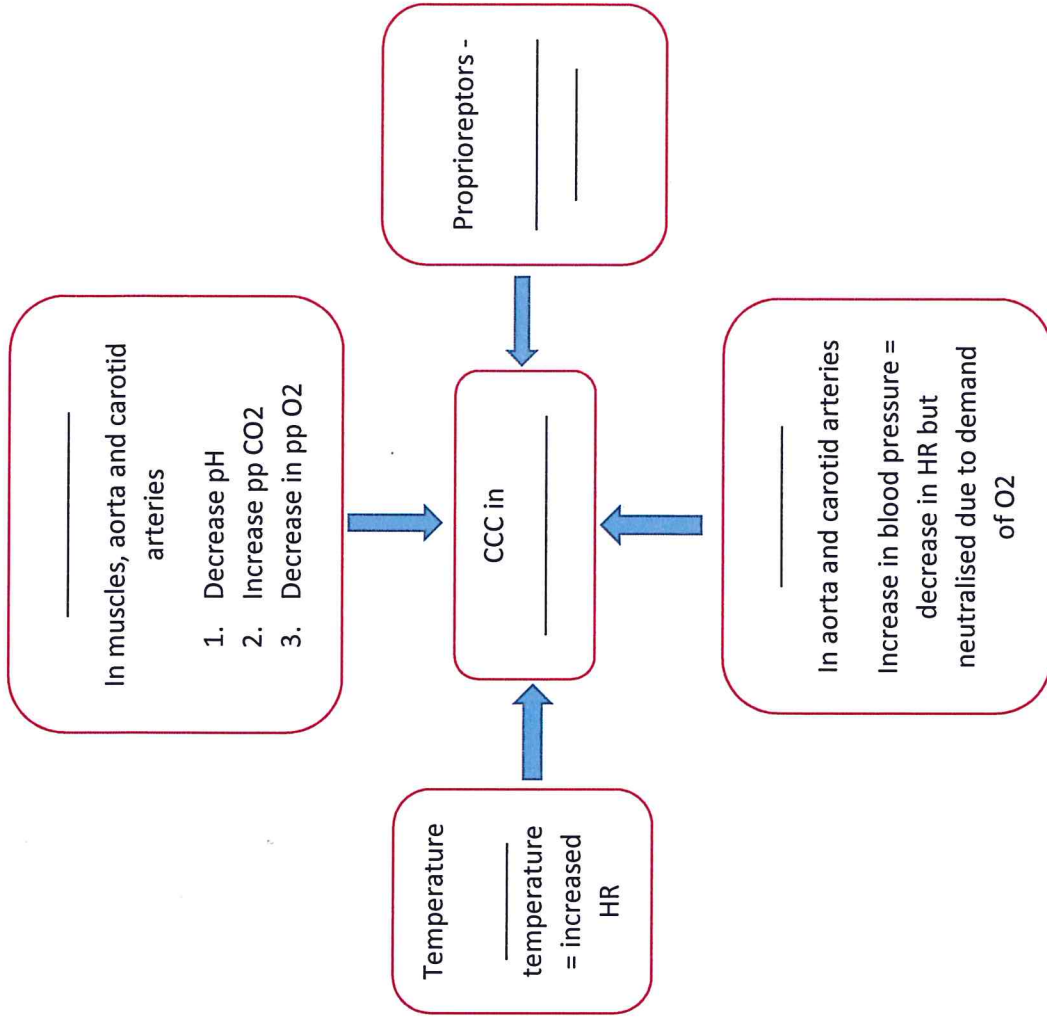
Motor nerves:

Nerves from the central nervous system passing instructions to body parts e.g. muscles, to contract.

Three main factors affecting activity of CCC

- *Neural control
- *Intrinsic control
- *Hormonal control

In response to **receptor stimulation** via **sensory nerves** the CCC initiates the **sympathetic or parasympathetic nervous systems** to **stimulate the SA node** to either **increase or decrease HR**. Sympathetic nerves increase HR while parasympathetic nerves decrease HR.



Increased Medulla Oblongata Motor activity Chemoreceptors Baroreceptors

The Vasomotor Control Centre

- What is it?: the centre that regulates the vascular shunt mechanism.
- It is located in the medulla oblongata.
- It stimulates the sympathetic nervous system to either vasodilate or vasoconstrict the pre capillary sphincters and arterioles going to the organs or muscles.
- The VCC receives information from the chemoreceptors and the baroreceptors.
- Chemoreceptors – when lactic acid and co2 increases.
- Baroreceptors – when blood pressure has increased or decreased.

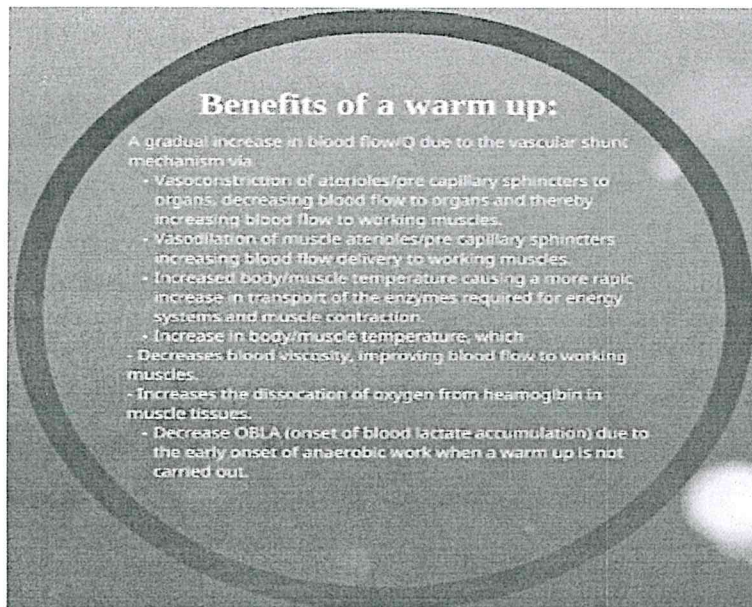
During exercise (organs): Vasoconstriction of pre-capillary sphincters and arterioles leading to the non-essential organs.

During exercise (muscles): vasodilation of pre-capillary sphincters and arterioles leading to the muscles.

The VCC allows effective blood and thus oxygen transport to the working muscles during exercise. 97% of oxygen is transported within haemoglobin while 3% is transported in blood plasma. **Efficient transport allows:**

- Prolonged duration of anaerobic and aerobic activity
- Increased lactate threshold/ decreased OBLA
- Increased intensity
- Speeding up of recovery

Effects of a warm up on VCC:



E Y H D N E R O X G
 L W R Y D V Q I Z G
 O O L A P C J C I Y
 I X J V L G M W L Q
 R O Z A G L X X R Z
 E N X S O A I L J P
 T Z S O B Z I P G E
 R T W C W K G S A Q
 A M D O T U H H Q C
 T O D N E B Z E Q G
 R J U S I O W U J V
 R H E T B H Y N A Y
 S C N R D J F S C T
 S A R I E A O K R B
 B R F C W D X S Q D
 K J O T I D M B R K
 A S H L Z N Y T M O
 H J A U F Z O Q Q V
 Y T W C I D L D B M
 E R E T C N I H P S

ARTERIOLE
 CAPILLARY
 SHUNT
 SPHINCTER
 VASOCONSTRICT
 VASODILATE

Effects of a down cool on VCC:

1 (b)(ii) Describe <u>three</u> other effects of an active cool down on the vascular system of the performer. (3 marks) (Accept first three only)			
1 (metabolic activity)	Keeps metabolic activity elevated / gradually reduces heart rate or respiratory rate		Maintains heart rate / Maintains respiration
2 (capillaries)	Keeps capillaries dilated	Maintains vascular shunt mechanism / arterioles dilated = BOD	Keeps blood vessels or veins or venules dilated
3 (oxygenated blood)	Flushes oxygenated blood through the muscles or circulatory system	Maintains supply of oxygen to the muscles	
4 (waste products)	Removes waste products or CO ₂ or lactic acid / repays oxygen debt	Reduces lactic acid	Prevents build up of lactic acid / Prevents DOMS
5 (pump mechanisms)	(Maintains) action of (skeletal) muscle pump or respiratory pump		Pump on own
6 (blood flow / venous return)	maintains blood flow or stroke volume or cardiac output or blood pressure / venous return	SV for stroke volume / Q for cardiac output /	
7 (blood pooling)	Prevents blood pooling		

5 marks in total for question 1 (b)