Kitchen Science! – Magnetic Cornflakes

Engineering Atoms

<u>What you will need:</u>
A bowl
Cornflakes
Water
Other cereals
Magnet
Plastic zip lock bag

<u>What to do:</u>

1) Take a bowl and fill with water
2) Take ONE cornflake and sit it on the surface of the water in the middle of the bowl (don't let the cornflake get too close to the edge of the bowl or it will stay there).
3) Move the magnet close to the cornflake. Make sure the magnet is not touching the cornflake or the water.
4) Move the magnet around and see what happens. Don't let the cornflake get too close to the edge of the bowl, or it will get stuck.
5) Repeat the experiment using different cereals and see what happens
6) Take the zip-lock plastic bag and add a handful of cornflakes
7) Fill the bag about 2/3 full with water and seal the bag. If you're worried about spilling the bag then put the whole bag inside another bag. We don't want to make a mess!
8) Crush and smoosh the cornflakes in the water in the bag as much as possible. Leave the bag for a while to make sure the cornflakes are really soft – about 15mins or so.
9) Hold the magnetic up to the outside of the bag and move the magnet all over the surface (you can swirl the contents of the bag at the same time to help this!)
10) Look *very carefully* at where the magnet meets the bag and see if you can see anything
11) After the experiment, empty the contents of the bag down the drain outside (you may want to ask a grow-up to help!)

<u>What you should find:</u>

a) When you move the magnet around the bowl, the cornflake should follow the magnet
b) Different cereals should move different amounts
c) You may see very small flecks or grey in the bag where the magnet touches

Once you've done the experiment have a look at the next page to find out a bit more about what is going on and why!

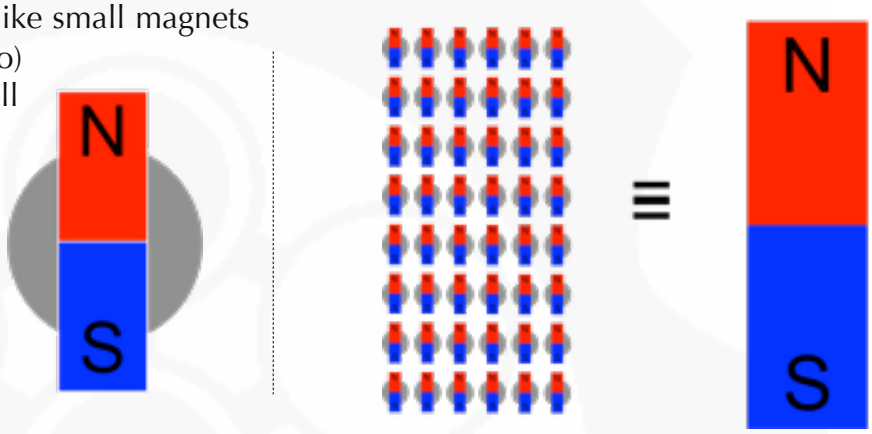
The science

Cornflakes are magnetic because they contain a significant amount of iron, a magnetic material. Standard cornflakes contain around 8 milligrams of iron per 100 grams (so 0.008% of the weight of a cornflake is iron). This is enough to cause a floating cornflake to move when it is near a magnet. By crushing and then soaking the cornflakes we can separate out the iron, which is insoluble (doesn't dissolve in water). Holding the magnet near the pulp pulls the small flecks of iron out of the mixture. Different cereals will have different amounts of iron and so will move around differently (faster, slower etc). See if you can find out which of your cereals has the most iron in!

We know that materials like iron (and materials that contain iron, like steel) are magnetic. However, they don't always act like permanent magnets - we can't use a random piece of steel to pick up other bits of steel. So, what makes a magnetic material act like a permanent magnet?

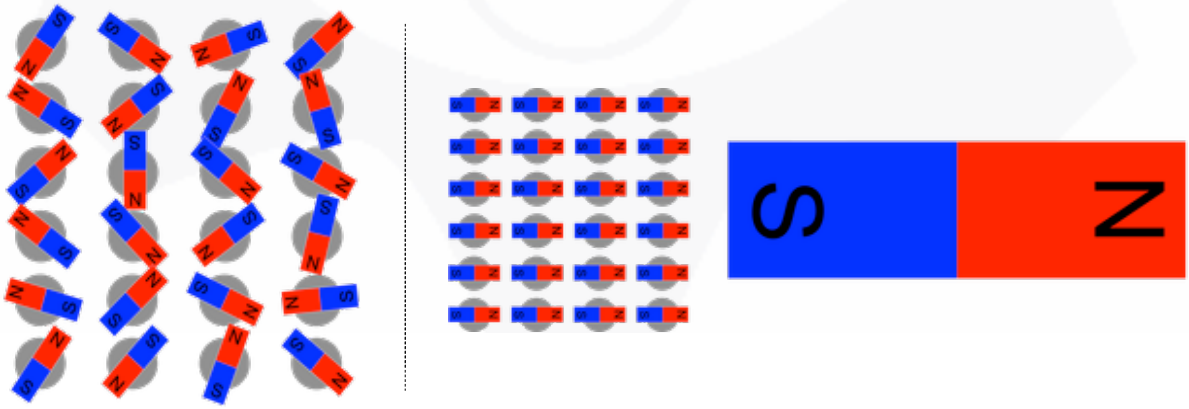
In any magnetic material, the atoms act like small magnets (so the atoms of iron in the cornflake do) In permanent magnets, all these small magnets line up. This makes the material act like one big magnet:

In magnetic materials that don't act like magnets, like steel, all these small magnets are misaligned, so there is no overall magnetic field However, when a permanent magnet is placed next to the material, all the small magnets in the magnetic material are aligned, acting like a big magnet too - the alignment means the materials now attract each other.



Left – Individual atom acting like a 'bar magnet'
Right – All the atoms lined up act together like a bar magnet

Usually, if the permanent magnet is removed, then the material will go back to being misaligned again. However, we can permanently *magnetise* a material by holding it in a strong magnet field. This is what happens to knives and forks if we store them on a magnetic rack in the kitchen, or if we hold a paperclip next to a permanent magnet for a long time.



Left – Magnetic atoms randomly arranged in normal material
Right – Magnet atoms line up when magnet is placed near them