

Teacher Notes:

Chemistry of chalk and MgCO_3 , explored through the sport of weightlifting

Sport: Weightlifting

Age group: 11 - 14

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 background picture as a visual introduction.

The first slide provides the title of the session and a picture of a weightlifter dusting chalk off his hands, introducing the topic and drawing a visual picture of the link between the sport and chemistry.

Slides 2 & 5 – Introduction – Weightlifting and the link to chemistry

Weightlifting, the sport of lifting weights in a variety of ways to a variety of different positions, has routes back to ancient times, with the lifting of heavy stones to determine a person's strength. This has continued through the ages and in many strongman contests today heavy stones are lifted, or attempted to be lifted.

Slide 2 gives a small amount of background to the sport of weightlifting.

Weightlifting as we know of it today started in Germany in the mid-1800s and quickly spread through the rest of Continental Europe. The International Weightlifting Federation (IWF), the sports governing body, was founded in 1905. Since 1896, weightlifting has featured at 23 Olympic Games but it wasn't until the sport's 21st Olympic appearance in Sydney that the programme included female competitors. Chalk is used by the competitors to aid their grip on the weights and bars and chemistry plays a large role in the manufacture of this chalk.

Slide 3 describes the link between the sport and chemistry through the use of chalk.

Chalk is a very useful natural substance and can be found in many sports. Originally chalk was used as a dusting powder in lawn tennis to outline the lines of the court. Its advantage is that if the ball hit the line, a cloud of dust would arise and this would be a good indication to the officials that the ball hit the line. This was especially important during serving. In the modern day, technology has improved and cameras and sensors now used have removed the need of the natural chalk dust cloud and titanium oxide is used for the court markings.

Slides 4 & 5 explore the use of chalk in sport before looking at some of its other common uses.

Chalk is used very frequently in sports such as gymnastics, rock climbing and wrestling. It is applied to hands, as in weightlifting, arms, legs and feet to reduce slipping and increase the amount of friction between the human body and an object or piece of apparatus.

Chalk also has many other uses and purposes. Chalk is found in small amounts in tooth paste. Probably the most commonly recognised purpose, however, is for writing on blackboards and drawing on pavements but it is also used heavily in the chemical industry.

Slide 6 – The characteristics of chalk

A brief description of chalks' characteristics.

Interesting Fact
Natural chalk, although normally thought of as being white, can also be red.

Chalk, in both its natural and man-made form, is white in colour and is considered to be a fairly soft solid. Naturally, chalk comes from the ground where it is found as a porous (can hold water) sedimentary rock. It is a form of limestone and is composed of the mineral calcite.

Chalk has been quarried for centuries and in ancient times was quarried for building materials and has been used on fields.

Most people associate chalk as being white, however red chalk also occurs naturally. Chalk comes from very pure limestone which is normally found in the ground in layers which can be 300 to 400 m thick. Within these layers of limestone there are often layers of other sediments such as flint or chert.

Slides 7 & 8 – Natural chalk

A more in depth exploration of natural chalk, how it is formed and the advantages of some of its characteristics.

Natural chalk is formed under deep marine conditions and occurs from the gradual accumulation of very small calcite plates. These plates are shed from micro-organisms; the micro-organisms are called coccolithophores.

Natural chalk is fairly resistant to erosion due to, amongst other things, its porous nature. It is quite often associated with clay but clay is far less resistant to erosion and weathering. This means that when the clay has been eroded the more resistant chalk and limestone forms steep cliffs and shelves, often where the chalk ridges meet the sea. A prime example of this is the white cliffs of Dover. Chalk is porous and can therefore hold a lot of water. This is a great advantage for areas which suffer from drought and have large amounts of limestone and chalk as these rock types can provide a natural reservoir that releases water slowly.

These three slides examine the characteristics, properties and manufacturing processes of MgCO_3 , as well as some of its uses. Magnesium carbonate has now widely replaced natural chalk in sport.

Key Point
Magnesium carbonate has the empirical formula MgCO_3 . It can be found naturally as a mineral in the ground but is also manufactured through a number of chemical processes.

Slides 9 - 11 – Manmade chalk

As already mentioned, natural chalk used in sport has been replaced in most circumstances with a man-made chalk. The manmade chalk is called magnesium carbonate. The empirical formula for this is MgCO_3 .

Similar to natural chalk, magnesium carbonate has the same properties and characteristics; it is white and a soft solid. Magnesium carbonate can be mined or produced through a range of chemical processes which include mixing solutions of magnesium and carbonate ions under a carbon dioxide atmosphere or exposing magnesium hydroxide slurry to carbon dioxide under pressure.

Magnesium carbonate has many other uses other than in sport. Some of which have been mentioned previously, ie toothpaste. Magnesium carbonate can also be found in flooring, fireproofing, fire extinguisher compositions, cosmetics and as a dusting powder. The versatility of the substance means it is also used as a drying agent, as a laxative for loosening bowels, and as a reinforcing agent for neoprene rubber.

Slides 12 & 13 – Summary

A brief summary of the topic, picking out some of the main learning points.

To recap briefly, chalk is widely used in sport, and in weightlifting it is used to stop the bar slipping. It helps to increase friction between the hands and the bar and also removes moisture due to its porous properties.

Chalk, when found naturally, is formed in deep marine conditions and occurs from the gradual accumulation of very small calcite plates. These plates are shed from micro-organisms; the micro-organisms are called coccolithophores.

Most applications of natural chalk in sport have been replaced with man-made magnesium carbonate which has the empirical formula MgCO_3

Magnesium carbonate is produced synthetically through various chemical reactions which combine magnesium with carbonate ions under an atmosphere of carbon dioxide or expose magnesium hydroxide slurry to carbon dioxide under pressure.



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 14-16 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. Chalk, when occurring naturally in the ground, comes from a sedimentary rock. Name the sedimentary rock and two other sediments that are sometimes found in this layer of rock.

The sedimentary rock that chalk comes from is limestone and other sediments which sometimes occur in limestone include flint and chert.

2. How is natural chalk formed?

Chalk is formed under deep marine conditions from the gradual accumulation of very small calcite plates shed from marine micro-organisms.

3. Describe a chemical process used to manufacture magnesium carbonate.

Magnesium carbonate can be produced by combining magnesium with carbonate ions under an atmosphere of carbon dioxide.

or

Magnesium carbonate can be produced by exposing magnesium hydroxide slurry to carbon dioxide. This process needs to take place under pressure.

4. Name five uses of magnesium carbonate other than when used in sport.

Answers could include: Fire extinguisher composition, drying agent, cosmetics, dusting powder, reinforcing agent for neoprene rubber and/or flooring.