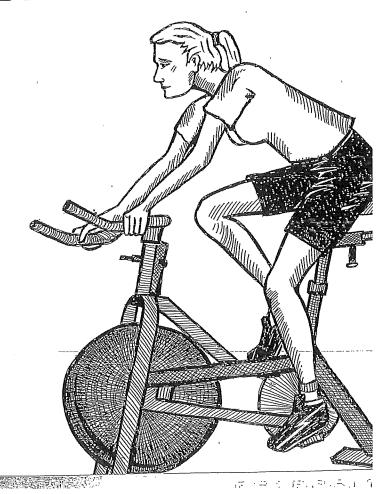
REVISE BIEC Sport

Made Backware work to an end the contract of t



Aerobic endurance is one of the six components of physical fitness It is important for any sustained physical activity.

Aerobic endurance is the ability of the CARDIORESPIRATORY SYSTEM to work efficiently, supplying NUTRIENTS and OXYGEN to working MUSCLES during sustained physical activity.

Activities that last for a long time require excellent aerobic endurance. Think of marathon running, long-distance swimming and triathlons.



Marathon runners need excellent aerobic endurance to ensure that they can continue to run over a long distance.

Physical fitness

There are six components of physical fitness:

- aerobie-endurance-
- muscular endurance
- flexibility
- speed
- · muscular strength
- body composition.

You will learn about the other components in the following pages.

Remember

AEROBIC means in the presence of oxygen. ANAEROBIC means without oxygen. Aerobic endurance is also known as

cardiorespiratory fitness, cardiorespiratory endurance and aerobic fitness.

The cardiorespiratory system

The cardiorespiratory system is made up of the cardiovascular system and the respiratory system.

The table to the right shows the components that make up each of these.

The cardiorespiratory system:

- uptakes oxygen from the air that you breathe in
- transports nutrients and oxygen around your body
- takes oxygen to working muscles
- removes waste-products such as carbon dioxide from the body.

Cardiovascular Respiratory system system Heart Lungs Blood Airways . Blood vessels

Worked example

Give one reason why top-class sprinters do not require good aerobic endurance.

(1 mark)

Sprinters only work for very short periods of time so aerobic endurance is not a physical fitness requirement for them.

Explain one reason why aerobic endurance is important for an athlete competing in a triathlon.

(2 marks)

There is only one mark available so think

carefully about how much to write.

Muscular endurance

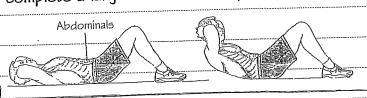
Muscular endurance is one of the six components of physical fitness. It is important for sustained muscular activity involving light to moderate resistance.

Muscular endurance is the ability of the muscular system to work efficiently, where a muscle can continue contracting continuously against a light to moderate fixed resistance load.

In simple terms it is being able to use your muscles repeatedly without them getting tired.

Voluntary muscles

Voluntary muscles are the muscles attached to your skeleton that help to produce movement. For example, your abdominal muscles require good muscular endurance if you are going to complete a large number of sit-ups.



Muscular endurance versus muscular strength

Muscular endurance and muscular strength are different.

Muscular-enduranee allows you to:-

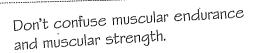
- work the muscles for a long time without getting tired
- work against light to moderate levels of resistance.

Muscular strength is about working for a shorter time against high levels of resistance. Weightlifters need muscular strength. You will revise muscular strength on page 5.

Muscular endurance: repetitive, light/moderate

resistance

Muscular strength: not repetitive, heavy/maximum resistance

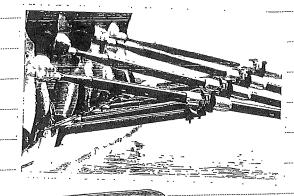


Worked example

Look at the image of the rowing crew competing in a race.

Describe why these athletes need good muscular endurance for their event. (2 marks)

Rowers have excellent muscular endurance in their legs, back and arm muscles. They have to keep repeating the same movement against the resistance of the water for the duration of their race.



New try this

Make sure you refer to the length of the event.



Explain why a 1500 m swimmer requires good muscular endurance. (2 marks)

	Learning
Flexibility is one of the six components of pt an adequate range of movement.	lysical fitness. Flexibility is important to ens
Flexibility can be defined as having an adequate the ability to move a joint fluidly through its	ate range of motion in all joints of the body
	1 movement.
All-round flexibility	Stretching to improve
Some sports performers require good	flexibility
all-round flexibility. Gymnasts need high	,
levels of flexibility in order to move, bend and flex their bodies around the	You can improve your flexibility by doin
different pieces of apparet 201	STRETCHING exercises. Stretching ca
different pieces of apparatus. Other sports performers might need flexibility	help to make muscles more elastic so
in more specific joints.	that your joints can move fluidly through
For example, hurdlers	their complete range of movement.
need-good-hip	Active Ballistic
flexibility in order	
to achieve an	Types of
accurate hurdling	Static Stretching Promises to
position.	Proprioception neuromuscula
	Passive facilitation (P
Gymnasts need high	, assive
levels of flexibility.	You will learn more about these types o
	stretches on pages 25 and 27.
Worked example	A THE STATE OF THE
The image shows a golfer preparing to swing.	
Explain one reason why shoulder flexibility is important	
	t for marks)
Having good shoulder flexibility allows the to increase the range of motion in her swing that more power care.	golfer
1 2200 more power call be applied to the 1-11	
that more power can be applied to the ball make it travel further.	
Total more power tall he applied to the rear	
1 2200 more power can be applied to the 1-11	
1 size more power can be applied to the rear	
make it travel further.	
make it travel further.	
make it travel further.	
make it travel further. Flexibility is important in all sporting activities.	
make it travel further.	be used by each performer. (3 marks)
make it travel further. Flexibility is important in all sporting activities. Complete the table below to show how flexibility would in the ball travel further.	
make it travel further. The power can be applied to the ball make it travel further. Flexibility is important in all sporting activities. Complete the table below to show how flexibility would be applied to the ball make it travel further. How is flexibility uses the ball make it travel further.	be used by each performer. (3 marks)
make it travel further. Flexibility is important in all sporting activities. Complete the table below to show how flexibility would lead to the ball make it travel further. How is flexibility used to the ball make it travel further. How is flexibility used to the ball make it travel further.	
make it travel further. The second of the s	

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Learning aim	A

Nearly there

Nailed it

\$ 2000

Speed is one of the six components of physical fitness. Some sports are all about speed, such as sprinting, and many others involve speed combined with other components of physical fitness. Speed can be defined as: DISTANCE TRAVELLED DIVIDED BY TIME TAKEN. There are three types of speed.



Accelerative speed

After sprinting for approximately 30 m, a sports performer will have accelerated to his or her top speed. In gymnastics, the vault run-up is approximately 25 m long, so the gymnast is almost at top speed when they reach it, increasing the height and distance of their vault.

Calculating speed

Speed is measured in metres per second (m/s).
To work out how fast someone travelled you need to use the following formula:

DISTANCE TRAVELLED = SPEED (m/s)

For example, if you run 100 m in 14 seconds, your speed would be calculated as follows:

 $\frac{100}{14} = 7.14 \text{ m/s}$



Pure speed

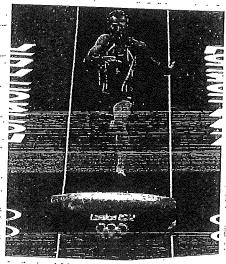
Some events, like sprints up to 60 m, are all about speed: the event is won by achieving the quickest time. The faster an athlete runs, the greater his or her speed.



Speed endurance

Speed endurance is an athlete's ability to sustain maximum, or near maximum, episodes of speed over a prolonged period of time with short periods of recovery.

Footballers require good speed endurance - they spend lots of time chasing, moving and passing the ball but get periods of rest when the ball is not in their area of the pitch. Footballers can use speed to beat an opponent to a loose ball.



The vault run-up takes advantage of accelerative speed.

Worked example

There are three types of speed: accelerative speed, pure speed and speed endurance.

Explain which type of speed is most important to a long jumper. (2 marks)

Accelerative speed is most important because a long jumper needs to be travelling at maximum speed at take-off to maximise the length of the jump.

Don't forget to state the type of speed and then say why it is important.

Don't forget to show your workings.



An athlete runs 200 m in 24.5 seconds.

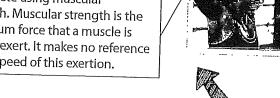
Calculate the athlete's average speed over this distance. (2 marks)

composition and athletic ability. Body composition will impact on-sports performers. Sprinters benefit from having a low ratio of body fat to muscles as a leaner body performs better amd faster, while-sumo-wrestlers-willnormally have a higher body fat to muscle ratio as body mass is important to their success.

the ability to use muscular strength at speed.

An athlete using muscular strength. Muscular strength is the maximum force that a muscle is able to exert. It makes no reference to the speed of this exertion.

Think about the difference between muscular strength and muscular power.



Complete the table below by giving an example of how muscular strength would be used by each (3 marks)

Performer _	How is muscular strength used?
Sprinter	
Rugby player	·
Gymnast	·

UNIT 1	
Learning aim	M

Nearly there

Nailed it

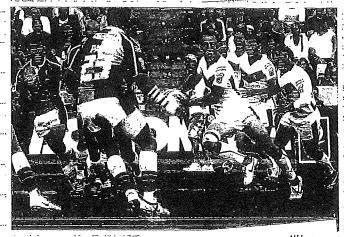
There are five components of skill-related fitness. Agility is one of these. Agility is the ability of a sports performer to quickly and precisely move or change direction without tosing balance or time.

Agility in action

Sports performers are often required to dodge and move quickly past the opposition to create space and score goals.

This is most common in team sports where there are lots of players in the same space at the same time.

If performers do not have good agility then it is easier for the defence to mark them closely and make tackles, intercept passes and keep them out of the game.



Rugby players need to have good agility in order to change direction quickly and avoid tackles from opposing players.

When is agility not important?

100 m sprinters do not have to change direction or worry about other players.

Improving agility

Sports performers can improve their agility by taking part in SPEED, AGILITY, QUICKNESS (SAQ) TRAINING. This involves lots of quick, explosive movements.

Worked example

Describe **one** example that shows why agility may be needed in a sport of your choice.

In netball, agility is required by the wing attack in order to dodge away from the wing defence and into space on a centre pass. If the player does not have good agility the defender will be able to keep up with them and is more likely to intercept a pass.



The question asks for an example. It is a good idea to choose a sport where there are obvious examples so that you can describe one well.



During the online test, you can use the 'review' button to go back and check your answers.



When explaining why agility is important, try to give specific examples of when it may be used in a game situation.



Explain why agility is important for a basketball (2 marks)

and the second s	Had a look Nearly ther	e Nai	led it! UNIT 1	l m A
	D CL L	ance	D.	
- <u> </u>	Balance is one of the five components of sk ability of a performer to maintain their cents	sill-related fitnes	ss and can be defined at	
	ability of a performer to maintain their centrused in all activities but there are some in	e of mass over	a base of support. Balance is	***********
1	used in all activities but there are some in w two types of balance.	vhich balance is	especially important. There are	j
· ,	······			
		Stati	c balance	
]				
}		STATIONARY	NCE is maintaining balance in a position. A gymnast uses statio	·
1		balance during	a handstand to hold their	<u> </u>
·•		position still.		
]				
Ì			·	-
))		;		************
	A handstand			
.	requires the use of static balance.			
1	Of Statio business	 L		
!				***************************************
	Dynamic balance	2		
<u>i</u>	DYNAMIC BALANCE is all about a			
	performer's ability to maintain balance while.		Dynamic balance	
	in MOTION; for example, a gymnast's ability		allows a gymnast "	
	to perform a controlled cartwheel or an	-11		
	athlete's ability to run without falling over.		during a cartwheel.	
	Worked example	1	,	***************************************
	Motken everifie		·	
	Which of the following is an array of the following is a followed in the following is a following is a followed in the followed in the following is a followed in the following is a followed in the following is a followed in the followed in the following is a followed in the followed in			
	Which of the following is an example of static balance:	? (1 mark)	In some activities it might not be obvious	
:	A A footballer dribbling a ball		why balance is	
:	B 🗸 A headstand		important. Think about	
	···	:	the activity from start	
·····	C A backflip		to finish. Is there a -	***************************************
· 	D A sprinter competing in the 100 m		most important?	~~~
				(C-2)
7. T A	low try this			
:	Look at the image, which shows an athlete in the discus			
	throw event.			
<u>:</u>	Give one example of why balance is important for			***************************************
<u>;</u>	this athlete. (1 mark)			
:				
;			10000000000000000000000000000000000000	

UNIT	1	
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Nearly there

Nailed it!

Coordination

Coordination is one of the five components of skill-related fitness and is the ability to use parts of the body together to move smoothly and accurately. Good coordination ensures that tasks are performed efficiently and accurately. There are three types of coordination.

Procession of the last of the

Hand-eye coordination

Good HAND-EYE COORDINATION is needed in lots of sports. For example, baseball players need to ensure that the bat and ball make contact.



Foot-eye coordination

Good FOOT-EYE COORDINATION is needed in football to allow the players to watch the ball move towards and away from their feet and keep it under control.

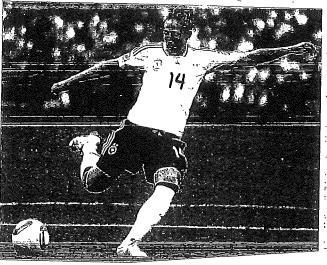


Hand-to-hand coordination

Good HAND_TO_HAND COORDINATION is needed by a basketball player to switch hands when dribbling the ball.

Poor coordination

Poor coordination reduces accuracy and can lead to mistakes that can cost vital points. It can also lead to injury during training.



Football players need excellent foot-eye coordination to keep the ball under control.

If a question asks you to 'explain', make sure you give specific examples to support the statement. Make it clear which body parts are working together.





Using a specific sports example, explain how poor coordination may increase the risk of injury.

(2 marks)

If a gymnast on the beam does not have good coordination they are more likely to misjudge where the beam is and get their foot/hand placement wrong. This increases the chance that they will fall off the beam and injure themselves.



Look at the netball player in the image below.

Give **one** example of when a netball player would use hand-eye coordination in their sport. (1 mark)



Power is one of the five comp		lower .				
strength at speed.	onents of skill-related fitness. Power is	s the ability to use				
In order to have power you mi						
have both STRENGTH and SPE		is important in lots of nt activities. Think of				
Calculating power Power can be calculated as follows: POWER = STRENGTH × SPE	activition explosion A good in bading did not	es that have lots of live movements in them. It describes the smash minton. If the player thave power, the shot be slower and much for the opposition to				
done in the time taken. So the faster or stronger a movement is, the more powerful it will be Physical or skill-related to have powerful you need to have coordination to direct and con	easier return. sprinte blocks in a jum smash shot. ted ve strength and speed, but also good itrol this power.	Other examples are a cr leaving the starting and a basketball player ap shot.				
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done in the time taken. So the faster or stronger a movement is, the more powerful it will be Physical or skill-related to be powerful you need to have coordination to direct and contact to the sure you understand how	easier return. sprinte blocks in a jum smash shot. ted ve strength and speed, but also good strol this power. vall of the components of fitness are Skill-related fitness To sho	Other examples are a releaving the starting and a basketball player up shot. I balance and related when you are ow your				
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done in the time taken. So the faster or stronger a movement is, the more powerful it will be Physical or skill-related to be powerful you need to have coordination to direct and consumed the sure you understand how revising this section. Physical fitness Aerobic endurance (page 1) Muscular endurance (page 2) Flexibility (page 3)	Badminton players use power in a successful smash shot. Ted ve strength and speed, but also good atrol this power. v all of the components of fitness are successful should be a successful smash shot. To should be a successful small should be a successful smash shot. The strength and speed, but also good strol this power. Vall of the components of fitness are successful small should be a successful sin a jum should be a successful small should be a successful should be a successful small should be a successful small should be a successful should be a succ	Other examples are a cr leaving the starting and a basketball player up shot. I balance and related when you are ow your estanding of all the conents of fitness, sure that you pply the theory pecific physical				
coordination to direct and con Make sure you understand how revising this section. Physical fitness Aerobic endurance (page I)	easier return. sprinte blocks in a jum smash shot. ted we strength and speed, but also good strol this power. all of the components of fitness are in Skill-related fitness Agility (page 6) Balance (page 7) Coordination (page 8) Power (this page) Power (this page) Resier return. sprinte blocks in a jum shocks in a	Other examples are a related when you are ow your restanding of all the ponents of fitness, sure that you apply the theory				

which an athlete would need power in their sport. Use a different sport for each example. (3 marks)

different	e>	'a	mŗ	ole	5.
•		٠		•••	٠

Now try this

1. A sprinter leaving the starting

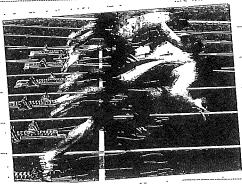
2. A high jumper at take-off

3. A shot putter releasing the shot

Lucy is a tennis player. She has been told that she needs to improve her power.

Using an example, explain why power is important to a tennis player. (2 marks)

Reaction time is one of the five components of skill-related fitness and refers to how quickly a sports performer can react or adapt.



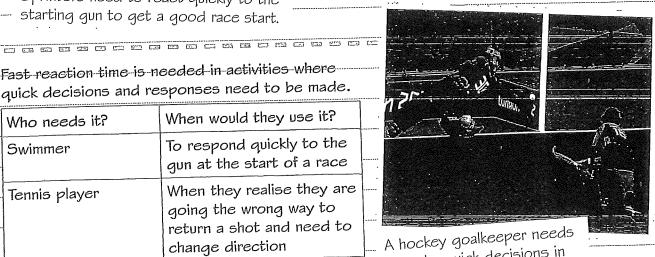
What is reaction time?

Reaction time is the time taken for a sports performer to respond to a stimulus and the mitiation of this response; for example, the time taken for a 100 m sprinter to hear the starter's gun and then leave their blocks. The shorter this period of time, the faster their reaction time.

Sprinters need to react quickly to the starting gun to get a good race start.

Fast reaction time is needed in activities where quick decisions and responses need to be made.

•		
	Who needs it?	When would they use it?
	Swimmer	To respond quickly to the gun at the start of a race
	Tennis player	When they realise they are going the wrong way to return a shot and need to change direction
	Hockey goalkeeper	To block shots accurately



to make quick decisions in order to block shots.

Worked example

For each performer, give one example of how they benefit from a fast reaction time.

(2 marks)

Performer	Why is having a fast reaction time important?		
Badminton player	To decide quickly on the type of return they will play and to initiate the required movement		
Netball player	Has three seconds to decide how to respond to any pass they receive		

Give **two** examples that demonstrate the importance of (2 marks) quick reaction times in cricket.



Think about two different playing positions and about when a player in each position might need to respond quickly.

The fitness component performers to meet the lt is important to cons	s covered on the physical are the asposition to use	n the previous paged of the previous paged of the previous paged of the previous that appropriate fitnes	CCESS IN SPORT ges are important for allowing nands of particular sports. t are required by different sports s training methods and tests that are mer.
What makes a p Look at the table below fitness in order to be s	v. It shows w	r successful? Thy certain perform	ners require certain aspects of
	Sports performer	Aspects of fitness	Why do they need it?
3	100 m sprinter	Speed, reaction time and power	Speed: to cover the distance as quickly as possible. Reaction time: to respond quickly to the starter's pistol. Power: to move powerfully out of the blocks to get a good start.
Don't forget that in some sports the different positions will have different requirements for successful participation!	Football striker	Speed and agility	Speed: to move quickly into position to receive the ball. They also need good speed endurance to be able to continue to move at speed throughout the game. Agility: to avoid defenders when in possession of the ball.
	Football goalkeeper	Reaction time and flexibility	Reaction time: to be able to get into position quickly to block shots made on the goal. Flexibility: to manipulate (by extending and bending) their bodies into positions to block shots made on the goal from all directions.
Worked example Which of the following as is least important to a box A Power	pects of fitness	No	
B Muscular endurance C Balance D Flexibility	in the arms		Identify one example when coordination is important to a squash player. (1 mark)

Exercise intensity:

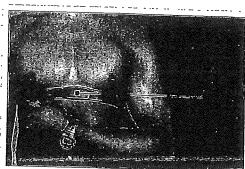
heart rate

Exercise intensity refers to how hard you are working during a training session. Measuring heart rate is one way of measuring exercise intensity.

Target heart rate

TARGET HEART RATE is the recommended maximum heart rate appropriate for a training zone or physical activity and is the most common method used for measuring exercise intensity. You need a different target heart rate depending on what you are trying to achieve. A target heart rate is the optimal heart rate you need to achieve in order to get specific training adaptations.

Heart rate can be measured manually by counting the pulse or by using a heart rate monitor.



Using a heart rate monitor to measure exercise intensity.

Why is intensity important?

It is important to get the intensity of your training correct. Training at the wrong intensity may not help to improve the element of fitness you are trying to develop. Training at too high an intensity can result in injury.

Key terms

You need to understand the following terms in relation to exercise intensity:

HEART RATE (HR): the number of times your heart beats per minute. It is measured in beats per minute (bpm).

RESTING HEART RATE: your heart rate at rest.

MAXIMUM HEART RATE (HRmax): the maximum recommended safe heart rate for an individual during exercise.

Calculating maximum heart rate

You need to be able to calculate your maximum heart rate as this will help you to work out your training zones and thresholds (see page 14).

In order to estimate your maximum heart rate, you need to use the following formula:

MAXIMUM = 220 - AGE HEART RATE

This means that if Bobby is 18 his maximum heart rate would be 202 bpm:

-220 - 18 = 202

Worked example

The table below shows the ages for three individuals.

Calculate their HRmax using this information. (3 marks)

Athlete	Age	HRmax
Rob	19	220 - 19 = 201
Nadeem	30	220 - 30 = 190
Aoife	54	220 - 54 = 166



Jane is a 33-year-old female athlete.

What is Jane's maximum heart rate (HRmax) in beats per minute (bpm)?

(2 marks)



Remember to show your workings when doing calculations. You'll be given a box to show your workings in the online test.

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	-		©	6	A	6	4		-

L'Aercise intensit Borg

Exercise intensity refers to how hard you are working in a training session. You need to be able to explain what the 'rating of perceived exertion' (RPE) scale measures, and how it can be used to measure exercise intensity and calculate heart rate.

The Borg Rating of Perceived Exertion	Rating of		
(RPE) scale	perceived exertion	Intensity	^
The Borg (RPE) scale measures a performer's rate of	6	No exertion	
perceived exertion – that is, how hard they think they	7		
are working.	8		
It is a scale from 6 to 20, where 6 is no exertion at all	9		
and 20 is maximum exertion.	10		
Alongside other physiological data it can be used to	11	Light	
estimate HEART RATE (HR) and therefore monitor if a	12		***************************************
person is in the correct training zone, i.e. if they are	13	Somewhat.hard	****
working at the appropriate intensity.	14		
It is generally agreed that ratings of perceived exertion	15	Hard (heavy)	
between I2 and I4 on the scale suggest that physical	16		
activity is being performed at a moderate level of	17	Very hard	
intensity. That would mean that AEROBIC ENDURANCE was being improved.	18		
was boild improved.	19,		
	20	Maximal exertion	e neza toto toto

Using the Borg (RPE) scale to predict heart rate

Instead of using a heart rate monitor, you can use the RPE scale to predict the exercise HR of an individual using the formula:

RPE × IO = HEART RATE (bpm)

If an athlete rates themselves at 14 on the RPE scale this would suggest a heart rate of approximately 140 bpm. This can help you to calculate training zones.

The Borg (1970) 6-20 RPE scale.

Example: Luca

Luca has been playing football for an hour. He rates his exercise intensity as 'hard' as he has been runnina a lot. He thinks he is at 15 on the Borg (RPE) scale.

This means that his exercise HR is:

 $15 \times 10 = 150 \, \text{bpm}$.

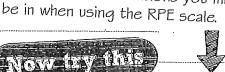
Think about the situations you might

Worked example

An individual reports an RPE of 13.

What is their approximate heart rate at this point?

(1 mark)



A | 120

B / 130

€ 140

D | 145

State one benefit of using the Borg (RPE) scale to assess perceived exertion and intensity. (1 mark)

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Learning aim	凰

Nearly there

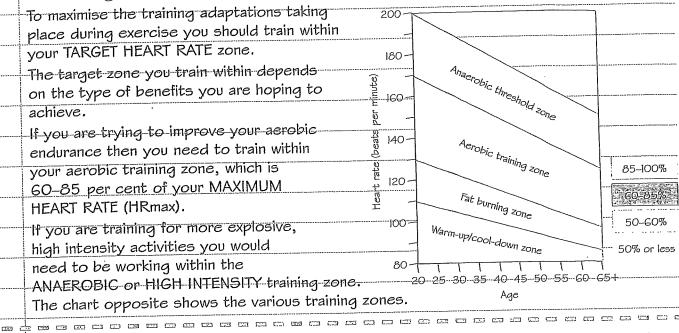
Nailed it!

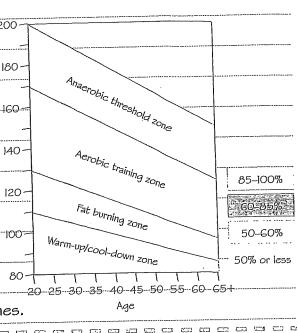
Exercise intensit

training zones

You will need to be able to explain and calculate training zones.

Training within your target zones





Calculating your target zones

Your target zones will depend on your age. You need to work out your maximum heart rate and then calculate 60-85 per cent of this total.

Always start with the figure 220.

220 - your age (or the age of the person who is doing the training) = HRmax

Calculate 60 per cent and 85 per cent of this total to give two figures.

These two figures are the two limits of your aerobic. training zone. Your heart-rate needs to stay within these limits to improve aerobic endurance.

Lucy is 15 years old. The calculation for her target zone is: 220 - 15 = 205 (HRmax)

 $60 \times 205 \div 100 = 123 (60\%)$

85 × 205 ÷ 100 = 174 (85%)

Therefore Lucy's aerobic training zone is between 123 and 174 bpm.

Keep practising calculations like these

and always check your workings!

Worked example

Nigel is 45 years old.

What is the upper limit of his aerobic training zone? (2 marks)

The upper limit of Nigel's aerobic training zone would be 149 bpm. This is because: $220 - 45 = 175 \, \text{bpm} \, (\text{HRmax})$ $85 \times 175 \div 100 = 149 \, \mathrm{bpm}$

Please show your calculations.

What would be the recommended training zone

for cardiovascular health and

fitness of a 16 year old? (2 marks)

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