



**МИНИСТЕРСТВО ОБРАЗОВАНИЯ  
РЕСПУБЛИКИ БЕЛАРУСЬ**

**Белорусский национальный  
технический университет**

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**Кафедра «Английский язык № 1»**

**Т. Е. Митьковец  
А. В. Муравьёва  
Е. В. Слесарёнок**

**ENGLISH FOR SPORTS ENGINEERING**  
**АНГЛИЙСКИЙ ДЛЯ СПОРТИВНОЙ ИНЖЕНЕРИИ**

**Пособие по английскому языку**

**Минск  
БНТУ  
2018**

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АНГЛИЙСКИЙ ДЛЯ СПОРТИВНОЙ ИНЖЕНЕРИИ

Пособие по английскому языку  
для студентов спортивно-технического факультета

*Рекомендовано учебно-методическим объединением по образованию  
в области техники физической культуры и спорта*

Минск  
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2018

УДК 811.111(075.85)  
ББК 81.2Англ.я7  
М66

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**Митьковец, Т. Е.**

М66

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Пособие по английскому языку предназначено для студентов спортивно-технического факультета и направлено на формирование навыков и умений устной речи, а также на расширение словарного запаса спортивной тематики. Основными целями данного пособия являются: формирование у студентов навыков понимания оригинального англоязычного текста; последующее развитие умений построения собственных монологических и диалогических высказываний.

Издание включает основной материал, дополнительные тексты для самостоятельной вне-аудиторной работы и глоссарий. Разнообразные задания пособия направлены на активизацию словарного запаса студентов, актуализацию их знаний по теме занятия.

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# Unit 1

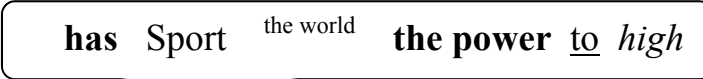
## Sport Is Great

### Lead in

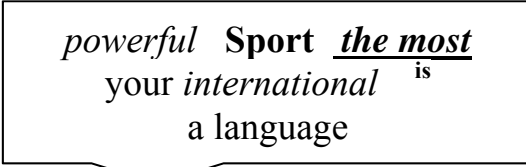
#### 1. Answer the following questions.

1. Are you good at sport?
2. Do you enjoy playing or watching sport? Why?
3. Do you think all young people should play a sport?
4. Do you wear any special clothes to play your favorite sport?
5. Do you know anyone who makes a living out of sport?
6. Which sports are most popular in your country?

#### 2. There are four word clouds below. Rearrange each set of words to form a statement about sport. In each sentence there is an extra word. Identify each of the unused words.

a.  has Sport the world the power to high

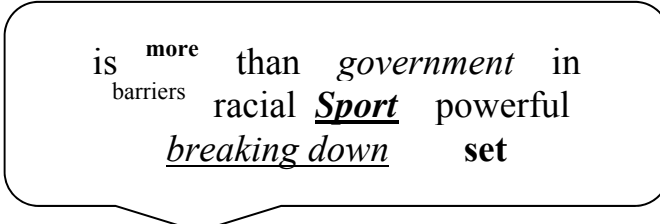
Extra word: ...

b.  powerful Sport the most is your international a language

Extra word: ...

c.  to inspire goals Sport the power has

Extra word: ...

d.  is <sup>more</sup> than government in <sub>barriers</sub> racial Sport powerful breaking down set

Extra word: ...

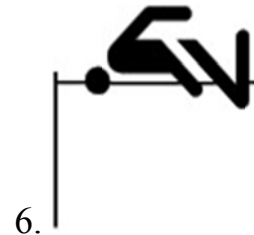
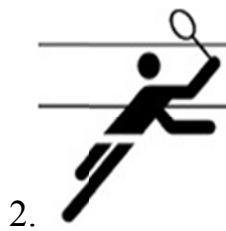
Can you make one last sentence from all the extra words?

#### 3. What do you think about the following statement? Share your thoughts with the rest of the group.

*Sport plays a crucial role in international relations and it makes the world a better place to live.*

4. Write *ten* sentences about the importance of sport on an individual level and in an international context.

5. Work with a partner to label the names of sport.



6. Identify the names of sport that match the descriptions below.

1. \_\_\_\_\_, a game played by two teams. Each team usually have six players, who wear skates and compete on an ice rink. The object is to propel a vulcanized rubber disk, the puck, past a goal line and into a net guarded by a goaltender, or goalie.

2. \_\_\_\_\_, a game in which two teams of 11 players, using any part of their bodies except their hands and arms, try to maneuver the ball into the opposing team's goal. Only the goalkeeper is permitted to handle the ball and may do so only within the penalty area surrounding the goal.

3. \_\_\_\_\_, a game in which two opposing players (singles) or pairs of players (doubles) use tautly strung rackets to hit a ball of specified size, weight, and bounce over a net on a rectangular court. Points are awarded to a player or team whenever the opponent fails to correctly return the ball within the prescribed dimensions of the court.

4. \_\_\_\_\_, a sport in athletics in which an athlete jumps over an obstacle with the aid of a pole.

5. \_\_\_\_\_, a court or lawn game played with lightweight rackets and a shuttlecock.

6. \_\_\_\_\_, a cross-country game in which a player strikes a small ball with various clubs from a series of starting points (teeing grounds) into a series of holes on a course. The player who holes his ball in the fewest strokes wins.

7. \_\_\_\_\_, the sport of riding breaking waves toward the shore, especially by means of a surfboard.

8. \_\_\_\_\_, a game played with a bat, a ball, and gloves between two teams of nine players each on a field with four white bases laid out in a diamond (i.e., a square oriented so that its diagonal line is vertical). Teams alternate positions as batters (offense) and fielders (defense), exchanging places when three members of the batting team are 'put out'. As batters, players try to hit the ball out of the reach of the fielding team and make a complete circuit around the bases for a 'run'. The team that scores the most runs in nine innings (times at bat) wins the game.

9. \_\_\_\_\_, a ball game similar in principle to lawn tennis and played on a flat table divided into two equal courts by a net fixed across its width at the middle. The object is to hit the ball so that it goes over the net and bounces on the opponent's half of the table in such a way that the opponent cannot reach it or return it correctly. The lightweight hollow ball is propelled back and forth across the net by small rackets (bats, or paddles) held by the players. The game is popular all over the world.

**7. Complete the table using the words from exercise 5.**

Sport	People	Places	Equipment
1.			
2.			
3.			
...			

**8. Complete each sentence with a word from the box.**

<b>bat</b>	<b>brush</b>	<b>bat</b>	<b>club</b>	<b>pole</b>
<b>racket</b>		<b>racket</b>	<b>cue</b>	<b>stick</b>
				<b>paddle</b>

- Tennis players hit the ball with a tennis \_\_\_\_\_.
- Cricketers hit the ball with a cricket \_\_\_\_\_.
- Pool players hit the ball with a pool \_\_\_\_\_.
- Hockey players hit the ball with a hockey \_\_\_\_\_.
- Golfers hit the ball with a golf \_\_\_\_\_.
- Table tennis players hit the ball with a table tennis \_\_\_\_\_.
- Baseball players hit the ball with a baseball \_\_\_\_\_.
- Badminton players hit the shuttlecock with a badminton \_\_\_\_\_.
- Pole vaulters attempt to vault over a high bar with the aid of a long \_\_\_\_\_.
- Curlers sweep the ice in front of their team's stones to melt the ice slightly using a curling \_\_\_\_\_.

**9. Complete each sentence with a word from the box.**

<b>boots</b>	<b>cap</b>	<b>helmet</b>	<b>ice skates</b>	<b>kneepads</b>	<b>pads</b>
<b>parachute</b>		<b>spikes</b>	<b>tanks</b>	<b>wetsuit</b>	

1. Soccer players wear football \_\_\_\_\_ when they play.
2. American footballers wear shoulder \_\_\_\_\_ when they play.
3. Baseball players wear a baseball \_\_\_\_\_ when they play.
4. Scuba divers wear oxygen \_\_\_\_\_ when they dive.
5. Runners wear running \_\_\_\_\_ when they race.
6. Motorcyclists wear a \_\_\_\_\_ when they ride.
7. Surfers wear a \_\_\_\_\_ when they surf.
8. Ice hockey players wear \_\_\_\_\_ when they play.
9. Skateboarders wear \_\_\_\_\_ when they skate.
10. Skydivers wear a \_\_\_\_\_ when they jump.

**10. Complete each sentence with a word from the box.**

<b>course</b>	<b>diamond</b>	<b>field</b>	<b>green</b>	<b>ground</b>
<b>pitch</b>	<b>sheet</b>	<b>rink</b>	<b>table</b>	<b>court</b>
				<b>lawn</b>

1. Soccer is played on a soccer \_\_\_\_\_ .
2. American football is played on a football \_\_\_\_\_ .
3. Tennis is played on a tennis \_\_\_\_\_ .
4. Golf is played on a golf \_\_\_\_\_ .
5. Baseball is played on a baseball \_\_\_\_\_ .
6. Cricket is played on a cricket \_\_\_\_\_ .
7. Lawn bowls is played on a bowling \_\_\_\_\_ .
8. Ice hockey is played on an ice hockey \_\_\_\_\_ .
9. Snooker is played on a snooker \_\_\_\_\_ .
10. Croquet is played on a croquet \_\_\_\_\_ .
11. Curling is played on a \_\_\_\_\_ of ice.

***Speaking Activity***

**11. Prepare a short presentation about a sport of your choice. Your presentation should be about 5 minutes long and could include information mentioned below.**

- where the sport is popular;
- what the rules are;
- what equipment you need to play the sport;
- the history of the sport.

**Use the Internet and include images and video to make your presentation as interesting as possible.**

**If you are not a fan of conventional sport, choose one which is less well known. You could even create your own kind of game / sport.**

## Grammar Spot

We usually use the **Past Simple** for completed events or actions. We often include a time reference.

*Example: Andy Murray **became** the first British tennis player to be crowned world number one **yesterday when** his semi-final opponent in Paris **had** trouble getting out of bed.*

We use the **Present Perfect** for:

1. life experiences in the past. We don't say when these happened: we are interested in the experience, not the time or date.
2. recent past actions that are important now.
3. situations that started in the past and are continuing now – unfinished actions, states and time periods (*How long...?; for, since*)

*Example: British tennis star Andy Murray **has** achieved one of his biggest successes by reaching the world number one ranking. Jürgen Klopp **has** managed Liverpool since 2015.*

**12. Complete the text with the Past Simple and Present Perfect form of the verbs in brackets.**

### Manchester United

The club was founded back in 1878 and <sup>1</sup> \_\_\_\_\_ (*have*) a successful history. It <sup>2</sup> \_\_\_\_\_ (*win*) the English championship twenty times (two more than closest rivals Liverpool, who were last crowned champions way back in 1990) and the European Champions' League (previously the European Cup) three times. A well-known tragedy in United's history was when many of their best players <sup>3</sup> \_\_\_\_\_ (*die*) in a plane crash in Munich, Germany, in 1958. It seemed the club might not recover, but ten years later, in 1968, they <sup>4</sup> \_\_\_\_\_ (*become*) the first English team to win the European Cup.

United were not so good in the 1970's and 80's but <sup>5</sup> \_\_\_\_\_ (*be*) very successful again since the 1990's under their Scottish manager Alex Ferguson. In the 1990's the best players <sup>6</sup> \_\_\_\_\_ (*include*) Eric Cantona, a Frenchman who was very popular with the fans, and David Beckham, who even people who hate football <sup>7</sup> \_\_\_\_\_ (*hear of*). Now United's best players are perhaps Wayne Rooney, Zlatan Ibrahimovic, David De Gea.

**13. Here are some simple definitions for words that appear in the text above. Find the words they refer to and fill in the gaps.**

1. ch \_ \_ \_ \_ o \_ \_ \_ \_ p – a competition to find the best player or team in a sport or game.

2. \_ \_ n – someone who likes watching or listening to something such as sport, films, or music very much.



3. \_ u \_ – a sports competition in which the prize is large metal cup.  
 4. \_ \_ cc \_ ss \_ \_ \_ – having achieved a lot, become popular, and / or made a lot of money.

**14. In the following task you will use a text about a famous sportsperson, Lionel Messi. All the words and phrases in the word cloud below will appear in the text. Look at the word cloud.**

- Try to write a sentence using the words and phrases.
- Are there any words or phrases you don't know the meaning of?

**was born**    one match    *he*    Messi    **needed**    *growth*

*hormone deficiency*    **only lost**    *in 1987*    **became**    and    **won**

**started playing**    *in Argentina*    *a Spanish citizen*    **moved to**

**moved to Spain**    *another youth team*    *he*    *his first FIFA Ballon d'Or*

*When he was 11*    Messi    **is involved**

Barcelona Football Club    Messi    By 2005

**was diagnosed with**    *for his local club*    **he**    was playing

*he*    *at five*    expensive treatment    *In 2010*    *in charitable work*

*in 1995*    his team    *for his medical bills*

**for** FC Barcelona's first team

**continues**    *he*    **to go from strength to strength**

**agreed to pay**    Messi    *to enroll in* **their youth academy**

1. Possible sentence(s)	2. Words / phrases I don't know

**15. Read the text. Check whether your sentences are true.**

*Many people around the globe think that Lionel Messi is the greatest player in the history of football. What makes him special?*

Messi was born in Argentina in 1987. He started playing for his local club at five and moved to another youth team, Newell's Old Boys, in 1995. In the next four years, his team only lost one match!

When he was 11, Messi was diagnosed with growth hormone deficiency and needed expensive treatment.

Barcelona Football Club agreed to pay for his medical bills if he moved to Spain to enroll in their youth academy, so Messi did just that. By 2005, Messi was playing for FC Barcelona's first team, became a Spanish citizen and also made his debut with the Argentina team. In 2010 he won his first FIFA Ballon d'Or (he has won three more since) and he continues to go from strength to strength. Messi is heavily involved in charitable work, establishing a foundation that helps vulnerable children (particularly in Argentina) receive education and health care. He has also been a goodwill ambassador for UNICEF since 2010.

**16. Match each idiom (1–7) to its definition (a–g).**

Idiom	Definition
1) against all odds	a) someone or something that is only good for one particular purpose, or at doing one particular thing
2) to give it your best shot	b) to stop trying to do something because you do not think you can succeed
3) to give someone a run for their money	c) you succeed although you were not likely to; despite difficulties or a low probability
4) to win hands down	d) to try your hardest; put in a lot of effort
5) to throw in the towel	e) to try hard to defeat someone and make it difficult for them to win
6) to be a one trick pony	f) it is your responsibility or decision to do something about a situation; It is up to you to make the next move
7) the ball is in your court	g) to win very easily

**17. Use the idioms you have just learnt to fill in the gaps.**

1. Argentina is not \_\_\_\_\_ and has many strong attacking options besides Messi.

2. \_\_\_\_\_ Barcelona miraculously reached the quarter-finals of the Champions League.

3. Many people around the globe feel that nobody can hold a candle to Messi and he is the greatest player of this era. There are others, however, who believe Cristiano Ronaldo \_\_\_\_\_ Messi \_\_\_\_\_ and even tops him.

4. According to the Office for National Statistics, 11 babies were called 'Ronaldo' last year while only 4 were given the name 'Messi'. And CR7 (Cristiano Ronaldo 7 (shirt number)) \_\_\_\_\_.

5. From an early age my coach instilled in me: 'Whatever you do, \_\_\_\_\_ and you give yourself the best chance to succeed.'

6. Cristiano Ronaldo refuses to \_\_\_\_\_ in the race for the Liga title.

7. 'We have put forward our plans and proposals. Now \_\_\_\_\_ it is up to you what happens next.'

**18. Find more information about Lionel Messi. Write a magazine article about the famous player, his experiences and achievements. Include an imaginary interview with him. Try to use the idioms you have learned.**

## Unit 2

### Evolution Is Great

*You can't put a limit on anything. The more you dream, the farther you get.  
Michael Phelps*

**1. Identify the main material in items of sports equipment 1–7. Tick the material used. More than one answer is possible in some cases.**

1) football	<ul style="list-style-type: none"> <li>– polyurethane</li> <li>– nylon</li> <li>– leather</li> <li>– plastics</li> </ul>
2) vaulting pole	<ul style="list-style-type: none"> <li>– carbon fibre</li> <li>– fibreglass</li> <li>– kevlar</li> <li>– magnesium</li> </ul>
3) canoe	<ul style="list-style-type: none"> <li>– wood</li> <li>– aluminium</li> <li>– fibreglass</li> <li>– canvas</li> </ul>
4) tennis racket	<ul style="list-style-type: none"> <li>– wood</li> <li>– graphite composites</li> <li>– titanium</li> <li>– rubber</li> </ul>
5) bicycle frame	<ul style="list-style-type: none"> <li>– steel</li> <li>– aluminium</li> <li>– titanium</li> <li>– polyester</li> </ul>
6) surfboard	<ul style="list-style-type: none"> <li>– plastics</li> <li>– wood</li> <li>– carbon fibre</li> <li>– iron</li> </ul>
7) ice skates	<ul style="list-style-type: none"> <li>– steel</li> <li>– animal bones</li> <li>– leather</li> <li>– nylon</li> </ul>

## Grammar Spot

THE PASSIVE	Be <sup>(not)</sup> + Past Participle (V <sub>3</sub> )
Present Simple: <b>am / is / are + V<sub>3</sub></b>	Some polymers <b>are known</b> generally by their DuPont trade name.
Past Simple: <b>was / were + V<sub>3</sub></b>	Most polymers <b>were developed</b> by large chemical companies, the most prominent of which was DuPont.
Present Continuous: <b>am / is / are being + V<sub>3</sub></b>	Computer technology <b>is being used</b> to design sports equipment from Formula-one cars to golf clubs and training shoes.
Past Continuous: <b>was / were being + V<sub>3</sub></b>	During the 1890's, aluminium <b>was being used</b> for putters, and later for whole set of clubs.
Present Perfect: <b>Have / has been + V<sub>3</sub></b>	Since 1970's, composites <b>have been</b> increasingly <b>utilized</b> in sporting equipment, such as skis and tennis racquets.
Future: <b>Will be + V<sub>3</sub></b>	A final decision to use the technology (video assistance referees) <b>will be made</b> after a thorough period of testing.
Modal Passive: <b>can / should / ...be + V<sub>3</sub></b>	GPS technology and accelerometers can be used to predict the risk of both contact and non-contact injuries.
<b>QUESTIONS</b>	<b><i>Change word order</i></b> – When and where <b>was</b> Messi <b>born</b> ?

**2. Write sentences about materials used to make the items of sports equipment mentioned in exercise 1.**

*Example: The first ice skates were made from animal bones.*

*Today the boots are usually made from leather and the blade from steel.*

**3. Work in pairs.**

**Student A** should read the texts about different materials used in sports equipment.

**Student B** should read the texts on page 20, exercise 18.

**Ask your partner questions to complete the missing information in your parts of the text.**

*Student A*

1. \_\_\_\_\_ (*what?*) was the first championship without a leather ball. Since then, footballs have been made of \_\_\_\_\_. (*what?*) – a type of plastic created \_\_\_\_\_ (*when?*) by German chemist Otto Bayer. With this material, modern balls are lighter and absorb less water when it rains because \_\_\_\_\_. (*why?*). Also, the balls do not dent when hit by players.

2. Pole vaulting is derived from the Dutch habit of dyke jumping, where men used long poles to cross canals. Poles were originally made from solid hickory wood but it was found that bamboo was much lighter and more flexible and so for many years this became the norm. Modern poles are constructed from layers of carbon and glass fibres embedded in a polymer (epoxy) resin. The fibres can be oriented to give maximum flexibility whilst maintaining sufficient strength.

3. Canoe – the earliest were made from \_\_\_\_\_ (*what?*). Wood and canvas canoes were developed and are still produced in a range of construction modes. Aluminium canoes were developed \_\_\_\_\_ (*when?*) as they were lighter and stronger than wood technology allowed at the time. Synthetic canoes are usually made from \_\_\_\_\_ (*what?*). Whitewater canoes are often made from polyethylene as \_\_\_\_\_ (*why?*).

4. Tennis racquets were originally made from solid wood (ash, maple or okume). Aluminium racquets were introduced in the 1970's and these offered increased stiffness and reduced mass. Modern racquets are made from carbon fibres embedded in an epoxy resin matrix and offer a considerable weight saving over both wooden and aluminium frames. The woven nature of the carbon fibres allows layers to be built up to give strength and stiffness where they are most needed.

5. \_\_\_\_\_ (*when?*) bicycles were made from wood and the ride was often very uncomfortable. The invention of pneumatic tyres in \_\_\_\_\_ (*when?*) by Thomson (they were reinvented by \_\_\_\_\_ (*what?*) in 1888) and the introduction of iron in the 1860's allowed designs to be improved and the bicycle became a viable mode of transport for all. In the 1890's T I Reynolds started producing relatively lightweight frames from steel rather than iron, but after this few major advances in materials were made until after the Second World War when \_\_\_\_\_ (*what?*) were introduced. \_\_\_\_\_ (*what?*) are made from a variety of materials: from steel and aluminium to carbon fibre and titanium.

6. Originally, surfboards were made from wood. Fibreglass began to be used in the late 1940's and plastics and Styrofoam during the 1950's. Boards were often made using a combination of these materials. Modern surfboards still use these materials though carbon fibre has recently been used to enhance boards.

**How many examples of the passive can you find? Which tenses are used?**

**4. Choose the correct options to obtain a logical and grammatically correct text.**

Titanium *is used* / *used* / *was used* for artificial knee and hip joints because it is so tough, but now scientists have come up with something even better. A super-hard metal *has made* / *has been made* / *have been made* in the laboratory by melting together titanium and gold.

This lab-made metal is four times harder than titanium. It is now the hardest known metallic substance that *was being used / can used / can be used* for implants in humans, according to a new study.

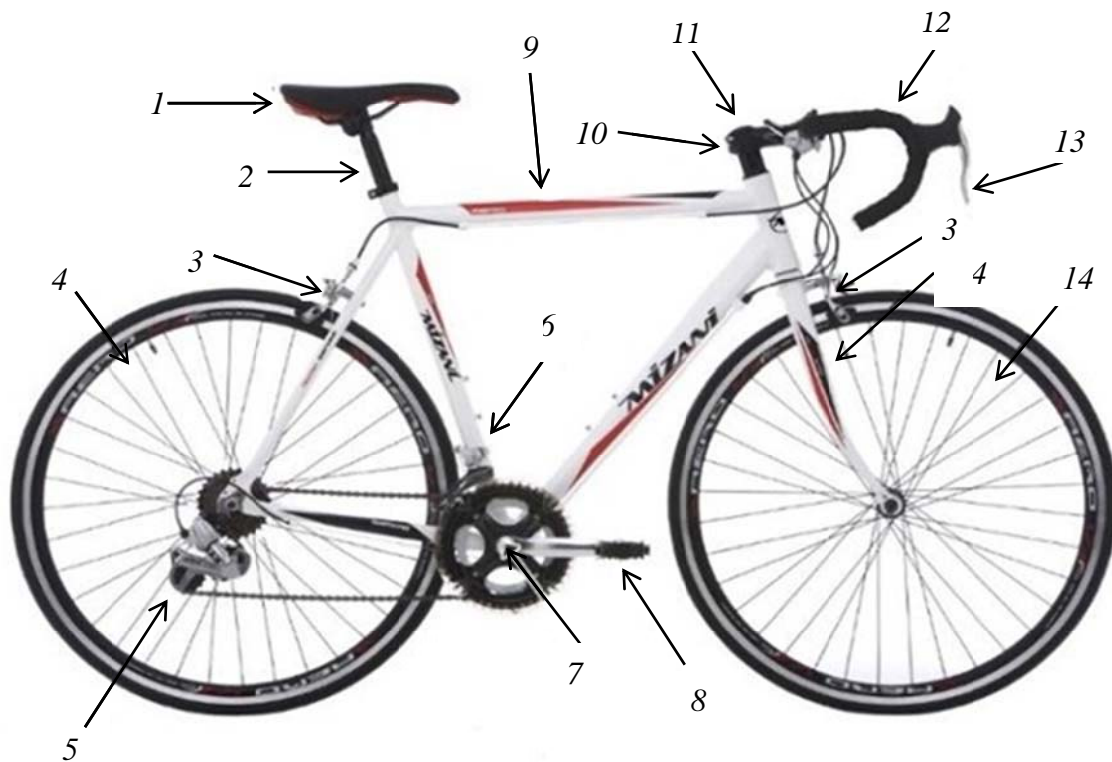
Titanium is one of the few metals that human bones are able to grow solidly around, but implants usually have to *be replace / be replaced / replace* after around ten years.

Because of its incredible durability, and the fact that it is easy to make, the new metal *could be used / couldn't be used / could use* to produce knee and hip implants that last much longer, potentially forever. It is may also have applications in the drilling industry, the sporting goods industry and many other potential fields.

The super-tough substance is a 3-to-1 mixture of titanium and gold. It *is being combined / is combined / combined* at very high temperatures in a process called arc melting. When it *will be formed / be formed / is formed* at lower temperatures, the alloy is about as tough as titanium, says the study.

### 5. Label the parts of a bicycle.

brakes	handlebar	pedals	frame	saddle
wheel	fork headset	stem	seat post	
front derailleur			shifters / brake levers	



1. ...	8. ...
2. ...	9. ...
3. ...	10. ...
4. ... includes rim, spokes and hub	11. ...
5. rear derailleur	12. ...
6. ...	13. ...
7. crank set / bottom bracket	14. ...

**6. Fill in each gap (1–11) by writing one appropriate word that matches the corresponding definition (A–K) below the text.**

### What makes a bike

A bike is not a simple toy. It is a means of transportation, a complex piece of machinery that has evolved over a hundred years. Today there are many types of bikes to suit all users and all purposes. A basic geared bike with no accessories consists of over a thousand pieces. As well as the <sup>1</sup> \_\_\_\_\_ and forks amongst the parts going into our bike are the <sup>2</sup> \_\_\_\_\_ handlebars, wheels, <sup>3</sup> \_\_\_\_\_ (plural), inner tubes, <sup>4</sup> \_\_\_\_\_, <sup>5</sup> \_\_\_\_\_, headset, bottom bracket, <sup>6</sup> \_\_\_\_\_, derailleurs (front and rear), chain, brake arms and springs, <sup>7</sup> \_\_\_\_\_, <sup>8</sup> \_\_\_\_\_ (and clamp) and more. Some of these parts are in turn made from many other smaller parts, and this is just for a basic bike.

Let's consider just one of these for a moment: the bicycle wheel. What an incredible invention. Light, strong and versatile. A wheel consists of a <sup>9</sup> \_\_\_\_\_, a number of <sup>10</sup> \_\_\_\_\_, a <sup>11</sup> \_\_\_\_\_.

A. the central structure of a bike, to which everything else is attached; the material of this part impacts on the overall weight of the bike, with carbon being very light and steel fairly hefty;

B. what your handlebars are attached to;

C. the rubber tube that fits around a wheel, accompanied by an inner tube inflated with air;

D. handlebar-mounted controls for activating the brakes;

E. levers mounted on the handlebars which are used to change gear;

F. where the feet are positioned on a bicycle;

G. the part of the bike you sit on; it's crucial to get the right one to make sure cycling is a comfortable experience for you;

H. a component which fits into the seat tube and has a clamp on the top to hold the saddle. It can be set at different heights to get your bike fit right;

I. the central part of a bicycle wheel joined to the rim by spokes;

J. thin metal struts which join the wheel rim and hub;

K. the circle of metal around the outside of a bicycle wheel connected to the hub with spokes.



## 7. Match a bike type with its description.

1. City comfort bikes...	a) have very skinny tyres – and skinny just about everything else for that matter! They are built for going as quickly as possible on the tarmac, but sometimes sacrifice comfort to do this.
2. Racing bikes...	b) are pretty much mountain style bikes but kitted with slick tyres and often enclosed hub gears. Very fast on road but comfortable too. Great for commuting.
3. Touring bikes...	c) have knobbly tyres and a wide range of gears to cope with riding off-road on paths and rough tracks. Their strong frames and comfy upright riding positions mean they are also good for commuting and general riding.
4. Mountain bikes...	d) look superficially similar to racing bikes, but are generally a bit more solidly built. They are designed for that round-the-world epic you dream about, and have a wide range of gears and plenty of places to put the piles of luggage.
5. Tandems...	e) are newer variations of the typical mountain bike. Smaller frames and less gears, designed for riding over obstacles (BikeTrials) and also designed for jumping earthwork courses sometimes racing head to head with another rider.
6. Trials / Dirt Jump...	f) are bikes made for two (or more) people.

## 8. Answer the following questions.

1. How old were you when you learned to ride a bike?
2. What's your bike like? How often do you cycle?
3. What's the purpose of your trips:
  - cycling for transport – such as to work or the shops;
  - cycling for leisure – such as along local cycle paths, forest routes or mountain biking;
  - or cycling for competition – such as road or off-road racing?
4. Which bike best suits your individual requirements?

## 9. Match the characteristics of materials with their definitions.

1. strength	a) refers to how well a substance can withstand damage caused by oxidization or other chemical reactions
2. weight	b) amount of force needed to change the shape of a material, opposite to flexible
3. stiffness	c) the ability to withstand wear, pressure, or damage
4. corrosion resistance	d) the amount of force required to crack, break or permanently deform a material
5. durability	e) the amount that something or someone weighs measured in units such as kilograms, pounds, or tons
6. cost	f) the amount of money needed to buy, do, or make something

## 10. Read the article and correct the information in the table.

	<i>Steel</i>	<i>Aluminium</i>	<i>Carbon</i>	<i>Titanium</i>
<b>Weight</b>	light	lightest	light	heavy
<b>Strength</b>	better	good	best	good
<b>Durability</b>	superior	good	very good	good
<b>Cost</b>	medium	lowest	high	highest

Bikes can be made from all sorts of different materials, from less common metals like magnesium all the way down to wood or bamboo. But in the current market there are four materials that are by far the most popular: carbon fibre, aluminium, steel and titanium. All four of these have different properties and will give you a bike with a different feel to the others.

**Carbon fibre.** There are a few reasons why carbon fibre has become by far the most popular material for a performance road bike, but the central one is strength-to-weight ratio.

Carbon is incredibly light, which is how brands like *Cervélo* and *Trek* have managed to create frames that weigh under 700g, but strong enough that these bikes can actually be ridden to their limits in the toughest races in the world, not slowly down to the shops taking care to avoid potholes.

But it's comparatively brittle, as you'd find out if you hit your toptube with a hammer (we can't emphasise enough how much you shouldn't ever consider doing this). Where metal will dent, carbon will crack and render your pride and joy totally unusable.

Carbon has also allowed designers to be much more creative with their designs. With carbon, you can make large, aerodynamically shaped tubes and not worry about weight, because it's so light.

So if carbon fibre is light, stiff, and versatile, why would you choose anything else? It's not cheap – although it has become significantly more affordable in recent years.

**Steel.** For a long time, steel was pretty much the only option for a bike frame. Other materials were either in their infancy or yet to be used for frame building, and the strength and durability of steel means its minimal fuss in maintenance terms.

Steel is isotropic meaning that it's equally strong in every direction without any special treatment. The beauty of this is that it means a steel frame can be very strong in a riding sense, but also highly durable when it comes to general wear and tear or crashes. Steel will bend rather than snap, a real plus in longevity terms and its ability to survive crashes.

The most obvious downside of steel is weight. If you get a steel frame and a carbon frame in the same size, the steel one will almost always be heavier. This is why steel has pretty much disappeared as a material for performance bikes at the highest level.

Another advantage steel has is in comfort. Steel has a bit more of a spring in it than aluminium – the ride will be less harsh.

While steel bikes are far less prevalent than they used to be, it is still a viable and popular material, particularly for commuting, winter training and touring bikes, thanks to its strength, ride quality and durability.

**Aluminium.** Aluminium is popular because although it's not as strong as steel, it has a better strength to weight ratio, meaning you can build a lighter frame. It's also a very rigid material, meaning it can build into a nice, stiff, responsive frame. Another bonus of alu is that it's cheap.

Similar to its metallic cousins, titanium and steel, another of aluminium's excellent properties is durability and ease of repair. While not being in the same league as steel when it comes towards durability, which in turn isn't as durable as titanium, aluminium is still ahead of carbon in the fact that it can bend and dent rather than shatter or snap. It's for this reason that aluminium is still a popular choice with amateur racers.

Aluminium can feel rather harsh to ride, though – it is very stiff, but the newer good alloys are addressing this problem.

While many riders are drawn towards carbon fibre if they have around £1,000–2,000 in their pockets, don't write off aluminium. A top-end alloy frame can often be lighter than an entry-level carbon one, with a more responsive ride. Plus you'll have some money left in your pockets to upgrade other components.

**Titanium.** The first and most notable drawback with titanium is cost. It might be the main factor that's stopped titanium breaking through as a mass-market material, because in many other ways it's a great choice for a bike frame.

Where titanium takes a step ahead of steel is in weight. It's light, but not the lightest, but what titanium has over carbon and aluminium is durability (said to be twice that of steel) and damping. The reason that most *ti* frames aren't painted is that they don't have to be, as the material naturally resists the corrosion that other materials suffer from and it doesn't rust either. Similarly, they're far easier to repair than carbon frames.

Titanium does an excellent job of minimising vibrations as the metal has a lot of natural shock absorption.

**11. Steel, aluminium, carbon fibre, and titanium each have their pros and cons. Complete the following sweeping generalization with words from the box.**

titanium	harsh	steel	durable	carbon fibre
aluminium		heavy	delicate	expensive

The material your bike is made of is partly dependent on price: the cheapest bikes are made of <sup>1</sup>\_\_\_\_\_, mid-range ones are made of <sup>2</sup>\_\_\_\_\_, and top-end bikes are made of <sup>3</sup>\_\_\_\_\_ – or occasionally <sup>4</sup>\_\_\_\_\_. So is what enthusiasts will tell you about each material: that steel is sturdy, long-lasting but very <sup>5</sup>\_\_\_\_\_; that aluminium is light but <sup>6</sup>\_\_\_\_\_; that titanium is strong <sup>7</sup>\_\_\_\_\_ but very <sup>8</sup>\_\_\_\_\_; and that carbon fibre is light, strong, stiff but <sup>9</sup>\_\_\_\_\_.

**12. What about something more exotic? Find out about one more material used to build bike frames, e. g. *Magnesium*, its properties, the pros and cons of making bikes out of it. Compare it with the materials described above. What is your verdict? Explain why.**

**13. Complete the table with the advantages and disadvantages of the materials mentioned in the article of exercises 10 and 12.**

<i>Material</i>	<i>Advantages</i>	<i>Disadvantages</i>
<i>Steel</i>		
<i>Aluminium</i>		
<i>Carbon fibre</i>		
<i>Titanium</i>		
<i>Magnesium</i>		

**14. Complete the following table.**

	<i>Noun</i>	<i>Adjective</i>
1.	rigidity	rigid
2.	durability	
3.		stiff
4.	corrosion	
5.		strong
6.	comfort	
7.	harshness	
8.	lightness	

**15. Compare the materials described in the unit by writing *ten* sentences using adjectives from the table above.**

*Examples: Carbon fiber frames are generally more rigid than other materials.  
Titanium is about 50% heavier and stiffer than aluminium.*

**16. Answer the following questions.**

1. What is the best material to use in building a bicycle frame – steel, aluminum, titanium, carbon fiber or magnesium? Explain why.
2. What will your next bike be made out of?

**17. Complete the table with your own ideas.**

### Why should we cycle?

<i>...because a bicycle is good for our health...</i>	<i>...because a bicycle is good for our wallet...</i>	<i>...because a bicycle is good for our world...</i>
<ul style="list-style-type: none"> <li>– reduces the risk of heart disease;</li> <li>– about twice as fast as a car during rush-hours;</li> <li>– ...</li> </ul>	<ul style="list-style-type: none"> <li>– can be parked just about anywhere, so no parking bills;</li> <li>– ...</li> <li>– ...</li> </ul>	<ul style="list-style-type: none"> <li>– produces no pollution;</li> <li>– ...</li> <li>– ...</li> <li>– ...</li> </ul>

***Work in pairs. Additional material.***

**\*18. Discuss benefits of bikes with your partner.**

*Student B*

1. The EURO 1988 in Germany was the first championship without a leather ball. Since then, footballs have been made of polyurethane – a type of plastic created in 1937 by German chemist Otto Bayer. With this material, modern balls are lighter and absorb less water when it rains because the patterns on the surface are bonded, not sewn. Also, the balls do not dent when hit by players.

2. Pole vaulting is derived from the Dutch habit of dyke jumping, where men used long poles to cross canals. Poles were originally made from \_\_\_\_\_ (*what?*) but it was found that bamboo was much lighter and more flexible and so for many years this became the norm. Modern poles are constructed from layers of \_\_\_\_\_ (*what?*). \_\_\_\_\_ (*what?*) can be oriented to give maximum flexibility whilst maintaining sufficient strength.

3. Wood and canvas canoes were developed and are still produced in a range of construction modes. Aluminium canoes were developed around the end of the second world war as they were lighter and stronger than wood technology allowed at the time. Synthetic canoes are usually made from fibreglass, Kevlar and carbon fibre. Whitewater canoes are often made from polyethylene as it has an excellent resistance to abrasion.

4. \_\_\_\_\_ (*what?*) were originally made from solid wood (ash, maple or okume). Aluminium racquets were introduced in the \_\_\_\_\_ (*when?*) and these offered \_\_\_\_\_ (*what?*). Modern racquets are made from \_\_\_\_\_ (*what?*) embedded in an epoxy resin matrix and offer a considerable weight saving over both wooden and aluminium frames. The woven nature of the carbon fibres allows layers to be built up to give strength and stiffness where they are most needed.

5. In the early days bicycles were made from wood and the ride was often very uncomfortable. The invention of pneumatic tyres in 1846 by Thomson (they were reinvented by Dunlop in 1888) and the introduction of iron in the 1860's allowed designs to be improved and the bicycle became a viable mode of transport for all. In the 1890's T I Reynolds started producing relatively lightweight frames from steel rather than iron, but after this few major advances in materials were made until after the Second World War when aluminium, titanium and composites were introduced. Modern day bicycles are made from a variety of materials from steel and aluminium to carbon fibre and titanium.

6. Originally, \_\_\_\_\_ (*what?*) were made from wood. Fibreglass began to be used in \_\_\_\_\_ (*when?*) and plastics and Styrofoam - during the 1950's. Boards were often made using a combination of these materials. Modern surfboards still use \_\_\_\_\_ (*what?*) though carbon fibre has recently been used to \_\_\_\_\_ (*why?*).

**How many examples of the passive can you find? Which tenses are used?**

# Unit 3

## Playing Safe Is Great

### Part A

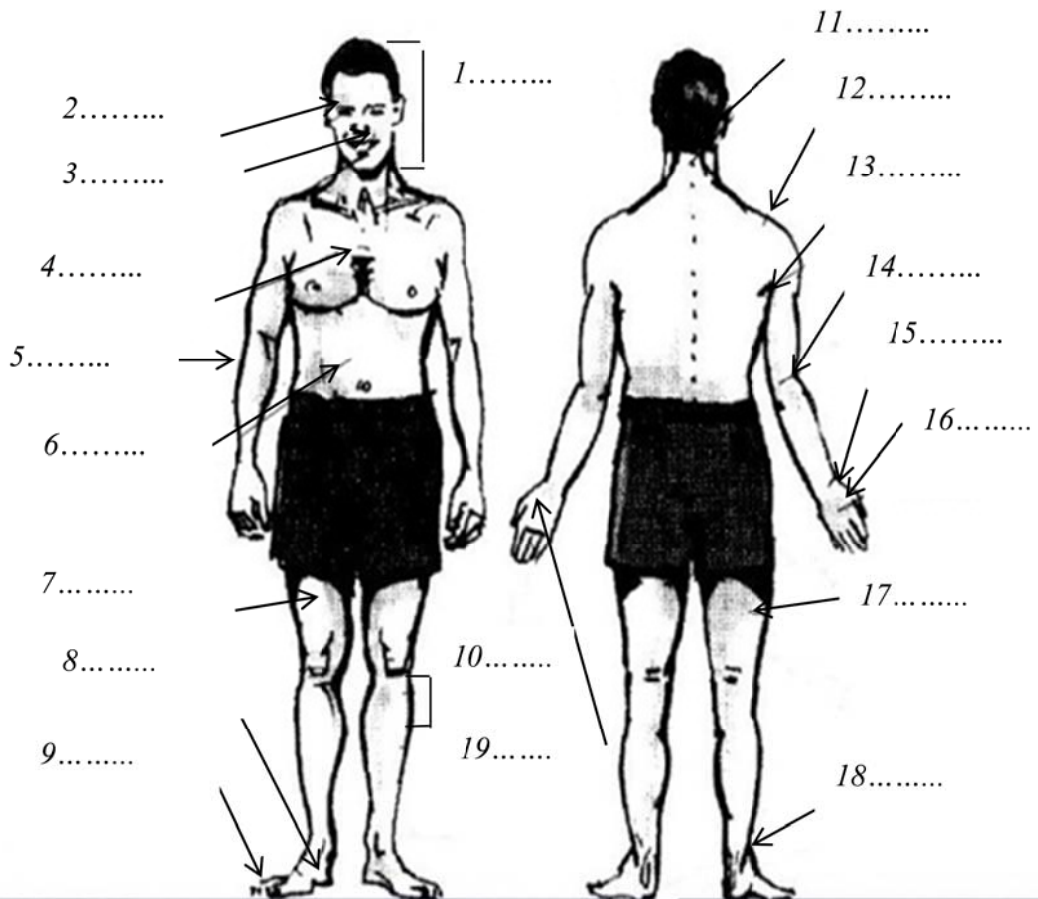
#### Lead in

#### 1. Read the information about the body and its structure.

The human body is the most wonderful and complex organism on this planet. The human body is a single structure but it is made up of billions of smaller structures of four major kinds: cells, tissues, organs and systems. The body is composed of ten major systems: Skeletal, Muscular, Nervous, Cardiovascular, Lymphatic, Respiratory, Digestive, Endocrine, Urinary, and Reproductive. Anatomy deals with the study of the component parts and structure of the body. Athletes come in all shapes and sizes and have different skin colours, but their bodies all work in exactly the same way. As you develop an understanding of how the body is built you are better able to understand how it responds to exercise and training.

#### 2. Vocabulary Preview.

1. Why is it important to know vocabulary for body parts?
2. How many parts can you label without consulting the dictionary?



**3. Develop your vocabulary. Match the words with their definitions.**

1) bones	a) this organ sends blood around the body, which in its turn provides oxygen and nutrients to the body parts
2) brain	b) a place in your body where two bones are connected
3) eye	c) organ inside the head that controls thoughts, memory, feelings and activity
4) heart	d) hard parts inside a human or animal that make up its frame
5) spine	e) the place where the foot joins the leg
6) joint	f) it takes in information about the world around you – shapes, colours, movement, and more, then this information is sent to your brain
7) shin	g) the front part of the leg below the knee
8) armpit	h) line of bones down the centre of the back that provides support for the body
9) ankle	i) hollow area on a person's body beneath the place where the arm and the shoulder meet

**4. Check your vocabulary. Put the body part in the correct column.**

Body parts you have <i>one</i> of	Body parts you have <i>two</i> of	Body parts you have <i>more than two</i>
– ...	– ...	– ...
– ...	– ...	– ...
– ...	– ...	– ...
– ...	– ...	– ...

**5. The letters in the following names of some body parts are mixed up. Put the letters in the right order.**

1. eken \_\_\_\_\_

2. osen \_\_\_\_\_

3. are \_\_\_\_\_

4. rathe \_\_\_\_\_

5. hamcost \_\_\_\_\_

6. olderush \_\_\_\_\_

7. piarmt \_\_\_\_\_

8. sinh \_\_\_\_\_



**6. Read the text and name the basic body movements and verbs that are associated with them.**

Exercise is a physical activity that is planned, structured and repetitive. It involves repetitive movements of the body done to improve or maintain one or more of the components of physical fitness - cardiorespiratory endurance, muscular strength, muscular endurance, flexibility, and body composition.

**Basic Body Movements**

*Arm movements* – exercises can be performed with the arms raised, stretched sideways, forward or backward, or crossed on the chest. They can be bent (slightly) at the elbows, or kept straight.

Changing the arm positions results in arm action, which is performed by e.g. circling, driving or bringing the arms forward or backward, lowering down, swinging or sweeping. The arm movements can be also done with the palms facing upward or down, or placed flat on the floor. The hands can be put, or rest on the hips, clasped behind the head, or placed flat on the floor.

*Leg movements* – the exercise can be performed with the legs straight, stretched or bent (slightly or fully) at the knees or hips. Changing the position of legs results in leg action or footwork, which can be accomplished by raising / lowering the legs together or alternately, lunging, swinging, or driving the legs forward / backward. The leg action can be also taken with the feet flat on the floor, with the toes pointing upward, forward, inward, or outward.

*Upper body movements* – when doing the exercise, the upper body can be kept straight when we are instructed to stand or sit straight (tall), or (slightly) bent when leaning forward, backward, to side, or against e.g. a wall. Changing the upper body position can be also done by raising or lowering the upper body from the lying position, twisting in both directions, circling, or curling the trunk slowly and gradually.

**7. Complete the sentences with the grammatically correct words and cross them out in the word square.**

1. Four verbs your arm can do:

r\_\_\_\_\_, b\_\_\_\_\_, s\_\_\_\_\_, c\_\_\_\_\_.

2. Four verbs your hand can do:

p\_\_\_\_\_, r\_\_\_\_\_, c\_\_\_\_\_, p\_\_\_\_\_.

3. Four directions your toes can point:

u\_\_\_\_\_, f\_\_\_\_\_, i\_\_\_\_\_, o\_\_\_\_\_.

4. Three nouns which follow the word “muscular”:

s\_\_\_\_\_, e\_\_\_\_\_ and f\_\_\_\_\_.

5. Exercise is done to

i\_\_\_\_\_ and m\_\_\_\_\_ components of physical fitness.

6. You can bend or stretch your legs

s\_\_\_\_\_ or f\_\_\_\_\_.

7. You can bend your legs at the k\_\_\_\_\_.

8. You can bend your arm at the e\_\_\_\_\_.

9. Footwork can be accomplished by  
r\_\_\_\_\_ or l\_\_\_\_\_ the legs t\_\_\_\_\_ or a\_\_\_\_\_.

10. You can curl the trunk s\_\_\_\_\_ and g\_\_\_\_\_.

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

### 8. Read the information about sports injuries.

Sports injuries are injuries that happen when playing sports or exercising. Some are from accidents; others can result from poor training practices or improper gear. Some people get injured when they are not in proper condition. Not warming up or stretching enough before you play or exercise can also lead to injuries. The most common sports injuries are: dislocations, twists, shin splints, sprains and strains, tears, whiplashes, fractures, cuts, concussions, bruises, knee injuries, swollen muscles.

### 9. Match the words (1–8) with the definitions (A–H).

1. \_\_\_\_\_ fracture

2. \_\_\_\_\_ twist

3. \_\_\_\_\_ cut

4. \_\_\_\_\_ tear

5. \_\_\_\_\_ bruise

6. \_\_\_\_\_ sprain

7. \_\_\_\_\_ concussion

8. \_\_\_\_\_ whiplash

A. a joint injury caused by overstretching;

B. an injury where the skin has not been broken but is darker in color, often a result of being hit by something;

- C. a neck injury caused by a sudden forward movement of the upper body;
- D. a brain injury caused by impact;
- E. a skin wound from a sharp object;
- F. to injure by rotation or turning;
- G. a broken bone;
- H. to injure by pulling tissue apart.

**10. There are many verbs associated with different body parts, but these ones are some of the most common. Which body parts can follow which verbs? Complete the table (some nouns can go in more than one column).**

<i>muscle fibers * ligament * teeth * joint * arm * ankle * knee * shin * shoulder * bone</i>							
break	twist	tear	stretch	move up / down	sprain	knock out	bend
— ...	— ...	— ...	— ...	— ...	— ...	— ...	— ...
— ...	— ...	— ...	— ...	— ...	— ...	— ...	— ...

**Think of any more verbs associated with the body parts and injuries. Complete the table with your ideas.**

**11. There are some common expressions with the word ‘injury’. Translate the collocations and check some into your dictionary. Make up your own sentences using these collocations.**

minor / slight injury  
 serious / severe injury  
 to receive / suffer / sustain an injury

internal injury  
 injury to the head  
 risk of injury

### ***Speaking Activity***

**12. Suggest a few activities that provide the lowest risk to injury and a few types of activity that provide the highest risk. Give reasons for your answers and discuss in pairs.**

<b><i>Useful Language</i></b>			
<b><i>Asking for opinions</i></b>	<b><i>Giving your opinion</i></b>	<b><i>Agreeing</i></b>	<b><i>Disagreeing</i></b>
<i>What do you think? How do you feel about this? What’s your opinion on...?</i>	<i>I think... If you ask me... In my opinion... As for me...</i>	<i>I agree. Yes, that’s right. I think so too.</i>	<i>I’m afraid I don’t agree. No, sorry, I disagree. I can’t go along with that.</i>

**13. Answer the following questions.**

1. Have you ever broken your arm, leg or another body part? What happened?
2. List some professional sports performers who had to have time out of their sport due to the injury. Analyze how their injury occurred.
3. What impact did this situation have on the athlete's life and career?
4. What are the ways to prevent injuries in sports?

**14. Match the phrasal verbs used for sport with their definitions.**

1) to warm up	a) to do movements / stretching after your main exercise to get it back to normal
2) to cool down	b) to do exercise routines / sessions
3) to join in	c) to gain weight and muscle
4) to work out	d) to beat someone in competition so they are no longer in it
5) to drop out	e) to surrender / quit
6) to bulk up	f) to take part in a sporting event or match
7) to give up	g) to leave a competition or race
8) to knock smb. out	h) to do movements / stretching to get your muscles / body ready for exercise

**15. Complete the sentences with the phrasal verbs listed above.**

1. You need to use special training equipment to \_\_\_\_\_ before and \_\_\_\_\_ after the match so you don't suffer from muscle spasms.
2. It's normally played on a pitch outside and anyone can \_\_\_\_\_.
3. It's a tough sport. You need determination and a high level of endurance because it involves a lot of running. This is why most people \_\_\_\_\_ in the first month.
4. Injuries are frequent, so athletes often \_\_\_\_\_ of competitions.
5. To play this sport you need a strong body and must weigh a certain amount. What this means is that competitors often \_\_\_\_\_ before matches.
6. I like to \_\_\_\_\_ in the early morning, because that's when I have the most energy.

**16. Choose one person to interview about the importance of sport in their lives. Ask *four* questions and use at least *three* phrasal verbs.**



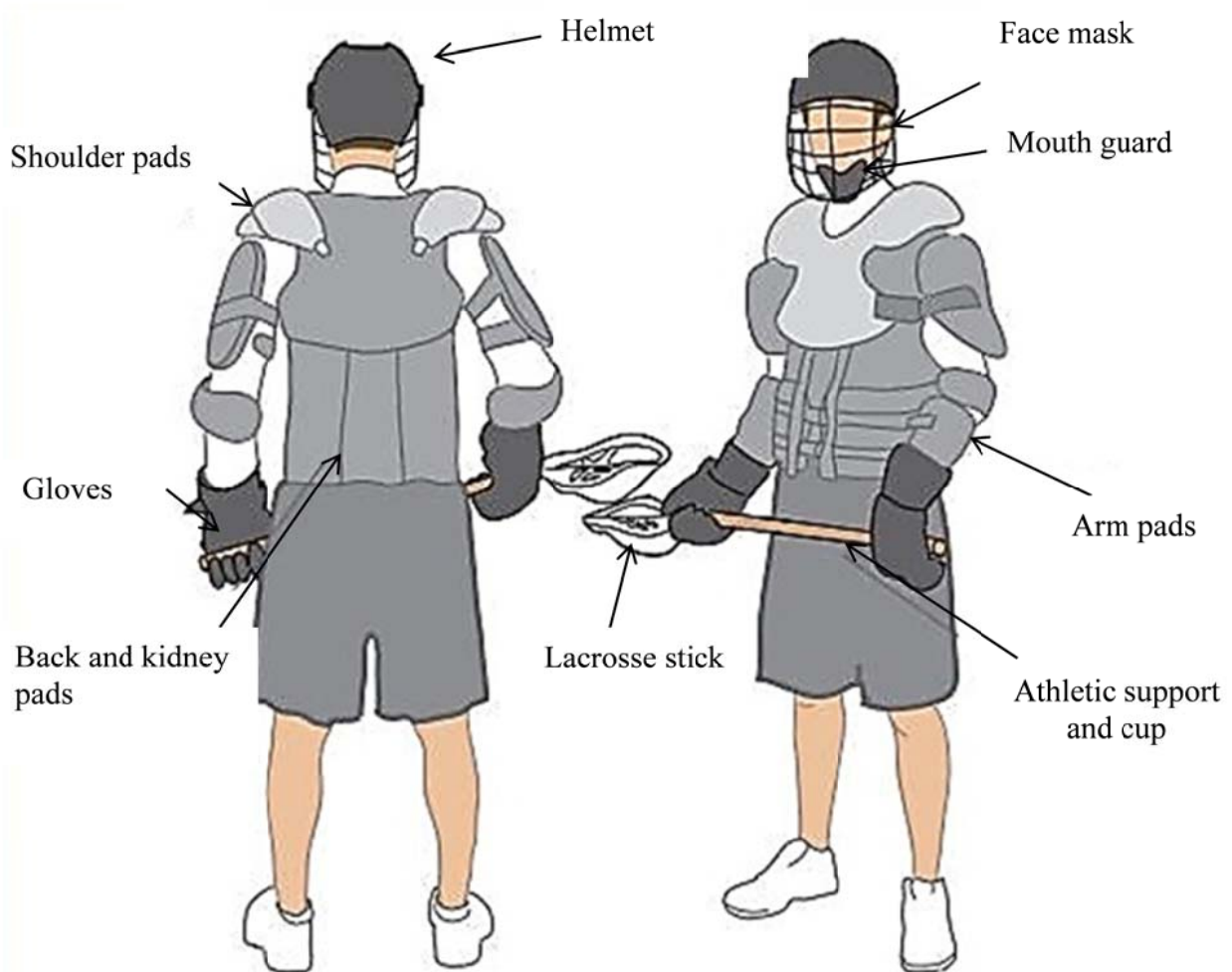
## Part B

### *Lead in*

#### 1. Answer the following questions.

1. How can following the rules of a game help you avoid getting hurt?
2. Why is it important to stop playing a game or sport if you get hurt?
3. Do you agree with the following statement: safety gear can prove to be the difference between life and death?

#### 2. Look at the picture of a lacrosse player with all the gear required. Study the words and check them into your dictionary.



#### 3. Provide the list of equipment which may be required for a hockey player / a snowboarder / a motor racer. Which piece of equipment in your opinion seems to be the most important/the least important?

#### 4. Match the words with their definitions.

1. glove	a) is a protective device for the mouth that covers the teeth and gums to prevent and reduce injury to the teeth, lips and gums;
2. shoulder pad	b) a pad fixed on an abdominal belt for external protection of your back and kidneys;
3. arm pad	c) a piece of clothing that is worn on the hand and wrist for warmth or protection, with separate parts for each finger;
4. helmet	d) a form of protective gear worn to protect the head from injuries;
5. mouth guard	e) a piece of protective equipment used in many contact sports in order to protect your shoulder blades and shoulder muscles;
6. kidney pad	f) a piece of protective equipment, used to protect your arms;

#### 5. Complete the sentences with the verbs in the passive voice.

1. Helmets \_\_\_\_\_ (*wear*) any time when there is a risk of head injuries.
2. This piece of protective equipment \_\_\_\_\_ (*design*) for hockey players in 1970.
3. The impact data \_\_\_\_\_ (*transmit*) wirelessly to a computer where it \_\_\_\_\_ (*analyze*).
4. Some helmets \_\_\_\_\_ (*equip*) with multiple sensors that measure the magnitude and direction of impacts to a player's head in 2014.
5. Mouth guards \_\_\_\_\_ (*should, consider*) mandatory safety equipment in sports that have any risk of injury.
6. Shin pads \_\_\_\_\_ (*use*) in football and ice hockey.
7. Adequate eye protection \_\_\_\_\_ (*require*) in many winter sports.
8. A player \_\_\_\_\_ (*take*) out of next few games due to the ankle injury.

#### 6. Read the text. Think of the proper title to it.

Sports safety equipment and gear may sometimes look a little bit odd or unfashionable, but using the right protective safety gear for your sport is essential for preventing serious injuries or reducing the severity of an injury you may receive. After all, the point of a sport is to actually enjoy participating, and getting injured can keep you off the playing field for weeks or more. Along with that, sophisticated technology in sports gear can enhance athletic performance. Hi-tech snowboarding equipment, futuristic helmets, lightweight pads and video camera ski goggles are changing the world of sport and athletic performance as we know it.

Here are some of the most important pieces of safety gear for athletes of all sports.

A **helmet** is a form of protective gear worn to protect the head from injuries. Helmets are worn when there is a risk of head injuries caused by high speed impact or accidents. Examples of these sports include cycling, motor racing, ice hockey, bobsleighbing, American football and many more. A properly fitted helmet, designed for the specific

sport you play, significantly decreases your risk of suffering a serious head injury, and even death. Modern helmets have a much wider range of applications, including helmets adapted to the specific needs of many athletic pursuits, and these very often incorporate plastics and other synthetic materials for their light weight and shock absorption capabilities. Some types of synthetic fibers used to make helmets in the 21<sup>st</sup> century include Aramid, Kevlar and Twaron. Some helmets are embedded with multiple sensors that measure the magnitude and direction of impacts to a player's head. The impact data is transmitted wirelessly to a computer where it is analyzed. This helps coaches and medical staff decide whether or not to take a player out of a game or the next few games.

**Mouth guards** are important if you are playing contact sports and should be considered mandatory safety equipment in sports that have any risk of injury to the face, jaw or mouth. They not only protect your teeth but shield you from a concussion. If you are intending to participate in sporting activities such as football, hockey, boxing and wrestling, you should invest in a good quality mouthpiece.

**Shoulder pads** provide stability and protection for the shoulder blades and the muscles of the shoulders during contact with other players and the ground. They can also offer some chest protection which can be useful if you play defense and block shots. Safety pads and guards are standard safety equipment in dozens of sports.

The type and style of pads seem endless and include also shin, knee, elbow, wrist, chest, neck, hip and thigh pads. Shin pads are worn in many sports to support and protect the shins and ankles. Wearing shin pads can help to prevent injuries such as fractures. Shin pads are commonly worn in football and ice hockey. Pads are another piece of protective equipment that have developed with technology. Today they are made out of lighter and more comfortable materials and are more reinforced and stronger. This gives players more confidence when going in for a challenge.

**Eyewear** is also essential protection equipment that is often neglected by people. Most eyewear is made of polycarbonate which provides good impact protection for your eyes. Activities such as ice hockey and baseball require adequate eye protection. Nowadays modern ski goggles integrate multimedia capability into the design. There are models, which track and display your progress in real time through your eyes. You are provided with the information such as speed, distance, time and where you're going thanks to the GPS navigation system.

In some cases, safety gear can prove to be the difference between life and death. That is why using the right protective equipment will greatly reduce your risk of injury and will make the game more enjoyable.

**7. Complete the table with the information from the text and your own ideas.**

<i>Piece of equipment</i>	<i>Part of the body</i>	<i>Sport</i>	<i>Purpose</i>	<i>Technological advancements</i>
<i>Helmet</i>				
<i>Mouth guards</i>				
...				

## Grammar Spot

Expressing the use or function of safety gear:

- to + infinitive: *eyewear **to protect** skier's eyes from the sun*
- for + -ing: *pad **for protecting** people from knee injuries*
- that / which + present simple: *sensors **that** measure the impact*

**8. Make full sentences based on the information from the table in exercise 6. Use a variety of forms from the grammar box above.**

***Example:** A stress sensor is an instrument **for monitoring** the magnitude and direction of impacts to a player's head.*

1. stress sensor – instrument – monitor – magnitude and direction – player's head.
2. eyewear – made – polycarbonate – provide – good impact protection – your eyes.
3. mouth guards – protective device – cover the teeth and gums – prevent – reduce – injury – the teeth, lips and gums.
4. protective safety gear – use – prevent – serious injuries.
5. elbow pads – device – shield – your elbows – contact sports.
6. shin pads – piece of equipment – worn in many sports – support – protect the shins and ankles.
7. modern ski goggles – protection equipment – track and display your progress – real time through your eyes.
8. gloves – ...

## Project

Make a sports safety poster. Follow these steps:

- Work in groups of three or four.
- Choose a sport.
- Find out which protective gear is important for this sport.
- Make your poster (including text and illustrations) and present it to the class.

You can visit these websites to help you:

[www.nmm.ac.uk/sailsafe](http://www.nmm.ac.uk/sailsafe)

[www.cyh.com/HealthTopics/HealthTopicDetailsKids.aspx?p=335&np=288&id=1573](http://www.cyh.com/HealthTopics/HealthTopicDetailsKids.aspx?p=335&np=288&id=1573)

[www.safesport.co.uk/staying-safe-playing-basketball.htm](http://www.safesport.co.uk/staying-safe-playing-basketball.htm)



# Unit 4

## Performance Is Great

### Part A

#### *Lead in*

#### **1. Answer the following questions.**

1. What words do you associate with the term “sportswear”?
2. Express your opinion on the following statements:
  - The right sportswear boosts confidence.
  - The right sportswear increases your performance.
  - The right workout gear adds protection and prevents injuries.
3. Do you know any companies from your country engaged in manufacturing of sportswear and equipment?

#### **2. Read the text. Try to make a list of sports-specific garments for skiing, hockey, volleyball, gym.**

Sportswear or active wear is clothing, including footwear (trainers and cleats), worn for sport or physical exercise. Typical sport-specific garments include shorts, tracksuits, T-shirts, tennis shirts, jerseys and polo shirts. Specialized garments include swimsuits (for swimming), wet suits (for diving or surfing), ski suits (for skiing) and leotards (for gymnastics). For most sports the athletes wear a combination of different items of clothing, e.g. sport shoes, pants and shirts.

Sport participants’ safety and success may depend on their clothing, protective gear, and equipment. Most sports have rules, procedures, and customs that dictate the clothing and safety protection worn: helmets in snow sports, safety pads and guards in ice hockey etc.

Sports clothing has come a long way from the cotton vest and shorts. A whole array of technical fabrics are now available, designed to enhance performance, increase comfort and protect the athlete.

#### **3. Discuss the following questions.**

1. Can you swim?
2. Do you like swimming? Why do you like it?
3. Do you prefer swimming in a swimming pool or in the sea, in a river or in a lake? Why?
4. Do you prefer to wear goggles when swimming? Why / why not?
5. Have you tried snorkeling / diving? Would you like to?
6. Have you ever had any bad experience regarding swimming?
7. Do you think swimming is an important skill? Why / why not?

## Swimwear

It shouldn't be surprising that professional swimmers often look for any way to improve their performance. Selecting the best swimsuit and swimsuit material for training or competition can be tricky. Which type of swimsuit you choose can make a dramatic difference to your results. When you are in the water, the kind of swimwear you have can slow you down by creating more drag, or speed you up by reducing drag. It was claimed that wearing swimsuits made of different materials can increase or reduce drag by around 10 to 15%. Technical suits compress your body in all the important places to make you hydrodynamic. Specialized suits do not impede your movements or ability to take deep breaths. So, what type of swimwear is better?

Classic swimsuits come in a wide variety of styles, colours and materials. Most suits are chlorine resistant and can be comfortably used for swim training. Suits should fit well but not too tightly, especially around the legs.

Here are the basic options:

**Men's swimsuits.** Baggy *swim trunks* are fine for water exercise or the beach, but they inhibit effective lap swimming. All the extra fabric is heavy and creates drag, slowing and pulling you down in the water.

**Briefs, racers, and 'Speedos'** are the most recognizable form of swimsuit for men. These minimalist suits allow full range of motion for all strokes and have decreased drag. Briefs are the traditional lap swimming suit for men and are worn for practice and racing. Take note that while briefs and races are sometimes colloquially called 'Speedos', Speedo is a brand that makes a full run of swimsuit styles.

**Jammers** are a longer version of briefs. The easiest way to identify swim jammers is by the fact that they look a lot like a pair of lycra cycling shorts. Jammers extend from the waist down to just above the knee and come in a huge range of styles and colors. Jammers are mainly used in competition to obtain speed advantages. They are generally made of nylon, polyester and lycra /spandex materials.

**Legskin** is a type of competitive swimwear worn by male swimmers. Most legskins are made of technologically advanced lycra-based fabrics designed to hug the body tightly and provide increased speed and decreased drag resistance in the water. The legskin covers from the swimmer's mid-waist to his ankle and resembles leggings.

**Women's swimsuits.** For casual wear or water exercise, two-piece and one-piece suits, scoop-back suits are fine. For lap swimming or racing, one-piece racer-back suits are much better.

**Racer-back** is a type of women's one-piece swimsuit design common today among competitive swimwear. The top-back of the swimsuit is not covered to provide flexibility and movement of the arms during swimming.

**Two-piece suits** work well for casual wear, water exercise and beach sports. Some feature a cropped top, while others have a longer tank to cover the torso. Because they're not as streamlined as one-piece suits, they're not suitable for lap swimming.

**Kneeskin** is a type of competitive swimwear worn by both male and female athletes. Kneeskins are normally made of lycra-based fabrics. Their uses range from aqua aerobics to competitive racing.

**Legsuits** are full-body suits which cover the torso and thighs for less resistance and drag in the water.

**Bodyskin** is a style of competitive swimwear worn by both female and male athletes. The bodyskin resembles the design of a *dive skin*, commonly used by snorkelers and scuba divers for warm weather climates. Some bodysuits provide full body coverage from the ankles to the neck and wrists. Bodyskins were banned from FINA competitions from the start of 2010 after many national swimming federations demanded the action, and leading athletes such as Michael Phelps and Rebecca Adlington criticized the suits.

**Thermal swimwear** stays warm in the water and protects your skin from the sun with various thermal swimwear options. There is thermal swimwear for men, women, and children, including water shirts, full body suits, and kid's wetsuits. Thermal suits are excellent for water aerobics, swimming lessons, and even open water activities.

**Performance swimwear** is designed for racing. These are high-tech performance swimming garments, often designed in specialist labs and with the help of elite swimmers. Performance swimsuits tend to have a very short lifespan, they're designed to go very fast in the water, but the chlorine in the pool starts to break down the technologies in the suit faster than almost any other type of swimwear. Never use performance swimwear for training sessions and always rinse it with fresh cold water straight after exiting the pool to get the most out of your competitive swimsuit.

**4. Complete the table below.**

<i>Women's swimsuits</i>	<i>Men's swimsuits</i>
— ...	— ...
— ...	— ...

**5. List the types of competitive swimwear worn by both male and female athletes and their characteristics.**

**6. According to the text what are the advantages and the disadvantages of performance swimwear?**

**7. Describe a swimming garment but don't say the actual word. Other students have to guess the type of swimsuit described.**

## 8. Match the words with their definitions.

1. chlorine resistant	a) man-made elastane fiber; never used alone, but always blended with other fibers; it has unique stretch and recovery properties.
2. compression	b) low profile, technical eyewear meant for racing, fit close to the eye socket. The close proximity to the socket reduces drag, making you more hydrodynamic.
3. drag	c) the specific area in which a swimmer is assigned to swim.
4. goggles	d) designed to achieve superior results.
5. high performance	e) when your body is squeezed in all the important places to make you hydrodynamic.
6. lane	f) glasses-type devices worn by swimmers to keep their eyes from being irritated by the chlorine in the water.
7. lycra	g) does not fade or thin over time due to chlorine exposure.
8. racing goggles	h) resistance.

## 9. Match the opposites.

- |                         |                    |
|-------------------------|--------------------|
| 1. to slow down         | a) loose           |
| 2. to increase          | b) to assemble     |
| 3. tight                | c) casual swimwear |
| 4. speed                | d) to speed up     |
| 5. competitive swimwear | e) slow            |
| 6. female               | f) to reduce       |
| 7. to break down        | g) resistance      |
| 8. fast                 | h) male            |

## Speaking Activity

10. Which type / types of swimwear would you recommend for the people below? Compare your choices with a partner.

<i>Useful language</i>	
<i>I recommend...</i>	<i>I wouldn't recommend ...</i>
<i>You need a swimsuit which...</i>	<i>You shouldn't buy a ...</i>
<i>Why don't you buy a ...?</i>	<i>You don't need a ...</i>
<i>A ... would be ideal/ perfect for you.</i>	<i>I think ... is not for you.</i>

A. Jessica, 19, from Miami: I would like to engage in competitive swimming and start exercising regularly, so I'm looking for a good piece of swimwear. Any suggestions?

B. Deborah, 34, from Toronto: I'm looking for the warmest garments for my kids swimming in winter? What do you think would be the best?

C. Mike, 21, from Sydney: I'm looking for a piece of swimwear totally for a leisure beach time, focusing on aesthetics and being resistant to salted water (and chlorine). Any advice?

D. Lucas, 20, from Brazil: I'm a competitive racer and I'm taking part in FINA World Championship next summer. I really need something that will increase my performance. Thanks for your advice.

E. Barbara, 45, from Belfast: I'm looking forward to my summer holidays. We're heading to the Caribbean in a few days. But the problem is that I'm a bit overweight and totally conservative in my sense of dressing. What should I do?

F. Nick, 54, from Chicago: Can someone please tell me which swimsuit would be the best and warmest, for a 10–12 year child taking professional swimming lessons in an unheated pool?

## Part B

### *Lead in*

#### **1. Answer the following questions.**

1. Can you ride a bike? If so, when did you learn? Was it easy?
2. Have you ever been on a cycling tour / holiday? Where did you go? Would you do it again? Why / why not?
3. What are the advantages and disadvantages of riding a bike regularly to university or office?
4. How dangerous do you think cycling is? Why?
5. Have you ever fallen off your bike? Were you hurt?

#### **2. Match the words with the definitions.**

**cleat, chamois, stopwatch, cushion, jersey, cadence, visor, cycling bib**

1. a watch that can be started and stopped in order to measure the exact time of an event, especially a sports event;
2. a part of a helmet that can be pulled down to cover the face, or a curved piece of stiff material that is worn above the eyes to give protection from strong light from the sun;
3. a soft object or part that is used to make something (such as a seat) more comfortable or to protect a surface from damage;
4. a shirt that is worn by a member of a sports team;
5. a piece of clothing that covers the area above a person's waist with attached pants or shorts;
6. a padded liner, which protects your groin area from friction and helps to cushion your ride;

7. a piece of rubber, wood, or metal that is fastened to the bottom of a shoe or boot to prevent slipping;
8. a regular rhythm.

### 3. Match the words with similar meaning.

- |                    |                  |
|--------------------|------------------|
| 1. to cut down     | a) to shake      |
| 2. to drag         | b) close-fitting |
| 3. to flap         | c) to slow down  |
| 4. to make the cut | d) to reduce     |
| 5. skintight       | e) to succeed    |

### 4. Complete the sentences with words from the previous exercises.

1. Coaches use a \_\_\_\_\_ to measure the exact time of a race and to decide the winner.
2. In our e-shop you will find a whole range of cycling wear from cycling \_\_\_\_\_, shorts and sweatshirts to gloves, balaclavas and warmers.
3. This helmet completed with a \_\_\_\_\_ is a very good idea for a sunny day.
4. One of the first pieces of advice given to new riders is to buy a pair of cycling shorts padded with a \_\_\_\_\_ for more comfortable riding.
5. When you buy a pair of mountain bike shoes, do the \_\_\_\_\_ come with them or do you have to buy them separate?
6. Your choice of clothing affects your aerodynamics. Baggy shorts, loose T-shirts increase friction drag. But you can reduce it by wearing \_\_\_\_\_ clothing.

### 5. Read the text and learn more about wear and gear for cycling.

When you invest in a new road bike, you want to get the gear that goes with the bicycle for the optimal cycling experience. This gear typically consists of a skintight cycling suit, a set of cycling shoes, gloves, a helmet and some accessories for turning an everyday ride into a serious training regimen. Road cyclists care about cutting down weight, so an item has to be particularly useful to make the cut.

The first piece of gear commonly associated with a road cyclist is a cycling bib (or shorts) and jersey. These two clothing items are usually made of spandex, which uses elastic material to hug the shape of your body and prevent any flapping that would increase drag. A cycling bib has a chamois sewn between the legs to provide a cushion for soft tissue. This is essential for serious riding; not wearing a chamois can be very painful after a few miles. Cycling shorts are vital pieces of equipment that give the rider several advantages over regular street clothes. They're a necessity any time you want to hop on a bike and hit the road.

The cyclist's jersey is also designed to enhance comfort; zippers allow ventilation during intense pedaling, and pockets along the lower back easily store small items like

a phone or a pair of arm warmers for quick access. Cycling suits should fit your riding shape, so they are made of stretchy fabrics. Stretchy fabrics have a compression effect that supports your muscles and stimulates blood flow. Another big advantage is that the fabrics have high-tech fibers that wick away moisture and allow your skin to breathe. Look for suits made of nylon spandex with a polyester yarn woven throughout.

Cycling shoes or cleats allow a cyclist to clip into the pedals of the bicycle, which provides several advantages. A rider using clipless pedals can pedal at a higher cadence without slipping, which ultimately improves efficiency. The cleat connects to a stiff plastic or carbon fiber last in the shoe, distributing pressure along the entire foot for comfort.

A helmet is probably the most important piece of gear for a cyclist. 70 percent of all fatal injuries sustained by cyclists in a crash involved head injuries. Helmets for road cyclists are heavily ventilated for comfort, and can sometimes feature a visor to keep sun out of your eyes during the middle of the day. The best helmets are compatible with cycling sunglasses.

Other optional gear for a road bike includes accessories designed to enhance cycling and training. A bike computer comes in a variety of forms, from a standard wired computer for speed and a stopwatch to an advanced computer that provides biometric data and GPS. Other gear might include a repair tool and bicycle pump, which gives you options if you're stranded with a flat tire or broken chain. Overall, these items are not strictly necessary like a helmet and a chamois, but they can make your ride much safer and more enjoyable.

## 6. Which accessory...?

1. ... provides a cushion for soft tissue?
2. ... prevent slipping of a boot and distribute pressure along the foot for comfort?
3. ... store small items like a phone, gloves, etc?
4. ... hug the shape of your body and prevent any flapping and drag?
5. ... wick away moisture and allow your skin to breathe?
6. ... prevents head injuries?
7. ... keeps sun out of your eyes?
8. ... have a compression effect that supports your muscles and stimulates blood flow?

## 7. Complete the sentences with prepositions given below.

**through, of, into (×2), over, for, about, away, out, with, to (×2)**

1. These fabrics have high-tech fibers that wick \_\_\_\_\_ moisture and allow your skin \_\_\_\_\_ breathe.
2. The cleat connects \_\_\_\_\_ a stiff plastic or carbon fiber last in the cycling shoe.
3. The best helmets are compatible \_\_\_\_\_ cycling sunglasses or sun visors.

4. Cleats allow a cyclist to clip \_\_\_\_\_ the pedals of the bicycle, which provides several advantages.

5. Cycling shorts are vital pieces of equipment that give the rider several advantages \_\_\_\_\_ regular street clothes.

6. A visor is designed to keep the sun \_\_\_\_\_ of your eyes during the middle of the day.

7. Cycling gear typically consists \_\_\_\_\_ a skintight cycling suit, a set of cycling shoes, gloves and a helmet.

8. Pockets at the lower back of a cycling jersey are designed \_\_\_\_\_ quick access to your small items like a phone or a pair of arm warmers.

9. Some cyclists want to turn their everyday ride \_\_\_\_\_ a serious training regimen.

10. Wicking is the transport of moisture \_\_\_\_\_ a fabric.

11. Road cyclists care \_\_\_\_\_ cutting down weight/

### **8. Put the words in the correct order and answer the questions.**

1. cycling, fibers, are, What, jerseys and bibs, made, usually, of?

2. advantages, the, What, fibers, are, of, these?

3. cycling, What, cleats, is, function, the, of?

4. important, Why, is, the, cyclist, most, for, piece, helmet, of, gear, a, probably?

5. name, having, What, special, shorts, advantages, cycling, can, of, you?

6. include, What, road, optional, gear, for, bike, does, a?

7. provided, What, bike, data, by, is, a, computer?

8. is, the, purpose, sun, of, a, visor, What?

### **9. Make up the summary of the text in exercise 5.**

The main idea of the text is ...

The author starts by telling the reader about ...

Much attention is given to ...

According to the text ...

The reader is informed about ...

In the conclusion the author says...

I found the text interesting / boring / informative ...

### ***Speaking Activity***

### **10. Discuss the following questions in small groups.**

1. What clothes do you usually wear when you ride a bike: regular street clothes or specialized cycling wear?

2. Is the use of helmets obligatory in your country? Do you use one? Why / why not?



## Unit 5

# Textile Technology Is Great

### *Lead in*

#### **1. Answer the following questions.**

1. What materials are used for making sport clothes? Are they natural or synthetic?
2. What are sport shoes made of?
3. Have you ever heard about such materials as Gore-Tex, Kevlar, and neoprene?
4. What special properties should sports materials possess?

#### **2. Now read the text and find the answers to the questions.**

#### **3. Skim the text. Then decide whether these statements are true (T) or false (F).**

1. Lycra is a natural fibre that is sometimes combined with another fibre in a fabric.
2. Tinsulate fibres form a thin tangled web of fibres that trap a lot of air and keep heat.
3. Kevlar is a very strong artificial fibre that is used for light and flexible clothes.
4. Lycra is known for its ability to be stretched four to seven times its original length and will still return to its normal state and length when released.
5. Mesh allows air to circulate and reach the skin meaning that it is ideal for ventilation areas of a garment.
6. There are three types of neoprene: open cell, semi-opened cell, closed cell.
7. A micro fibre is 5 times finer than a human hair.
8. Fleece fabrics are used in sportswear often for tracksuits, hoodies and zip tops.
9. Wicking is the transport of blood cells through a fabric.
10. Sports clothing needs to prevent rain and wind from getting in but at the same time allow moisture from the inside to escape out.

### **Sports fabrics**

Smart materials can change their properties in response to an external stimulus. Materials such as Lycra, Thinsulate, Kevlar, Teflon, Gore-Tex and many others have different special properties that make them suited to particular uses.

**Teflon** is the trade name for a polymer called polytetrafluoroethene or PTFE. It is very slippery so it is used to make non-stick coatings for pans. It is also used in clothing to make it difficult for dirt to stick, and it is used in Gore-Tex. PTFE is also unreactive, so it is used to make pipes and containers for chemicals.

**Gore-Tex** is a fabric that is designed to keep you dry in the rain without getting sweaty. It contains a layer of plastic based on PTFE. This contains very many tiny holes called pores. There are around 14 million pores per square millimetre. Each one is too small for water droplets to pass through, but big enough to let water molecules from sweat go through. This makes a 'breathable' fabric which can also be combined with insulation such as **Thinsulate** to make outdoor clothing that keeps you dry and warm.

**Thinsulate** fibres are much thinner than most other artificial fibres. They form a dense tangled web of fibres that trap a lot of air and reflect heat. This reduces heat loss, so clothes containing this material keep you very warm. The fibres also absorb very little water, so they still keep you warm if the clothes get wet.

**Kevlar** is a very strong artificial fibre. It is woven to make a material that is used for light and flexible body armour. It is strong and tough because its molecules can pack closely together and there are chemical bonds between adjacent molecules. Kevlar has a unique combination of high strength, high modulus, toughness and thermal stability. It was developed for demanding industrial and advanced-technology applications. Currently, many types of Kevlar are produced to meet a broad range of end uses.

**Lycra** is Du Pont's brand name for elastane. It is a synthetic fibre which is always combined with another fibre in a fabric. Lycra can provide considerable stretch and give fabric a better drape. Lycra is known for its ability to be stretched four to seven times its original length and will still return to its normal state and length when released. Other admirable properties of Lycra include its resistance to sunlight, sweat and improvement of comfort, ease of movement and shape retention when used in a fabric.

**Elastane** can be used in sportswear for compression garments which are used to improve blood circulation, reduce lactic acid and DOMS (**Delayed Onset Muscle Soreness**), also called muscle fever, is the pain and stiffness felt in muscles several hours to days after unaccustomed or strenuous exercise.) and it can also be used to help hold a garment up. Elastane is also resistant to salt water, chlorine and colour fading which is why this fabric is suitable for swimwear.

**Mesh** is a fabric which includes a certain amount open spaces. A typical mesh is about 85 percent material and 15 percent holes although different mesh fabrics will vary in weight and hole size. Mesh is beneficial in sportswear as it provides good comfort and stretch and allows air to circulate and reach the skin meaning that it is ideal for ventilation areas of a garment, especially for places where heat accumulates very quickly such as on the back.

**Neoprene** is a foam-like synthetic rubber made from polychloroprene chemicals. It doesn't fray, is a good insulator and is water resistant. There are two types of neoprene: open cell and closed cell. Closed cell neoprene is cheaper and is the most common type; it consists of nitrogen filled separated bubbles and allows a small amount of water to pass through which is heated by the body. This type of neoprene is lined and is suitable for people who will stay continually active in the water so that body heat continues to keep the layer of water inside the suit. For very cold conditions and for activities where there is waiting around, open cell neoprene is the appropriate option. Open cell neoprene is raw (unlined), softer and more flexible than closed cell which is rigid and strong. Open cell is made up of interconnected air spaces

and works by clinging tightly to the body. It can contain up to 98% still air inside it giving good insulation to weight properties. Open cell is more insulating and depending on the thickness and type, can be used for deep sea diving and for staying in the water all day. Neoprene is used for water sports and is now very fashionable for casual sporty type clothing and swimwear.

**Water resistant fabrics** are used in outdoor sports to protect from weather elements. If a fabric is waterproof then it is likely to be wind resistant also. Some fabrics are water repellent meaning that they do not allow the ingress of only a certain amount of water. If a fabric can resist a water pressure of at least 13,000 pascals then the fabric can be classed as fully water proof. PU coating is one way of waterproofing a fabric and is suitable for jackets and tracksuit bottoms.

These lighter weight water resistant fabrics have a polyurethane coated back and is ideal for water proof clothing such as raincoats and jackets.

**Microfibre fabrics** are essentially fabrics made from extremely fine fibres. A microfibre is 60 to 100 times finer than a human hair! Microfibre fabrics are usually made from polyesters, polyamides or polypropylenes; they are made from manmade fibres because they are so small that natural fibres cannot be this small. The fineness of the fibre means that many more fibres are needed to make up a yarn. Microfibre fabrics make useful luxury sport fabrics due to their all round brilliant properties including being lightweight, having a luxurious drape and are breathable whilst still being resistant to rain and wind. Microfibre is ideal for trench coats and sports jackets.

**Sports fleece.** There are a few variations of fleece which come in different weights and have different naps, some longer or more textured than others. The fabric pile traps a lot of still air making it an insulating fabric. Fleece fabrics are used in sportswear often for tracksuits, hoodies and zip tops. The fabric does not fray making it very easy to wear.

### **Sport fabric properties**

Sports fabrics are technical materials which help to keep the wearer comfortable during exercise. The type of fabric required will depend upon the intensity of the exercise and the activity. Yoga clothing should use fabrics with good stretch ability for easy movement which will likely require the fabric to be of a knitted construction. Apparel for long distance running will keep the wearer in good comfort if it has excellent moisture wicking properties to enable sweat to transfer from the inside to the outside for the garment. Performance clothing for outdoor sports in the winter or snow sports ought to use breathable fabrics with very good insulating properties.

**Thermal Insulation.** Fabrics with good thermal conductivity are not good insulators, therefore these fabrics will be cooler to wear. Air is one of the worst conductors of heat which is why the more still air a fabric can trap, the warmer it will keep you.

**Wicking.** Wicking is the transport of moisture through a fabric. Moisture can pass between fibres, yarns and through the fibre itself. The ability for moisture to pass through a fabric will depend on the fabric construction and the fibre type. Synthetic fibres tend to dry quickly and are the most commonly used fibre in athletic wear now.

**Water Vapour Transmission.** When high intensity exercise takes place, sweating will occur to evaporate heat off the skin. If clothing is not breathable than there is nowhere for the moisture to escape. This causes moisture to build up inside the garment and on the skin resulting in the body getting hotter. Another consequence is when exercise decreases and heat stops being generated from the body, the moisture (which is less insulating than still air) will then increase heat loss rapidly, especially in a cold environment. From this we can conclude that clothing needs to prevent rain and wind from getting in but at the same time allow moisture from the inside to escape out. This process is known as water vapour transmission and fabrics which are able to do this are known as waterproof breathable fabrics.

**4. Choose the correct answer for these statements.**

1. **Teflon** is

- a) used in making shoes;
- b) used to make non-stick coatings for pans;
- c) very slippery.

2. **Tinsulate**

- a) increases body temperature;
- b) reduces heat loss, so clothes containing this material keep you very warm;
- c) helps lose weight.

3. **Kevlar** has a unique combination of

- a) easiness of fabrication;
- b) high strength, high modulus, toughness and thermal stability;
- c) high corrosion resistance.

4. **Lycra** is highly resistible to

- a) sunlight, sweat;
- b. water, heat;
- c) rust.

5. **Neoprene** is

- a) heat resistant;
- b) sweat resistant;
- c) water resistant.

6. **Microfibre fabrics** make useful luxury sport fabrics due to

- a) having a luxurious drape and are breathable;
- b) being resistant to rain and wind;
- c) being lightweight.

**5. Match the sentences.**

1. This material doesn't burn or melt if you heat it.      a) It's heat-resistant.

2. This material doesn't break if you strike it or      b) It's hard.

drop it.

3. You can't bend this material.      c) It's corrosion-resistant.

4. This material doesn't corrode if you put it in water.      d) It's tough.

5. You can't stretch this material or cut it.      e) It's rigid.

**6. Skim the text to find some extra information to complete the table.**

<i>Material / Fabric</i>	<i>Properties</i>	<i>End Use</i>
<i>Teflon</i>	– ... – ... – ...	– ... – ... – ...
<i>Gortex</i>	– breathable – lightweight – waterproof	– all-weather jackets and shoes – ... – ...
<i>Insulate</i>	– ... – ...	– ... – ...
<i>Kevlar</i>	– ... – ...	– ... – ...
<i>Lycra</i>	– ... – ...	– ... – ...
<i>Mesh</i>	– ... – ...	– ... – ...
<i>Neoprene</i>	– .... – ....	– ... – ...
<i>Water resistant fabric</i>	– ... – ...	– .... – ...
<i>Sport fleece</i>	– ... – ...	– ... – ...
<i>Microfibre</i>	– lightweight – soft – good drape – breathable – shower-proof	– raincoats – active sportswear – fashion clothing – ... – ...

**7. Now make up sentences describing sports materials using the prompt below.**

*Example: Microfibre is soft and lightweight material and it is used in making raincoats or active sportswear.*

**Grammar Spot**

**8. Study the examples and make up your own sentences using the prompt below.**

<i>Aim</i>	<i>of</i>	<i>material</i>	<i>is</i>	<i>Infinitive</i>
The aim	of	Kevlar	is	to allow air to circulate.
The purpose		Mesh		to improve blood circulation, reduce lactic acid.
The objective		Elastane		to keep someone safe.

**9. Study the properties of fabrics and make up sentences describing types of sports clothing and properties they should possess.**

<i>Aesthetic properties</i>	<i>Functional properties</i>	<i>Comfort properties</i>
handle drape colour appearance	strength durability crease resistance flame resistance stain resistance water resistance aftercare cost	absorbency breathability elasticity softness stretch warmth

It is important to match fabric properties to the requirements of the product.

For example:

- **Cycling jackets** need to be made from fabric that is warm, breathable, elastic, windproof and water resistant.
- **Sportswear** needs to be made from fabric that is soft, strong, durable.
- **Seat belts** need to be made from strong, durable, flame-resistant materials.
- **Tracking suit** needs to be made from fabric that...
- **Cycling bib** needs to be...
- **Sneakers** need to be...
- **Swimsuit** needs to be...

**10. Match the words with the definitions.**

1) polymer	a) moisture exuded through the pores of the skin, typically in profuse quantities as a reaction to heat, physical exertion, fever, or fear
2) sweat	b) the action of absorbing and continuing to hold a substance the soil's retention of moisture; failure to eliminate a substance from the body
3) armour	c) straighten or extend one's body or a part of one's body to its full length, typically so as to tighten one's muscles or in order to reach something
4) elastane	d) a piece of clothing; used especially in contexts where you are talking about the manufacture or sale of clothes
5) yarn	e) materials or substances are in their natural state before being processed or used in manufacturing
6) stretch	f) the metal coverings formerly worn to protect the body in battle
7) retention	g) a substance that has a molecular structure consisting chiefly or entirely of a large number of similar units bonded together, e. g., many synthetic organic materials used as plastics and resins

8) garment	h) an elastic polyurethane material, used for hosiery, underwear, and other close-fitting clothing
9) fade	i) thread used for knitting or making cloth
10) foam	j) another word for 'clothes'
11) fray	k) threads or fibres start to come apart from each other and spoil its appearance
12) raw	l) lose or cause to lose colour or brightness
13) ingress	m) acting to move moisture by capillary actions from the inside to the surface
14) repellent	n) a light, porous, semi-rigid or spongy material used for thermal insulation or shock absorption
15) apparel	o) water or other liquid diffused in a small quantity as vapour, within a solid, or condensed on a surface
16) wicking	p) the unwanted introduction of water, foreign bodies, contaminants, etc.
17) moisture	q) a substance used to treat something, especially fabric or stone, so as to make it impervious to water

### ***Speaking Activity***

*NeoTech is a company that has produced a revolutionary fabric called Protean. Skim the presentation of an expert and complete the fact sheet about Protean.*

#### ***Protean's main features***

1. Made from fibres \_\_\_\_\_ nylon and polyester; can be made very thick, or thin so that it can let some \_\_\_\_\_ through.
2. It is very soft to the touch, and also \_\_\_\_\_.
3. Can be made in any \_\_\_\_\_.

“Now I’d like to move to our most successful product, Protean. As I’m sure you know, our new product was named after Proteus, the Greek god of strength and power who was able to take on different roles and shapes. Indeed, Protean can be used for a wide variety of products because it is extremely flexible. Let me give you some basic information about Protean’s three main features.

Firstly, it is made from fibres that are similar to nylon and polyester. These fibres are coated with a special, innovative metallic substance, so that the fabric can conduct electricity. In addition, the fabric can be made very thick or very thin – so thin in fact as to become translucent, – to let some light pass through. Secondly, as you can experience for yourselves from the samples that are going round, not only is it very soft to the touch, but it is also very strong and long-lasting. Finally it can be made in absolutely any color.”

***Here are the products that NeoTech has launched using Protean.***

1. “Dazzle” – a range of water shoes for sportsmen.

***Advantages***

- Light and comfortable – adapt to the shape of a person’s foot
- Their color can be changed at any time
- Shiny, smart and very durable
- Ideal for swimming and scuba diving.

2. Protean steering wheel

***Advantages***

- Better grip for drivers
- Safer than all other steering wheels
- Very pleasant to the touch

3. Protean watch straps

***Advantages***

- Waterproof and easy to clean
- Anyone can wear them – non-allergic
- More beautiful than other straps
- Light up in the dark

***Task***

***Work in groups***

You are a member of Product Research & Development Department. You are supposed to hold a meeting to propose ideas for exciting new sports products which use Protean. Discuss the advantages of each proposal.

***Writing***

You are a member of Product Research & Development Department. The Chief Executive of NeoTech has asked you to write a short report on one of the products you have chosen. Outline the product’s key features and give practical suggestions to deal with the new product.



## Supplementary reading

### How has technology changed sport?

Technology has had a huge influence on the modern world, across most industries – and sport is no different. Particularly over the past two decades there have been some cutting edge developments that have demonstrated just how much technology and sport go hand in hand, in terms of training, fan participation and handling issues that might arise during a game or match.

For athletes and sportswomen and men, technological advances and breakthroughs constantly provide the opportunity to be better, faster, stronger and more competitive. Clothing, equipment and footwear is now designed incorporating technology and with specific sports in mind, from the full bodysuits swimmers wear that can shave valuable seconds of a race time, to racquets that can help prevent tennis elbow. Training has been made much more effective by the ability to monitor and analyse progress and technique, whether through a full professional set up or something as simple as an app for an iPad. Recovery is also much speedier now, thanks to technological advances, and athletes can use developments such as hypoxic tents – which simulate high altitude training – to push their bodies to the peak of physical fitness, instant response and fast recovery.

For the fans, social media has introduced an entirely new dimension to sport, with athletes and sports people taking to Twitter and Facebook before and after games to drum up excitement, provide their opinions on a match or post behind the scenes images. London 2012 was a great example of how much more spectator participation this generated with 10 million tweets alone during the opening ceremony. Large screen technology – both at home and in stadiums and sports venues – helps fans to engage more with sports people and teams and the ability to record live matches means that none are ever missed. When it comes to the sports themselves, technology has been instrumental too in improving accuracy and fairness, from Hawkeye use in cricket, to goal line technology used in football and the ability to accurately umpire tennis challenges.

Of course, for some all this technology destroys some of the mystery of sport and allows it to be picked apart too much. Social media abuse of swimmer Tom Daley during the Olympics was a sad side effect of the fact that technology allows everyone to be a pundit, however malicious, and for some the accuracy of goal line technology and the like reduces the element of excitement and chance every good game should have. Some have speculated that technology in sport means that children fail to learn valuable life lessons and, arguably, watching sport on a big screen takes away some of the excitement of the live match.

However, no matter how much technology intrudes into sport, at its heart we think it will always remain the pure joy of that burst of physical activity, the spirit of competition and gamesmanship, and a great way to learn discipline and skill.

## The Many Uses of Kevlar

Contrary to popular belief, Kevlar has not been around for very long. Stephanie Kwolek who worked for DuPont made Kevlar. Kwolek did a lot of testing and was attempting to develop a stronger tire for DuPont to manufacture and sell during a gas shortage. Instead of revolutionizing the tire world, Kevlar revolutionized the entire world.

Kevlar is one of the strongest materials on earth. It is a fiber that when woven together has the five times the strength of steel. It has been in used in many products throughout the years and researchers are still finding new uses for it today. The inner lining of bicycle tires is made from Kevlar. The Kevlar lining helps the tires to last longer and to avoid being punctured. Kevlar is used on the interior of many ping-pong paddles. The Kevlar helps the ball to bounce off of the paddles further than the traditional paddles. Kevlar is also used in the back plates on some cellular phones. The Kevlar helps to protect the interior workings of the phone from becoming damaged if the phone is dropped. Clothing is currently using Kevlar to decrease the amount of injuries that are caused on the worksite. Gloves containing Kevlar save hands from scratches and nicks while boots with Kevlar toe lining protect the feet if something should fall on them.

The most popular and well-known way that Kevlar is used today is in body armour. There are many different forms of body armour that use Kevlar to keep someone safe and protected from small arms fire, large arms fire, and even knives. Kevlar is very lightweight so it does not bog someone down when they are wearing it. It is also very thin and fits into a carrier that is specially designed to protect the Kevlar. Kevlar cannot be exposed to direct sunlight. This will cause the fibers to lose their density and thus decrease the protective properties of the Kevlar. Kevlar cannot be exposed to liquid or it will begin to offer less protection, as well. The carriers are specifically designed to carry the Kevlar in the perfect place on someone's body and to insure that the Kevlar does not become damaged while it is being worn.

When choosing a carrier for your Kevlar panel, it is a good idea to take the time to determine if you are going to wear the vest under or over your clothing. You may want to choose if you want the vest to have a zipper or if you are okay with the Velcro fasteners that traditionally come on a vest. The zippers are ideal for someone who is interested in taking their vest on and off frequently. The Velcro fasteners allow the vests to be adjusted to fit the body perfectly.

Kevlar has revolutionized the way the world manufactures items and how durable items are. There are many items that you may be using right now that have Kevlar in them and you do not even know it. It has been an invention that has made a global impact and will continue to do so for many years to come.

## Chemistry in Sport

It takes years of training if an athlete is to achieve their olympic dream, whatever their sport. To help realise this dream improvements to new kit can help, too. Many equipment, stadium and accommodation improvements are only possible thanks to developments in chemistry and the chemists who work hard to create new materials that are stronger, lighter and more resilient. Chemists also run the drug tests that help ensure a level playing field by catching the cheats. While there will never be an alternative to hard work and sheer dedication, chemistry can add value to making sport happen.

### Chemistry is ... light

Bike design can give a cyclist a real speed advantage, and bikes designed for racing on the road or the track are carefully engineered to be as aerodynamic as possible. What they are made out of makes a big difference too – the lighter a bike is, the less weight a cyclist has to drag around, and the faster they will be able to go. Modern carbon fibre racing cycle frames are every bit as stiff and strong as their metal counterparts, but significantly lighter.

Carbon fibres were first made in the 1950s, but it was in the 1960s at the UK's Royal Aircraft Establishment at Farnborough that a practical process was developed, where they started to be used in applications where a strong but light material was an advantage. As well as being extremely light, the fibres are strong and flexible.

The fibres themselves are very fine – at 5 to 10 nanometres, they are finer than human hairs. The fibres are wound together to make a yarn, and these can also be woven together to create a fabric. The bike parts themselves are made from composite materials where the carbon fibre is mixed with a plastic resin to form a carbon fibre reinforced polymer. Although the term polymer is sometimes taken to refer to plastics, it actually encompasses a large class comprising both natural and synthetic materials with a wide variety of properties. The fibres are arranged in a mould, the resin is added, and after curing the pieces are removed from the mould.

Many other parts of a bike can also be made from carbon fibre, from wheels and forks to handlebars and seatposts, and smaller components such as brake levers and gear shifters. Even the soles of cycling shoes and the shells of cycling helmets can be made out of carbon fibre reinforced polymer to make them lighter and stiffer.

### Chemistry is ... strong

Once, canoes were made of wood and bark. Then, they were replaced by wooden frame constructions covered in canvas. Over the years, other materials started to be used – aluminium, plastic, fibreglass. But now, racing canoes and kayaks are commonly made from the polymer Kevlar, which is both strong and light, and thus is ideal for the speed required for flat races, and the turbulence and obstacles encountered in whitewater slalom. Kevlar – or polyparaphenylene terephthalamide, to give it its chemical name – was developed by scientists at DuPont in the 1960s. It is made by

mixing the two component molecules, or monomers, together, and these react together to form the polymer. These long polymer molecules are then spun out mechanically to form fibres. Because of the way the polymer molecules bond together within the fibres, they are extremely strong – at least five times as strong as steel. They can then be woven to form very strong fabrics.

Kevlar's first commercial use was to replace steel in racing tyres, and it is perhaps most familiar for its use in bullet-proof vests. But its properties make it ideal in sporting products, too. To make a Kevlar canoe, layers of the polymer fabric are combined with a resin on a mould, and then cured to harden the resin. This creates a strong and light hull that does not tear easily, and is resistant to abrasion. However, it does need to be painted with a protective UV-resistant coating because sunlight damages the polymer.

The Kevlar can also be mixed with other materials, such as graphite and fibreglass. A Kevlar canoe is typically 20% lighter than the same design made of fibreglass, but much more resistant to damage.

### **Chemistry is ... stadiums**

Modern construction materials have revolutionised the design and performance of sports venues, whether it's a showpiece stadium, a velodrome, an aquatics centre or a multi-purpose sports arena. They can allow venues to be built more quickly, stand the test of time better, and even reduce their energy usage. Concrete, for example, can be formulated with additives that make it set more quickly to speed up building time, or more slowly if it needs to stay liquid for longer to allow it to be pumped further. Admixtures are specially formulated products that are added in small amounts to concrete, mortar or grout during the mixing process in order to modify the concrete properties in the plastic and / or hardened state. These admixtures can make a real difference – for example, the Bird's Nest olympic stadium in Beijing was constructed using BASF concrete admixtures that allowed the building process to be completed more quickly. These admixtures were also used to speed up the construction of the Beijing olympic village, tennis centre and aquatics centre. Chemistry also provides the paints and coatings that protect surfaces from the weather and other damage, as well as a decorative finish. Many modern coatings are 'greener' than traditional paints, and yet can still protect just as well – if not better. For example, during the recent renovation of Bayer Leverkusen's football stadium in Germany, Bayer's polyaspartic coatings were used to protect the metal girders from corrosion. These have a low viscosity so they can contain higher levels of solids. They also dry more quickly and thicker layers can be applied, so fewer coats are needed, and as there is less solvent to be evaporated, they are more environmentally friendly. By painting the girders with this coating, a very tight schedule was met, and only two coats were needed instead of the usual three.

### **Chemistry is ... springy**

Athletics track design was revolutionised by the introduction of Tartan by 3M in the 1960s. This polyurethane made its olympic debut in Mexico City in 1968, and since that time these types of synthetic polymers have become the dominant materials

used to surface tracks. These all-weather tracks still work well in heavy rain, unlike the grass and cinder tracks they replaced, and since the original Tartan several alternatives that are harder wearing and ‘bouncier’ have been developed. One of the most common surfaces used for athletics tracks these days is Conipur, made by Conica, part of BASF. The company has been making liquid plastics for synthetic sports surfaces since the late 1970s, and several major athletics stadiums use this track surface, including the Jawaharlal Nehru stadium in New Delhi that was used for the 2010 Commonwealth Games, and the refurbished olympic stadium in Berlin where the 2009 World Championships were held.

The track surface has three layers. The top layer is hard but elastic, and the liquid polyurethane is poured onto the track in one piece, which makes it waterproof and resistant to both weather and temperature. Beneath this, two softer layers protect the athletes’ joints. Typically, an outdoor track lasts for 10 to 15 years, and this can be extended by resurfacing. Many competition tracks, such as those installed in the stadiums for the Athens, Sydney and Beijing Olympics, are made by the Italian company Mondo, and this style of track is also being used in the London 2012 olympic stadium. The prefabricated synthetic rubber ‘mats’ are seamed together along the edges of the lanes. The honeycomb backing increases the natural springiness of the rubber material and supports the foot, reducing the amount it rolls when running. Over the years improvements in the design have contributed to some very fast tracks – five World records were set in Beijing alone.

### **Chemistry is ... balls**

Where once footballs were made from stitched-together panels of leather, modern footballs are carefully designed using modern polymer technology. They’re lighter, don’t soak up water and – unlike stitched balls – are perfectly round.

The first unstitched ball to gain official approval was the Adidas Roteiro, which was used at Euro 2004 in Portugal. Rather than being stitched, the pieces are thermally bonded together. Underneath the waterproof polyurethane surface is a layer of foam made from Bayer’s Impranil polyurethane material.

This contains millions of really tiny gas-filled ‘bubbles’, and gives the ball better elasticity, so when it is kicked more power is transferred from the foot to the ball. As the ball is so waterproof, it still behaves as well in heavy rain. As air can leak out of balls over time causing them to deflate, the inner bladder of balls such as basketballs and footballs can be made from Exxon’s butyl rubber, or polyisobutylene. This synthetic rubber is a copolymer of isobutylene with a small amount of isoprene (the building block of natural rubber). It provides a very good barrier to air, making it an ideal material for the bladder in a ball as it helps keep the air inside.

Meanwhile, although tennis balls are usually made of natural rubber, the fluffy felt outer cover is made from a synthetic fibre. This felt improves the way the balls fly through the air by reducing aerodynamic drag. One fibre that is used to make this is Rhodia’s Noval polyamide, which improves the balls’ resistance to both wear and abrasion, so the felt retains its texture better and the balls keep flying well for longer

## **Chemistry is ... recovery**

It's important to drink when exercising – it's easy to become dehydrated as so much water is lost in sweat. But it's not only water that's lost – sweat contains salt and other essential chemicals. And then, of course, the energy that's been burnt up needs to be replaced. Ever since the launch of Gatorade in the 1960s, a steady stream of new sports drinks have appeared on the shelves, and today there are many sophisticated products that contain chemicals designed to aid recovery

A sports drink contains these three essential components – water, electrolytes and carbohydrates. Water on its own isn't enough – it quenches the thirst too quickly and there is a danger that the athlete will remain dehydrated. Even if they do drink sufficient plain water, there is a risk that the level of salt in the blood will fall to dangerous levels. Electrolytes, including sodium and potassium salts, replace those lost in the sweat. The carbohydrates are also important, as they replace the 'fuel' that has been burnt by the muscles. These might be glucose, fructose, maltodextrin or even sucrose.

A number of sports recovery drinks also contain proteins. The aim here is to increase the levels of glycogen and protein in the muscles, and help muscle repair and growth. Some of these drinks also contain amino acids, the chemical building blocks that make up proteins. There are also claims that if products containing whey protein are drunk after exercise, it can reduce muscle soreness.

## **Chemistry is ...**

Many types of sports equipment rely heavily on chemistry to help athletes reach peak performance – and provide critical safety and protective functions along the way. Whether it's a tennis ball or baseball bat, elite athletes from around the world depend on the products of chemistry.

*Polyurethanes.* Polyurethanes, a kind of plastic, will play an important role this summer as they are frequently found in running and other athletic shoes, making them more resilient. In addition, polyurethane is found in a wide variety of popular sporting equipment, such as soccer balls, binders on running tracks and judo mats.

A number of styles of sport flooring and pour-in-place track surfaces use polyurethanes, as well. These equipment necessities alongside such items as surfboard, roller blades, bowling balls and spandex apparel are all made possible in part due to polyurethane innovations.

*Nanotechnology.* Nanotechnology is also changing the way we play sports. For instance, nanotechnology used in golf balls can greatly improve performance by reducing hooks and slices. Tennis racquets manufactured with nanomaterials become stiffer and lighter, giving athletes faster returns and more powerful serves. And for the javelin throw or archery, rosin bags, which are derived from pine chemicals and also used by pitchers in baseball and softball, provide a strong grip.

*Polycarbonate.* Chemistry also helps sports equipment meet modern day needs. Polycarbonate, a strong, shatter-resistant plastic, can also be found in protective sports equipment.

Polycarbonate is often used in riding and biking helmets, helping protect riders competing in equestrian and cycling competitions. Polycarbonate sunglasses and protective visors, which provide optical clarity as well as shatter-resistance, are worn by runners and rowers, just to name a few. Polycarbonate lenses can also be found in swim goggles.

The impact of innovative chemistry is not confined to summer sports. Plastics can be vital to the performance and safety of winter athletes, like skiers and snowboarders. Plastic products' unique combination of lightness, durability, strength and flexibility make ski boots, snowboards, and knee braces help meet high-performance demands.

## Technology in Sports Equipment

Through better nutrition and training, the athletes of today are becoming faster and stronger. Old records are constantly being broken, and new ones set. While the vast majority of these achievements are likely due to the athlete themselves, improvements in sports technology have also played a notable role. New sports gear technologies have especially been relevant to the sports of rowing, cycling, swimming and tennis, giving rise not only to new records, but also ways in which the sport is played.

**Cycling.** At top speed, ninety percent of an elite cyclist's energy is used to counter air-resistance. By comparison, 3 to 7 percent of a runner's energy is spent overcoming air-resistance. Cycling behind a competitor or teammate, or drafting, can reduce drag on a cyclist by up to 38 percent. However, since most cycling teams already practice this technique, cyclists today are searching for new ways to reduce air-resistance and differentiate themselves from their competitors.

A rough formula used to calculate the drag of a cyclist is  $0.5qCA$ ,  $q$  being the air density,  $C$  being the drag coefficient, and  $A$  being the projected cross-sectional area of the front of the bike and rider. The cross-sectional area is the variable cycling teams can best modify and reduce, and has there been focus of recent technological improvements. Using wind tunnels and computer models, engineers have found that something as simple as attaching a water bottle on the lower part of the bicycle frame rather than the upper part, can have a major impact on reducing drag.

Engineers have also improved handlebars, primarily by smoothing over the edges. In 1992, the standard racing handlebars of the time contributed to 10% of the drag created by the bicycle. Over the years, engineers have been able to dramatically reduce the drag created by the handlebars. For example, aerobars (handlebars that are low and forward that a cyclist rests his elbows on) have been shown to reduce the time taken to race across 15 kilometers in a time trial by 60 seconds. The handlebars of a bicycle are the first part of the bicycle to cut through the air, so minimizing turbulence is essential. Although smoothing over the edges barely reduces the projected cross-sectional area, it does prevent recirculating currents and eddies from forming in front of the cyclist's body. This helps the cyclist better cut through the air.

The wheels of a bicycle also have a large effect on the airflow around a bike. Racing bicycles have thinner tires to reduce the cross-sectional area of the front of the bicycle. More significant improvements have come from changing the spokes in wheels. When a wheel spins at high speed, the spokes rapidly cut through the air, and the drag incurred slows down the wheel. Additionally, a large number of spokes cutting through the air disturbs the air current flowing around the bike, creating eddies which reduce the overall aerodynamics of the bicycle.

A simple solution to this problem is to remove the spokes entirely, and make the wheel a solid disk. While this increases the weight of the wheel, new lightweight materials mean that the positive impact of removing spokes far outweighs the detriment on performance due to additional weight. Solid disk wheels are used on all bicycles during indoor racing events. However, such wheels are not used outdoors. In the presence of a cross wind, solid wheels act like sails, throwing the rider of course. As a result, 3-spoked wheels that allow air to pass through them are favored for outdoor races. These provide reduction in drag, while still preventing cross-winds from being a problem. Bicycles are approaching the limit of how thin they can be. Over the last decade engineers have shifted their focus from reducing the projected cross-sectional area to ensuring that air flows smoothly around the cyclist. The most advanced helmets aim to smoothen out the area between the cyclist's head and upper back. These helmets protrude from behind the cyclist's head covering the cyclist's neck, and thus eliminating the dip between head and upper back. This ensures that air turbulence is minimized and eddies and recirculating currents are not formed behind the cyclist's head.

**Rowing.** Elite rowers face a similar dilemma as cyclists. They have to contend with drag from water, which creates 12 times the resistance of air. Manufacturers of top-end racing hulls, or shells, claim that the difference between shells can be the difference between first and second place.

Shell manufacturers are constantly looking for the perfect combination of high rigidity, balance, low surface area, and smoothness. Unfortunately, not all of these attributes can be achieved simultaneously. For example, the surface of the shell that comes into contact with the water, known as the wetted area, causes 80 percent of the drag. However, reducing the wetted area leads to a trade-off in stability and a smoother material may be less rigid. A rigid hull is important, because the more a smoother material may be less rigid. A rigid hull is important, because the more a hull bends and torques, the less efficiently power is transferred from the rower to the water. Much of the technology that has gone into reducing the friction between the shell and the water rowing past it comes from racing yachts, which often get their technology from the aerospace industry. An example of this is the riblet. Riblets are v-shaped grooves that run along the side of the shell parallel to the direction of water flow. Developed by NASA, they are "no deeper than a scratch," but can cut drag by up to 8 percent. No matter how rigid the racing shells are, sweep shells still experience oscillating non-zero transverse movement, or wiggle. In sweeping, each rower has only one oar. Although rowers are traditionally lined up so that they row on alternate sides, this does not achieve the symmetry in power application that is required to remove wiggle. In 2009, Cambridge University asked a member of its mathematics



department, John Barrow, to solve the problem of wiggle in an eight-man sweeping boat. The issue occurs because despite alternating rowers, the forces on the shell are unbalanced. This is because the four rowers on one side are on average closer to the bow than the four rowers on the other side. Four possible rowing configurations where the transverse waves created by the rowers cancel each other out, eliminating wiggle (provided each rower is applying the same amount of force). Interestingly, two of the configurations found by Professor John Barrow were experimented with in the 1950. While configurations “a” and “d” were completely new, configuration “b” was already known as a “bucket” rig and was used in Germany in the 1950’s. Configuration “c” was used by the Italian Olympic team, which subsequently won gold at the Melbourne Olympic Games in 1956. However, one of the reasons that these rigs are unlikely to be used is that they only manage to eliminate wiggle if each rower is applying an equal amount of power on each stroke – an unlikely scenario.

**Swimming.** Another sport that struggles with water resistance is swimming. After the 2008 Beijing Olympics, official competition rules were changed to reduce the effect high tech swimsuits had on race times. This change came in response to the astounding 42 swimming world records that were broken in the Beijing Olympics. Thirty-eight of these new records were broken by swimmers wearing the Speedo swimsuits. The Speedo swimsuit is made of nylon-elastane. Nylon-elastane is extremely light and helps compress the swimmer’s body into a more hydrodynamic shape. Although compression is not new to racing suits, the swimsuit has three times the compression power at half the weight of the suit used in the previous Olympic Games. The compression is so strong that it takes 20 minutes to squeeze one’s body into the suit. This compression not only smooths out the swimmer’s body, but it also helps support the swimmer’s hips, which hang lower and increase drag as a swimmer tires. Instead of sewn seams, which disrupt water flow and increase drag, the swimsuit is held together using ultrasonic welding, which according to Speedo reduces drag by 6 percent. The suit is also composed of polyurethane panels that are placed at high friction points on the suit. This further reduces drag by a stunning 24 percent.

Tests have shown that swimmers wearing the swimsuit consume 5 percent less oxygen to achieve the same performance – a clear indication of the reduction in effort required by the swimmer. Although the suits were banned in 2010 under the new restrictions that only allow male swimmers to wear swimsuits that go from waist to knee, they are a clear example of a technology that is revolutionizing a sport.

**Tennis.** Reducing drag is not the only way sports benefit from scientific advances. Tennis racquets have undergone two major transformations over the past twenty years. Racquet heads became larger, and strings have become better at helping players generate spin on the ball. A large racquet head gives a player more reach, and enlarges the “sweet spot” on the racquet. Contact at a racquet’s sweet spot, which is located at the center of its head, results in the greatest conservation of energy of the ball upon impact, meaning that the ball moves more quickly.

Racquet head enlargement has only occurred recently because a larger racquet head requires greater string tension. More tension is needed to keep the strings taught across a longer distance, which in turn requires that frames be stronger. Bigger,

stronger frames, formerly meant heavier, thicker racquets. Heavy racquets with thick frames suffer from an increase in air resistance during the swing and are detrimental to players who are looking to make fast serves and swings.

The shift in frame material first from steel to aluminum, and then from aluminum to graphite and foam, resulted in frames that are stronger and stiffer without being thicker. However, despite being strong enough to withstand increased string tension, graphite racquets were heavy. The relatively recent incorporation of titanium in modern racquet frames, truly allowed frames to become larger, lighter, and thinner. Although racquets have become lighter and bigger, the biggest improvement in tennis racquets has come from improved strings. A player who can generate high amounts of spin is able to hit shots that drop down onto the court (much like a curveball in baseball). Hitting a shot that curves down allows players to hit harder shots without the fear that the ball will land outside the court. Studies have shown that adding 100 rotations per minute to the rate at which the ball spins reduces flight distance by 6 to 12 inches. Co-polyester strings have been shown to create 20% more topspin than nylon strings. Counterintuitively, they create more topspin despite reducing friction between racquet and the ball. Co-polyester strings slide with, rather than grip the ball along the racquet face. The strings then snap back and add spin to the ball after the ball has changed direction. The use of co-polyester has had an astounding effect. In the words of Andre Agassi, “the advent of a new elastic co-polyester string, which creates vicious topspin, has turned average players into greats, and greats into legends”.

Technology has helped athletes hit better shots and race faster. Still, competition has not changed: It remains the man, not the tool that must win.

## Glossary

**abdomen** *noun* a space inside the body that contains the stomach, intestines, liver and other vital organs

**abdominal roller** *noun* a piece of gym equipment that works the abdominal muscles

**accelerometer** *noun* an instrument or device for measuring acceleration, especially one in which a sensor converts acceleration into an electrical signal

**active force** *noun* a force that creates movement and is entirely a result of muscle activity. Compare **impact force**

**aerodynamic** *adjective* used for referring to the way in which objects are affected when they move through the air

**altitude** *noun* the height of an object above sea level

**assessment** *noun* careful consideration of something to make a judgment about it; a judgment based on evidence

**backboard** *noun (in basketball)* the vertical board situated behind the basket that serves to rebound the ball into the basket or onto the court. Also called **board**

**backhand** *noun* in tennis and other racket games, a stroke made with the back of the hand turned towards the ball or shuttlecock as the arm moves outwards from a position across the body *verb* to hit the ball with a backhand

**back stop** *noun* a screen or barrier to stop a ball travelling out of the playing area

**badminton** *noun* an indoor game in which rackets are used to hit a shuttlecock back and forth across a high net

**balance** *noun* the act of staying upright and in a controlled position, not stumbling or falling

**ball** *noun* an object, usually round in shape and often hollow and flexible, used in many games and sports in which it is thrown, struck or kicked

**baseball** *noun* a game played with a bat and ball by two teams of nine players on a field with four bases marking the course the batters must take to score runs

**basket** *noun (in basketball)* a mounted horizontal metal hoop with a hanging open net, through which a player must throw the ball in order to score

**basketball** *noun* a game played by two teams of five players who score points by throwing a ball through a basket mounted at the opponent's end of a rectangular court

**baton** *noun* a short stick or hollow cylinder passed by each runner in a relay team to the next runner

**bench** *noun* a long seat in a gym, used for lying on when doing exercises

**biathlon** *noun* a competition that combines cross-country skiing with rifle shooting at targets along the course

**bicycle** *noun* a vehicle with two wheels and a seat that is moved by pushing pedals with the feet, and steered by handlebars at the front wheel *verb* to travel by bicycle

**billiards** *noun* an indoor game in which a felt-tipped stick is used to hit balls across a cloth-covered table into pockets

**biomechanics** *noun* the study of body movements and of the forces acting on the musculoskeletal system, used in sport for analysing complex movements to improve efficiency and help avoid injury

**boxing** *noun* the sport of fighting with the fists with padded gloves, with the aim of knocking out the opposing boxer, or inflicting enough punishment to cause the other boxer to retire or be judged defeated

**boxing ring** *noun* a square raised platform with roped-in sides, used as the fighting arena in boxing matches. Each fighter has a designated corner diagonally opposite the other.

**canoe** *noun* a lightweight boat, pointed at each end, that can be paddled by one or two people and can carry passengers. Canoes were originally made from natural materials, but modern canoes are made of aluminium or of moulded plastic and fibreglass. *verb* to paddle a canoe, often as a sport or hobby

**centrifugal force** *noun* the force of acceleration away from the axis around which an object rotates

**coach** *noun* someone who trains sports players or athletes *verb* to train someone in a sport

**contest arena** *noun* the place in which an athlete performs in competition, which may differ in important ways from the training arena

**cross-country** *noun* a sporting activity or event such as running, cycling or racing that is done off the roads

**decathlon** *noun* a contest in which athletes compete in ten different events and are awarded points for each to find the best all-round athlete. The events are long jump, high jump, pole vault, shot put, discus, javelin, 110-metre hurdles, and running over 100 metres, 400 metres, and 1,500 metres.

**deceleration** *noun* the act or process of reducing speed or making something go more slowly

**DOMS** *abbreviation* delayed onset muscle soreness

**drag racing** *noun* the sport or activity of racing cars with specially modified bodies and engines over a distance of a 1/4 of a mile at extremely high speeds

**drop handlebars** *plural noun (on a racing bicycle)* handlebars that curve downwards, enabling the rider to adopt a more aerodynamic posture

**duathlon** *noun* a sports event in which athletes compete in two endurance events, e. g. cross-country skiing and rifle shooting, or running and swimming

**dynamics** *noun* the branch of mechanics that deals with motion and the way in which forces produce motion

**faceguard** *noun* a protective grille worn to protect the face in certain sports, e. g. base-ball and American football

**face shield** *noun* a piece of protective sports equipment that covers the head and face and protects them from flying objects

**figure skating** *noun* a form of competitive skating in which skaters trace patterns on the ice and perform spins, jumps, and other manoeuvres

**foam** *noun* a light, porous, semi-rigid or spongy material used for thermal insulation or shock absorption

**free diving** *noun* the extreme sport of submerging into deep water for as long as possible without the aid of oxygen tanks

**gymnastics** *noun* **1.** physical training using equipment such as bars, rings and vaulting horses, designed to develop agility and muscular strength **2.** the competitive sport in which athletes perform a series of exercises on pieces of gymnastic equipment

**hammer** *noun* a heavy metal ball attached to a handle of flexible wire, thrown in an athletics field event

**hammer throw** *noun* a field event in which competing athletes try to throw a heavy metal ball attached to a handle of flexible wire as far as they can

**handball** *noun* a game for two or four people in which players hit a small hard ball against a wall with their hands

**hand grip** *noun* a resistant piece of equipment used to develop hand strength

**ice hockey** *noun* a game played on ice by two teams of six skaters. Points are scored by hitting a rubber disc (**puck**) into the opposing team's goal with a long flat-bladed stick.

**ice rink** *noun* an area of frozen water used by ice-skaters, ice-hockey players and curlers, especially an enclosed prepared surface

**iron man competition** *noun* a triathlon for men and women that includes competitions in endurance events, usually cycling, swimming and running

**javelin** *noun* a long thin piece of wood, plastic or metal with a pointed end, thrown in field competitions

**kayak** *noun* a lightweight fibreglass canoe propelled by a double-bladed paddle, used for leisure and in competitive sport

**kinematics** *noun* the scientific study of motion

**lap** *noun* a single circuit of a racetrack or running track or one length of a swimming pool *verb* to overtake a competitor on a racetrack or running track after having completed at least one circuit more than he or she has

**lap of honour** *noun* an extra lap round a racetrack or running track run by the winner of a race or game to acknowledge the presence and applause of spectators

**Lycra** a trade name for a lightweight stretchy polyurethane fibre, or a fabric made from this, used for making sportswear

**mechanical sport** *noun* any sport in which a machine or vehicle is used, e. g. motor racing

**mechanics** *noun* the study of the forces acting on moving parts or systems, e. g. the human body

**microfibre** *noun* a wrinkle-resistant washable fabric made of fine synthetic fibres

**mileometer** *noun* a device that records distance travelled, e. g. one fitted to a racing cycle

**neoprene** *noun* a type of plastic used for making sports injury braces and supports and for making wetsuits

**pacemaker** *noun* a battery-operated electrical device inserted into the body to deliver small regular shocks that stimulate the heart to beat in a normal rhythm

**paragliding** *noun* a sport in which someone jumps from an aircraft or a high place wearing a rectangular parachute that allows control of direction in the descent to the ground

**pedometer** *noun* an instrument that measures the distance covered by a walker by recording the number of steps taken

**photo finish** *noun* the end of a race in which two or more contestants are so close that the result must be determined from a photograph taken as they cross the finish line

**powerlifting** *noun* a weightlifting sport that consists of the three events of the squat, the bench press and the deadlift

**puck** *noun* a small disc of hard rubber that the players hit in ice hockey

**punchball** *noun* a large heavy ball on a stand, used for training or exercise, especially by boxers

**quadrathlon** *noun* four tests for measuring improvements in an athlete's explosive power, consisting of a standing long jump, a triple jump, a 30-metre sprint and an over-shoulder shot put

**racewalking** *noun* the sport of racing at a fast walking pace, with rules that require walkers to keep at least one foot on the ground at all times

**racket, racquet** *noun* a lightweight bat with a network of strings, used in tennis, badminton, squash and similar games. The frame is usually made of wood, aluminium or graphite and the strings of gut or nylon.

**rings** *plural noun* a pair of metal rings that are suspended from a ceiling and used to perform gymnastic routines

**rink** *noun* a smooth, enclosed and often artificially prepared ice surface used for ice-skating, ice hockey or curling

**rowing** *noun* the propelling of a small boat through the water using oars, especially the sport of racing in specially designed lightweight boats

**rhythmic gymnastics** *noun* a sport in which athletes combine gymnastic dance movements with the use of apparatus such as ribbons and hoops

**sambo** *noun* a modern martial art originating in the former Soviet Union, with forms similar to wrestling and aikido and a form based on self-defence

**scuba diving** *noun* the sport of diving, using an apparatus for breathing underwater consisting of a portable canister of compressed air and a mouthpiece

**snowboarding** *noun* the sport or pastime of riding a snowboard, also an extreme sport with acrobatic tricks and moves

**starting gun** *noun* a gun fired as the signal for a race to start

**starting line** *noun* a line marked across a racetrack to show runners where to start

**step aerobics** *noun* a form of aerobic exercise in which the participants step up and down to music, using a low platform

**swimming pool** *noun* a water-filled structure in which people can swim, usually set into the ground outdoors or the floor indoors, or a building that houses such a structure

**swimsuit** *noun* a piece of clothing worn for swimming, especially a one-piece garment worn by women

**table tennis** *noun* a game that resembles tennis and is played with small bats and a light hollow ball on a table divided by a low net

**tandem** *noun* a bicycle with two saddles and two sets of handlebars and pedals, one behind the other, so that it can be ridden by two people at the same time *adjective* describes sports activities undertaken by two people together, usually positioned one behind the other, especially when one person is a novice

**tennis** *noun* a game played on a rectangular court by two players or two pairs of players, who use rackets to hit a ball back and forth over a net stretched across a marked-out court

**tennis ball** *noun* a white or yellow fuzzy cloth-covered hollow rubber ball about 7.5 cm<sup>3</sup> in diameter, used in tennis. In lawn tennis the ball is pressurized.

**trampoline** *noun* a strong sheet, usually of canvas, that is stretched tightly on a horizontal frame to which it is connected by springs

**triple jump** *noun* an athletics event in which contestants perform a short run and three consecutive jumps, landing first on one foot, then the opposite foot, and finally both feet, in continuous motion

**twintip** *noun* a ski of the type worn in the sport of freeskiing, broader and softer than a downhill ski and with turned-up points front and back, designed so that the wearer can move forwards and backwards on a slope and execute the complex moves performed in freeskiing

**wakeboarding** *noun* a water sport in which someone riding a single board is pulled behind a motor boat and performs jumps while crisscrossing the wake of the boat

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# ENGLISH FOR SPORTS ENGINEERING

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Пособие по английскому языку  
для студентов спортивно-технического факультета

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