

Olympic composites – teachers' notes

Composite materials are used in many applications including in Olympic sport. These resources allow students to explore what a composite is and how to make one themselves.

There are three parts to the resource:

- Introductory single PowerPoint slide.
- Worksheet with general information about composites and questions.
- Making a composite.

Each part of the resource can be used alone, if wished.

PowerPoint slide

Show students the slide and ask the following question:

'What do the four sports shown have in common?'

The answer:

They all use composites in the sports equipment. The parallel bars in gymnastics are made of fibreglass with a wood coating. The canoes can be made of a number of different materials, but it is often composites of fibre glass, Kevlar and carbon fibre. Most racing bicycles' frames are made from carbon fibre composites and usually weigh less than 1 kg. Tennis rackets are composites consisting of a polymer with carbon fibre, glass fibre, ceramics, titanium or boron added.

Answers to Questions

1. A composite is a material made by combining two or more other materials. It is possible to tell the component materials apart as they do not dissolve or blend into each other.
2. Collagen on its own would be too flexible to be useful in the skeleton. It would not provide the support required by the body.
3. Composites are particularly important in nature as structural materials. Trees could not stand up and therefore not grow so tall without wood. Animals could not stand up or move without bone.
4. a. Mud is the matrix and straw the reinforcement
b. Cement is the matrix and gravel (and sand) the reinforcement
c. Plastic is the matrix and glass fibres the reinforcement
5. Bucky ball plastic composite used in badminton rackets as they are exceptionally light and strong. Carbon fibre composite used in racing bikes and tennis rackets as it is very light and strong. Fibreglass is used in boats as it is light and strong. Fibreglass with a wood coating is used for gymnastics bars as it is strong and flexible. (There are many other possible answers to this question).
6. Composites are used in a wide range of sports equipment as there are a huge number of composites. They can be moulded into complex shapes and designed so their properties meet those required.

Making a composite

In this practical activity, students can make a composite from strips of fabric and a flour and water paste. They can then compare the properties of the resulting composite with those of the original materials. The process is very similar to making paper mache.

The activity could be extended into an investigation, if wished. Students could make mini samples of composite using just two pieces of fabric with varying mixes used for the matrix. Different types of flour could be tried as well as PVA glue.

The moulded composite could be tested for strength. This could be done in a number of ways including stacking weights onto it until it crushes.

The composite pots could be tidied up and painted.

To make the basic composite pots you will need:

- Strips of fabric, about 5 cm x 3 cm – students could cut their own strips (in which case they will need sharp scissors). The amount that they will need depends on the size of the moulds they are using. Alternatively, they can use pieces of fabric large enough to drape over their mould and simply use three of these soaked in flour paste.
- Flour – about two or three tablespoons per mould, but again this will vary depending on the size of their mould
- Water
- Oil or Vaseline
- Mixing pot per student or group of students
- Spoon or spatula
- Plastic pot as mould for composite per student or pair
- Two other plastic tubs as moulds per student or pair
- Cling film
- Newspaper or old magazine per student or pair

Pots which are not thoroughly dried out will probably go mouldy, but otherwise they last well. A radiator or sunny windowsill is the best place for drying out and even in these conditions they will probably take at least two days. In cooler conditions it will take longer.

Other possible activities

Concrete is a composite and huge amounts of it have been used to make the Olympic venues.

Bone is a natural composite and without it none of the Olympics would be possible.

These two composites can be investigated. Visit Inspirational Chemistry¹ and see section 4.3 for more details. There is plenty of background information and some further practical activities in the SEP booklet *Composites: Designing materials for the future* available from the STEM centre e-library.²

¹ Inspirational Chemistry, <http://www.rsc.org/education/teachers/Resources/inspirational/>

² SEP booklet *Composites: Designing materials for the future*, <http://stem.org.uk/rx4ch>