

Teacher Notes:

Materials used in the sport of football

Sport: Football

Age group: 7 - 11

These notes are designed as a guide on how to lead the session, and are written in a script format. If you wish to lead the session in a different way please feel free to do so.

The **red text** indicates what each slide includes, while the **blue text** highlights the key points being discussed in each slide. The **owl symbol** demonstrates where students are required to perform a task (eg questions, experiment, etc.). These are used to help you observe the students learning and recap any information which the students have found difficult to understand.

Depending on the level of student understanding this module may require two lessons to complete.

Slide 1

Opening slide containing title of session and visual introduction to the sport the topic relates to.

The first slide provides the title of the session.

The objectives for the session are for students to:

- Be able to identify characteristics of a material;
- Be able to identify properties of a material;
- Be able to choose a material for a purpose.

Slide 2 – Introduction (Football and science)

Football, or soccer as it is also known, is one of the oldest modern day team sports and references to the game, in a variety of forms, can be seen throughout recent history and as far back as the 8th century. The modern game was formalised in 1863 the year the British Football Federation was established. Eight years later, the federation counted 50 club-members.

A brief introduction about football and what chemistry there is in the sport.

Football has been an Olympic Sport since 1900 and it was the first team sport introduced in the Modern Olympic Games. Football is played by both men and women. In Britain the men's teams, and tournaments they play in, are more widely reported on and heard about but in other countries around the world the women's game is nearly as popular, especially amongst youth teams, Canada being a good example of this.

Football uses lots of different types of materials, some of these materials are natural and others are synthetic or manmade. Materials are everywhere within the game. The clothing the players wear, the ball they kick, the goal the players score into, and the pitch they play on, are all made from different materials. Each of these materials has been chosen for their specific properties to assist and aid the players to perform at their highest.

Specifically this case study will look at the materials in the football, the goalies gloves and the goal posts.

Slides 3 & 4 – The Football (Historic & Modern day)

Identifying and exploring the historical and modern day materials used to make footballs. The characteristics of some of these materials are also examined.

Key Point
Synthetic means manmade. Common manmade materials include plastics. Most plastics are originally produced from the distillation of crude oil.

Historically natural materials were used to make footballs. The outer layer used to be made from leather. Leather is a naturally occurring material. It actually comes from the skin or hide of cows. The hide would have been cleaned and treated, sometimes with chemicals, and then cut into shape and sewn around the 'inner' of the ball.

The 'inner' of the football, known as the bladder, actually takes its name from its historical roots. In the olden days the bladder was actually exactly that, a bladder from a pig. This would have been emptied, then filled with air and sewn up. Due to the natural shape of the pigs' bladders, the resulting footballs were not overly round in shape, unlike the modern day footballs we now see.

Footballs used today are made from synthetic, or manmade, materials. Manmade materials do not occur naturally. They are made from chemicals, many of which come from the distillation, or separation, of crude oil. Most manmade materials have a plastic look and feel about them.

In a modern day football the outer layer is made from synthetic leather, a type of plastic. The inner layer or 'bladder', as it is still known today, is made from another manmade material. Latex can be found in a natural form and comes from a type of rubber tree. Natural latex is used in the production of chewing gum. This natural latex is not however used to make football bladders; manmade latex or a material known as butyl is used. The latex is a flexible material that is stretchy and elastic. It also has a rubbery texture to it, when you touch it, much like natural latex.

Synthetic leather is durable and very resistant to abrasion, so it does not scuff or scratch as natural leather often does. The manmade materials used to make the bladders in today's footballs are also stronger and hold their shape better than the traditional materials used. Many manmade materials are also cheaper than their natural alternatives, again giving cause to replace traditional materials.

These materials are also used elsewhere in sport and in everyday life. Synthetic leather is used in football boots, shoes and in horse saddles amongst many other items. Latex is seen in clothing and is used as seals on waterproof garments.

Slide 5 – Goalies Gloves

A closer look at the materials used to make goalies gloves.

As well as the footballs the players use in today's game materials can also be seen in the gloves that the goalies wear. Goalies gloves can be made from rubber, neoprene, cloth, and leather. Notice that some of the materials are the same as those used to make the footballs, as some of the properties the gloves need to have are the same, such as being strong, durable and resistant to abrasion. The gloves can be made from a combination of these materials where each of them can provide advantages to the player depending on where they are on the glove. Examples include leather on the inside of the palm of the glove. This can protect the skin from being cut as leather is durable and will not tear easily and plastic coatings on the inside of the fingers to aid with grip. Historically the materials would have been natural but, like the modern day footballs, most materials used are now manmade. The characteristics of leather have already been explored when discussing the materials used to make footballs. Rubber, another material found in goalies gloves, has elastic characteristics and is strong; it is hard to tear or rip and is durable. Neoprene, the material often used to make wetsuits, can also sometimes be found in goalies gloves. This material has advantages in different weather conditions.

Neoprene is a useful material in the wet. It can keep water out therefore keeping hands dry or can allow a small amount of water in. The water let in can be trapped between the layers of neoprene and can be heated up by the player's body temperature thus keeping the player's hands warm.

Slide 6 – Goal Posts – Materials made from metal

A closer look at metal goal posts and the properties of metals.

Key Point

Metal

Characteristics

- Strong
- Durable
- Inflexible (or rigid)
- Shiny when cut
- Greyish in colour (normally)
- Conduct heat and electricity.

Having explored some of the materials used to make footballs and goalies gloves it is noticeable that these are all non-metallic materials. There is however metal found on the football pitch. Can you think of where this is?

The goal posts seen at either end of a typical football pitch are a good example of where metal can be found in the game of football.

The goal posts are typically made from steel tubing. Steel is a metal and is most commonly known for its strength, its durability and the fact it is not that flexible.

These properties are common amongst metals, with others including; a shininess when cut, the conduction (or passing) of electricity and heat and their greyish colour. One of the problems with many metals is that they can corrode (become damaged) by water and sometimes other liquids. This is why metals are often coated, normally with layers of varnish or paint. In football posts it is the white paint coating that gives the posts their white colour.

Steel is prone to rusting if it has lost its coating. The rust can change the characteristics of the steel and reduce its strength over a period of time.

Steel has been used in the building of stadiums, in bike frames and in hockey pucks. More generally it is commonly used to make tables, sinks and used for piping.

Is metal a manmade material? Metals can be found naturally, especially the unreactive metals such as gold. Normally, however, they are found in rocks and stone in their ore or oxidised forms. When found in these forms the metals have reacted with other elements, often oxygen, to make the ores. Humans have, over many thousands of years, developed ways of removing the metals from their ores. Therefore, metal cannot be classified as manmade or synthetic. It is normally best to refer to a metallic material as just that – a metal.

Slide 7 – Recapping types of materials

Using the sport of football as our example, we have explored different types of materials such as metals, used in goal posts, manmade materials such as synthetic leather and latex, as well as natural materials, such as real leather, which comes from animals and natural latex which comes from trees.

Reviewing the different types of materials we have explored we can normally put materials into three different categories. These are:

- Manmade or synthetic materials. Examples include synthetic leather, plastics, glass and materials such as neoprene.
- Natural materials. These are materials which come from things we can find in nature such as animals and plants. Examples include leather (from animal hide), certain fabric materials like silk and cotton and materials from trees such as wood.
- Metals. These types of materials are normally easy to identify as they have very similar characteristics. They are normally very strong, durable, inflexible, and often grey in colour (as long as they have not been coated or painted).



Distribute the 'student handout worksheet' and allocate 20 minutes for the students to attempt the questions on the worksheet. The questions are related to the all of the slides.

Slides 8 - 10 - Questions & answers from worksheet

Go through the answers to the worksheet, with the students, with the use of these slides. Recap any areas where students have particularly struggled, to ensure learning takes place.

The slides can be used to cover the answers to the questions in a group situation or can be printed off and kept by the students for revision purposes.

1. Footballs are made up of two layers, an outer layer and an inner layer. Answer the following questions on the inner layer of a football.

a) What is the inner layer of a football often called?

The inner layer of a football is often called the 'bladder'.

b) What natural material did the inner layer of a football used to be made from?

A pig's bladder was the natural material an inner layer of a football used to be made from.

c) What material is the inner layer of a football made from in modern day footballs?

Modern day footballs' inner layers are now made from manmade latex or butyl.

2. What are the common properties or characteristics of a metal? Write down four in the spaces below:

A metal is:

- 1) Strong
- 2) Durable
- 3) Inflexible, or rigid
- 4) Shiny when cut

Other answers could include; greyish in colour (if not coated or painted), conducts heat and electricity.

3. Why have modern manmade materials replaced traditional materials in a goalkeeper's gloves?

Manmade materials replaced natural materials because their characteristics or properties are better for the chosen task than the natural equivalents. The materials used in goalies gloves are more weather proof and more robust to abrasion (getting scratched, scuffed or torn) than the old natural materials that used to be used. The modern day materials are often combined to add further benefits such as grip.