Tennis equipment and facilities

Equipment and facilities in tennis are essential for the successful conduct of the learning process with students. The proper selection of a tennis racquet, type of court surface and balls can help with and significantly shorten the training time and improve the game's technique, as well as to prevent injuries. The main elements of the tennis equipment and facilities are:

Tennis court

Tennis courts can be of different surfaces: clay, grass, concrete (hard court) or artificial. Depending on the material used for the surface of the tennis court, four main types of surfaces are distinguished:

1. **Clay courts** are made of crushed shale stone or brick. They are mainly practiced on by players who play from the baseline. They are used only at the French Open from the Grand Slam tournaments. Typical for them is the great adhesion/cohesion of the ball, resulting in slower speed, although the rebound is higher than on grass or hard courts. They are cheaper to build than the other types, but surface maintenance is more expensive. They are most common in Europe and Latin America.

Fig. 6. Red (clay) court

2. **Grass courts** are the fastest courts on which tournaments are held. Wimbledon is the only Grand Slam tournament played on grass. It is heavily planted into the ground and very difficult to nourish. The rebound on the grass court depends on many factors, the most important being the quality of the grass. The rallies are much faster in comparison to the other courts. The surface is a bit stiffer and slightly more slippery than the hard courts, as a result of which the ball slides and bounces lower, requiring more speed to reach it.

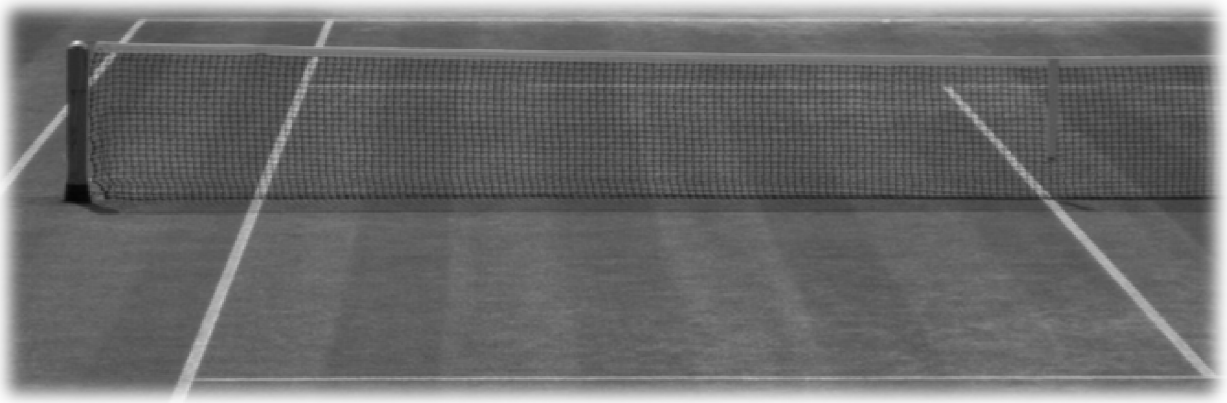

Fig. 7. Grass court

3. **Hard courts** are made of a homogeneous solid material, that is, sand with paint. As a result, the rebound of the ball is more predictable than the other surfaces. On such courts the speed may vary as they are faster than clay, but slower than grass. A certain amount of sand is added to the paint that determines and significantly affects the velocity – a result from the adhesion/cohesion of the ball to the surface.

Fig. 8. Hard court

The U.S. Open Championship is played on acrylic hard courts, while at the Australian Open - on synthetic hard courts. The main difference between them is the surface hardness level. The fastest rebound of the ball, compared to all other surfaces, indicates that there is no sand at the top layer of the paint.

4. **Carpet courts** are the fourth type of courts according to the surface specifics. The covering of tennis courts can be changed using a carpet - that is, artificial grass with sand. It is a fast-pace surface (faster than hard court) with a low bounce of the ball. It is common in Asia. Its base is made of rubber and can be temporarily utilized as flooring of a hall or an outside court. However, it is forbidden for use at professional competitions. Since 2009 there have been no tournaments of the ATP Tour on this surface.

Fig. 9. Carpet court

Tennis racquets

The racquet is a sports tool that represents a bent frame of an open-loop shape, with a network of strained cords inside. It is used to hit the ball in games such as squash, tennis and badminton, known as racquet sports.

At the birth of the tennis game, racquet frames were made of layered wood. Traditionally, the size of the racquet had been limited by the power and weight of the wooden frame, which also had to be strong enough to hold the cords and hard enough to hit the ball. In order to improve rigidity, manufacturers had subsequently begun to add non-wood laminates to the wooden racquets. The first ones were made of steel, after that - of aluminum, and later - of composite materials (carbon fibers). Most modern racquets are made of composite materials, including carbon fiber or fiberglass, metals like titanium alloys, graphite or ceramics.

The parts of a tennis racquet are head, neck, handle, cap, string.

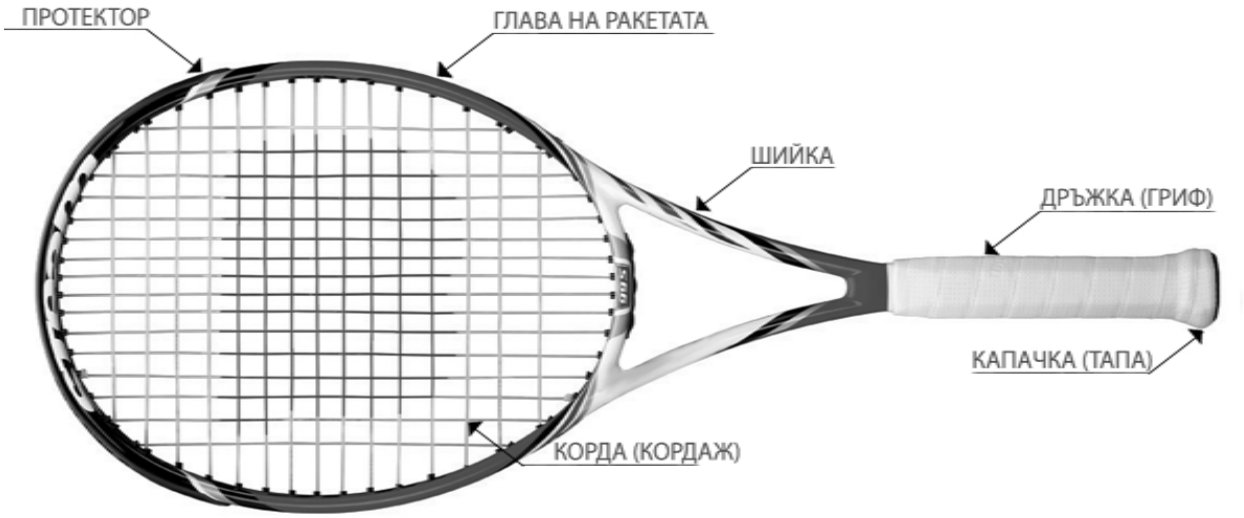

Fig. 10. Composition of a tennis racquet

Modern tennis racquets vary in terms of:

1. Length of the racquets:

a) for children and juniors, the range is from 48,25 to 66,7 cm;

b) for adult players and professionals is usually 68,5 or 67,38 cm.

Table 1. Distribution of racquet's lengths according to the height of the player

Height of player (cm)	**Size in inches**	**Size (cm)**
Up to 118	21	53,3
119–135	23	58,4
136–150	25/26	63,5/66,0
Over 151	27	68,5

The maximum length of the racquet allowed by the ITF is 29 inches (73.7 cm).

2. **Weight** of racquets: up to 165 g (children's racquets); up to 265 g is considered a light racquet; between 265 and 325 g - a medium one; and over 325 g - as a heavy racquet.

3. **Balance** - an important feature of a tennis racket. Three types of racquet balance can be distinguished: in the head, in the handle or neutral. The balance is determined by the weight of the racquet's head: HH (Head Heavy) - the head is heavy, the balance is in the head; HL (Head Light) - the head is light, the balance is in the handle; HM (Head Middle) - relatively balanced - the balance is at the middle of the racquet's length.

The racquet balance affects the stroke's power and the ability to control the ball. Head Heavy racquets are more powerful at the expense of greater effort and load pressure on the arm and wrist. On the other hand, the weight in the handle allows for a better control of the ball and for

playing a more varied game. Head Middle racquets are the most commonly used ones - they are universal.

4. The size of the head also plays a significant role in the quality of the racquet. It varies from 85 to 137 square inches (see Table 2). The average size of the racquet‘s head amongst most players is between 95 and 105 sq. in. In general, amateurs play mainly with head size ranging from 100-102 sq. in., while for professionals this range is between 90-98 sq. in. A bigger head of the racquet means more power and a larger "hot spot", i.e. an opportunity to hit the ball outside the center of the racquet, while the smaller size offers more precise control and more accurate game play.

Table 2. Size of the racquet head

Size of a racquet’s head	**In square inches**	**In square centimeters**
Standard	66	426
Midsize	70–89	452–574
Midplus (Midover)	90–105	580–677
Oversize	110–115	710–742
Super Oversize	116–135	748–871

5. **The size of the handle** is of great importance for the good performance of the individual technical elements of the tennis technique and to a great extent - for the health and comfort of the player. The handle should not slip out of the palm and should not be too thick, as in both cases there is too much shock on the wrist occurring. The standard girth types of the tennis racket handle are: L3 4⅜ in., L4 4½ in. (see Table 3).

Table 3. Dimensions of tennis racquet handles

Size of handle under the European system	**Size of handle under the American system (inches)**
0	4
1	4⅛
2	4¼
3	4⅜
4	4½
5	4⅝
6	4¾
7	4⅝

Tennis strings

The string is part of the tennis racquet that makes contact with the ball. It is the net inside the head - in the "hoop" of the rocket. Strings are made up of different materials and have various properties, such as dynamic stiffness, entrainment of strain during stringing, thickness, (pattern), ball rebound, efficiency and durability.

The material used to produce the cords can greatly influence the performance of the game and even the health of the player. Only certain materials are suitable for making tennis cords. They differ in terms of elasticity, durability, ball rebound's efficiency, material endurance, production costs, and so on.

(a) **Natural cords** are made from dried intestines that are extracted from a cow's small intestines. They contain collagen and have a thick membrane designed to withstand stretching and contraction. Specifically these fiber qualities - elasticity and durability make them preferred for the production of tennis cords. There are also sheep strings that have been used in the past. They were made from the same material and technology as the surgical threads.

According to unofficial data, the first natural gut strings (made from intestines) were produced in 1875 by Pierre Babola, who founded the Babolat brand fifty years later. These cords are usually sold sealed and cannot be played with in damp and wet places, because they get unraveled. They are one of the most expensive cords in the world and they provide the best feeling to the ball.

b) Synthetic cords are made of nylon and twisted, covered fibers. They are very cheap to manufacture and are often used in practice. The cord consists of a multitude of strands that greatly retain the string's stiffness and approximates it most closely to the natural one. Synthetic cords are produced and used extensively in the modern tennis industry.

c) Nylon cords find the greatest use amongst amateurs. Their price is cheap and their elasticity continuously improves due to the multiple-fiber thread. They have a durable moisture coating and can be used for a long time even in poor weather conditions.

d) Polyester cords are distinguished by hard and durable material. It has been found that it cannot retain the stiffness of the fibers, which is why it came available only after long studies and analysis in the tennis industry and sports practice. It is designed for players who often restring their racquets. In addition, studies show that this type of string can be used for playing balls with high topspin, i.e. they provide the greatest possibility for a rotating ball motion. It is known, however, that these cords have the fastest use up of balls in the game.

Types of tennis strings "patterns"

All modern tennis racquets are strung with an interlaced horizontal-vertical pattern, which provides more force to the ball at rebound from the string and makes them easier to play with. The racquets get stung either with two separate cords (four knots) or with a single one, ranging from 9 to 12 meters in length depending on the head of the racquet and the pattern (i.e. there are only two knots). Sometimes two different strings can be used to string one rocket. The main stringing patterns (horizontal to vertical) are 16/19 for amateurs and 18/20 for the professional athletes' racquets. This allows for more control when playing the ball.

Stringing of racquets

The tension (string stiffness) is expressed in kilograms. It shows the tension force with which the cords are attached to the racquet frame. Stringing characterizes the playing style of a racquet, such as ball feeling, control, strength, and so on. All racquets are used with recommended string tension (kg), most of which are in the 25-32 kg range. With softer strung racquets, the ball moves with greater force and speed, but the control over it is less, often times may hinder the start of the game. Higher strung racquets allow for more control over the ball, resulting in faster hand tiredness and even to a condition, known as a “tennis elbow”.

Advices for choosing a racquet for beginners and advanced students (both men and women)

Choosing the right racquet is extremely important at the beginning stage of the students' tennis classes. It can protect them not only from injuries, but also save time in the training process.

Table 4. Example chart of racquet choice for beginners and advanced players

	Head size	**Weight**	**Type of string pattern**	**Grip size**	**Stringing**
Beginners					
Women	100–112 sq. in.	198–255 g*	16/19	L2/L3	26–25 kg
Men	98–110 sq. in.	265–298 g*	16/19	L3/L4	28–27 kg
Advanced					
Women	98–102 sq. in.	240–272 g*	16/19–18/20	L2/L3	25–24 kg (power) 27–26 kg (control)
Men	95–102 sq. in.	278–325 g*	18/20	L3/L4	24–23 kg (power) 29–28 kg (control)

* The weight of the racquets is denoted with the string.

Tennis balls

One of the most important means of playing the game, which is also distinguished by the highest level of requirements and precision for quality, is the balls. They must meet certain size, weight, deformations and rebound criteria to be approved by the International Tennis Federation (ITF). The following have been established:

• **Official balls diameter**: 6,54-6,86 cm and weight of 56,0-59,4 g.

• **Color**: yellow and white - these are the only colors approved by the United States Tennis Association (USTA) and the ITF. Most balls are made with fluorescent yellow (known as "optical yellow") - the most contrasting color suitable for television, and were introduced in 1972.

• **Tennis ball bounce's standard**: A ball dropped on a concrete from 254 cm height must bounce between 135 and 147 cm.

Tennis balls are full of air and are made of a homogeneous felt-rubber compound, although there are also manufacturers who fill them with small polystyrene balls. The tennis balls are additionally marked with the manufacturer's brand logo, along with a description of the type of court surface to be played on. They start to lose their bounce quality as soon as the new can is opened, as they have been stored under pressure of around two atmospheres.

Tennis shoes

One of the most important element of a tennis player‘s equipment is the shoes. They must have soles that provide sufficient grip with the surface that is played on. A different type of shoes is required for each surface with respect to the grapple and thickness of the sole. They can be “fish bone” type for clay; with small hard-wearing buttons for hard court; and almost smooth for grass. Essential requirement for them is to absorb the vibrations and bruising when running, starting and stopping, by protecting the knees and ankles from traumas.

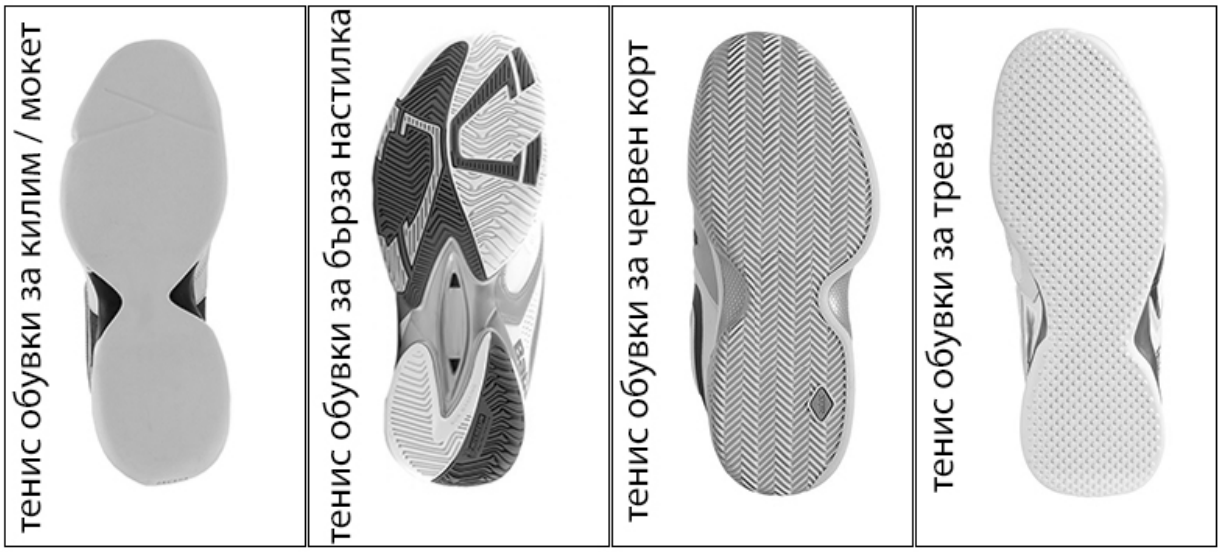

Fig. 11. Types of tennis shoes

Tennis apparel

In the past, the clothing of tennis players had been completely white. In modern tennis there is a combination of all kinds of colors and patterns. The basic requirement is to be comfortable and well-suited. Stylish and clean clothes stimulate the sense of pride in players when they come out on the court.

Fig.12. Modern tennis apparel by the Clima Cool technology

Generally, white clothes are better preferred, because they reflect the sun and do not hold the heat in the body. Recently, the production of cotton clothing has been replaced by the Dry-Fit and Clima Cool technologies to help players stay dry longer. For the tennis training process, it is also good to choose comfortable clothes - wider shorts with pockets for carrying two balls, which saves time.