

Physics and cheese



Beware of anomalies with mature Brie: apparent slippage may actually be fluid creep.

Got some left-over cheese from a dinner party? Bring it to school and use it to demonstrate some handy physics principles to your students.

Exponential attenuation of gamma rays

Processed cheese slices work well here. Measure the corrected count rate from a cobalt-60 source after the rays have passed through 1, 2, ..., 279 cheese slices. Plot a graph to find the half-thickness or mass absorption coefficient. Does this vary with country of origin? How much longer does the cheese last after carrying out the experiment?

Coefficient of static friction

Place a block of cheese on a marble cheeseboard. Tilt until cheese slides. The tangent of the

angle of tilt to the horizontal gives the coefficient of friction. A crumbly Caerphilly will behave very differently from a close-textured Cornish Yarg. And what about Emmenthal—do the holes reduce surface area and therefore grip? Beware of anomalies with mature Brie: apparent slippage may actually be fluid creep.

Refraction of microwaves

Cheese, like wax, will refract 3 cm waves well. The refractive index of a rectangular chunk of Wensleydale can be measured using Snell's Law. The critical angle can then be confirmed by totally internally reflecting the waves inside a 45° – 45° – 90° wedge. With some careful sculpture a lens shape can be fashioned and its focal length found.

The Fondue Viscometer

There are several possible approaches here, but dropping ball-bearings is a non-starter, given the opacity of melted cheese. What mass of melted cheese coats a piece of bread dipped for exactly one second? How does this vary with temperature? Is Gruyère really better than Cheddar for its absorption and adherence properties? How does alcohol content affect the outcome (the behaviour of the fondue **and** those testing it)?

Factors affecting resistance

A classic GCSE investigation with a cheesy twist. A long thin cuboid of Edam makes a good starting point, with crocodile clips attached to foil connectors.

Different lengths and cross-sectional areas can be tested, but cheese opens up interesting further possibilities:

- Feta—how does the high water content affect resistivity?
- Sage Derby—how does the herb affect resistivity?
- Emmenthal—does movement of holes affect conductivity?

Hardness testing

A 1 kg mass applied to a ball-bearing resting on a freshly cut cheese surface makes an indentation the diameter of which can be used to calculate a Brinell Hardness Number. Hard cheeses like Parmesan and Vintage Cheddar work best; but beware: with softer varieties such as Dolcelatte or Ricotta the ball bearing simply sinks under its own weight.

Young modulus

For this experiment you will need a Pizza Quattro Formaggio and a circular pizza cutter. Investigate the force needed to extend those cheesy strings that form when you lift a slice. Stress–strain curves will reveal early yield points and large areas of plastic deformation for most Italian cheeses, with ultimate tensile strains inconveniently high and well over 500%.

You may feel that the above suggestions are at best cheesy, at worst the last straw, but they might just get you out of a lesson-planning pickle!

Christina Astin

*The King's School,
Canterbury, UK*