



Champion
the Researchers

CHOCOLATE STRENGTH

Mithila is a materials engineer. Materials have different properties, which make them suitable for different applications. Titanium is used in the aerospace industry because it is lightweight. Plastic is used to make car windows; it can be see-through and doesn't smash easily.

PUPILS INVESTIGATE THE EFFECT OF TEMPERATURE ON THE PROPERTIES OF DIFFERENT CHOCOLATE BARS

Equipment

Nine chocolate bars per group (three types, three of each type) ... or more if you're feeling generous/hungry; access to a freezer and refrigerator; bucket of ice

Method

For each type of chocolate bar: freeze one, refrigerate one and leave one at room temperature.

Remove the wrappers from the three frozen bars and, using both hands, slowly break each one in half. Rate each chocolate bar on a scale of 1 to 5, where 1 is 'brittle' and 5 is 'ductile'.

Repeat the test with the refrigerated bars and then again with the room temperature bars. How do the scores compare with those for the frozen bars? How do you think temperature affects the properties of these materials?

Have a look at the insides of each chocolate bar. Do you think the ingredients make a difference? For example, is a Mars bar more or less brittle than a solid bar of chocolate? Does size make a difference?

Extensions

Try melting chocolate and reforming it in different ways – for example, compare a long thin bar with a short fat bar. Or place a lolly stick inside one bar and see how that changes its strength. You could also introduce 'fault' lines by comparing a solid bar with one that has 'grooves' to help people break it into pieces.

Try using inherently brittle substances such as dried pasta, and inherently ductile substances such as hard-boiled eggs. What effects do freezing or heating have on the material properties of these foods?

The research link

In a world with so many man-made objects, it's really important to understand what makes a material safe for use in a particular application. Failure testing – understanding when and how materials break – is an important consideration when conducting materials research.

Additional guidance notes

Pupils may need to discuss properties of materials – particularly what 'brittle' and 'ductile' mean.

Use an ice bucket to keep the foods frozen throughout the activity.

Take care if heating the chocolate bars.



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