Activity

Creating Captivating Cornflour

This is a short activity but extras are suggested. From experience, getting students (of any age) to stop might be a problem!

Cornflour is certain to mesmerise your group; but can they explain what is happening? What could this curious material be used for?
Try out this new spin on an old favourite...

What You Need

This activity can take place in the classroom, lab or kitchen.

You can do this activity with small or large groups, or even adapt it to use on a stand at a STEM fair.

If your groups are large, split them into smaller teams depending on the apparatus available (schools should have many of the items you need; so **remember to check with the teacher).**

It is always a good idea to put old newspaper on the tables before starting as this can get messy.

- ✓ A plastic bowl or beaker
- ✓ Spoon or stirring rod
- ✓ Cornflour
- ✓ Water
- ✓ A balance
- ✓ Measuring cylinder or jug
- ✓ Aprons if possible!

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Nationally coordinated by STEMNET

What To Do

1... **Measure out 15 g of cornflour.**

2... **Measure out 12 cm³ of water.**

3... **Add the water to the cornflour and stir.**

Some questions to ask:

- What happens when you stir the mixture slowly?
- What happens when you stir it quickly?
- Can you scoop some of your mixture out and roll it into a ball?
- What happens when you stop?

What do you think this material could be used for? Could it be useful in sports or as protection for mobile phones? Keep thinking about possible engineered products.

Curriculum Links

Using this activity you can discuss:

England

Science: Unit 7I: Energy resources, Unit 7K: Forces and their effects, Unit 9I: Energy and electricity

PSHE: looking at real-life situations, personal preferences and priorities.

D&T: Unit 07aii: Understanding materials Focus: resistant materials, Unit 09aii: Selecting materials Focus: resistant materials

Scotland

Science: Properties and substances 2-15a (Characteristics) Forces 2-07a,

Technological developments in society: (3-01a)

Some Extras...

Cornflour is used for thickening sauces in cooking; so, how do its properties change with temperature?

Discovering the properties of cornflour is fun (and rather messy) but the important question to ask is: "how can we use these unusual properties?"

Your group should have already thought about some engineered products. Ask them to choose one idea. They can then make and test a prototype, design a poster promoting their idea or even draw up a business plan for their product.

If the students like discovering this material, they may enjoy investigating slime:

www.practicalchemistry.org/experiments/pva-polymer-slime,153,EX.html

Explanation

Cornflour is just powdered white starch extracted from maize kernels but it exhibits the properties of a shear thickening fluid (also called a non-Newtonian or dilatant fluid).

The faster you stir, the more viscous the material becomes. This is because at low velocities the water can fill gaps between particles (in the cornflour) but at higher velocities the water is unable to do so. As friction increases, the viscosity increases!

In a Newtonian fluid, viscosity remains constant as the fluid is stirred.

Handy Hints

There are some obvious problems with using actual cornflour long term in a product: the natural material may dry out or go off.

However, the reusable, lightweight and impact properties are desirable. Ask your groups to think how they might overcome the problems e.g. suggest the idea of making a synthetic version that mimics the good properties but avoids the bad.

These properties are highly desirable in modern body protection. They could also be useful for everyone. Many of us have mobile phones, MP3 players, iPods and other mobile technology that we would like to keep working – no matter how many times we drop them!

Visit www.d3olab.com for a modern, synthetic equivalent.

STEM AMBASSADORS ILLUMINATING FUTURES

Profile: Who Uses Materials?

Laurie Winkless

**Higher Research Scientist,
National Physical Laboratory (NPL)**

Industry sector	Research & Development
What I do on an average day?	I tend to split my day in two – half is spent in the lab and the other half in the office. The lab work involves analysing samples with different bits of kit, making measurements, going through the data, and noting any interesting observations. The office work involves reading relevant journals, books and articles, or writing reports or papers as part of a project. I often have meetings, either about science or project management. I also spend a couple of days each month doing science outreach.
How I got here	When I was little, I was always very curious as to how things work, so I think deep down I always knew I wanted a technical career. I also love to write though, so I did consider that path too and thankfully my writing skills have come in rather useful in my scientific work!
My favourite part of my job	I just love the fact that every day is different – you just don't get bored! Frustrated when experiments don't work, yes, but bored? Never. I also like that most of my job involves playing around with bits of equipment, electronics, tools… its fun! I get to travel a lot with work, to meetings and conferences, and that is a big draw.
The future	In the short-term, I want to complete my PhD (due to submit 2014) and write as many articles as I can. I love science outreach, so I want to get better at it. In the long-term, I'd like to finally pick my career – the thing about science and engineering is that they open so many doors! There are a few paths I could see myself taking, but I would like all of them to lead to working in the space industry.
What is engineering?	Engineering, to me, is the application of great science. It's turning research into something tactile, something useful and real. Engineering and science can only co-exist, we'd be no good without each other.

This Is Engineering

Being creative with materials and applying their properties to new and exciting products is a great example of engineering. Materials engineers work in all areas of industry. They could be developing new materials for use in protection (like the shear thickening fluids) or analysing what happens when a material fails.

There are several different degree courses available covering materials and chemical engineering, requiring A-Levels, Advanced Diplomas or Scottish Highers for entry (**www.ucas.com**).

Related fields: Chemical engineering, materials science.

Process technology apprenticeships (**www.apprenticeships.org.uk**) can lead to a wide range of occupations in the chemical, pharmaceutical, petrochemical manufacturing and refining industries. You could be responsible for machine maintenance or analytical support, leading you into work on an oil rig or in a laboratory.

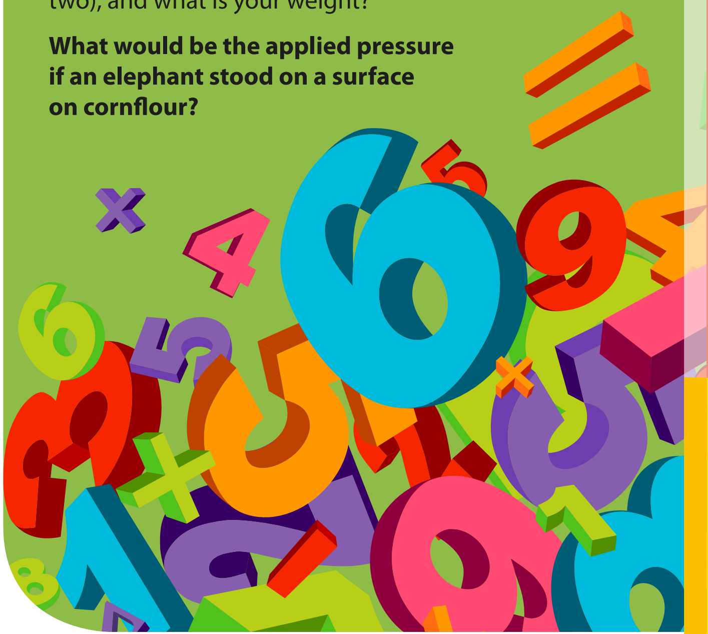
Extra Maths

Important to understanding materials is a knowledge of force and pressure. P = F/A where P = Pressure, F = Force and A = Area.

What would be the applied pressure if you stood on a surface of cornflour?

Hint: what is the area of your foot (remember you have two), and what is your weight?

What would be the applied pressure if an elephant stood on a surface on cornflour?



Next Steps

If you have internet access during your session, there are many YouTube (**www.youtube.com**) clips out there (but do check before showing to your group): search for 'brainiac store custard walk' for a clip showing the possibility of walking on custard, certain to get your group talking (custard is made with cornflour).

Following the extras? Perhaps you could develop this session further by joining a school STEM Club? **www.stemclubs.net**

There are more useful ideas at STEM*Networking* (**networking.stemnet.org.uk**).

Why not encourage the group to do a bronze CREST Award: **www.britishscienceassociation.org/crest**

For more information on the Engineering Engagement Project, visit The Royal Academy of Engineering website: **www.raeng.org.uk**

For more information on materials, visit the Institute of Materials, Minerals and Mining at **www.iom3.org/content/school-and-college-pupils**

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