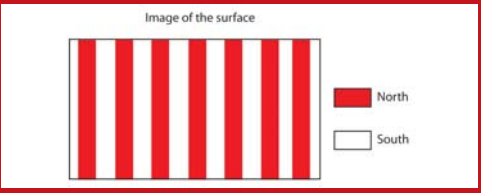
# magnetic probe

## Health and safety

This activity uses weak magnets, but these should not pose any health risk.




## What happens in this experiment?

Objects with details at the nanometre scale are far too small for our eyes to see. So how can we tell what they look like? One way is by using a special tool called a Scanning Probe Microscope.

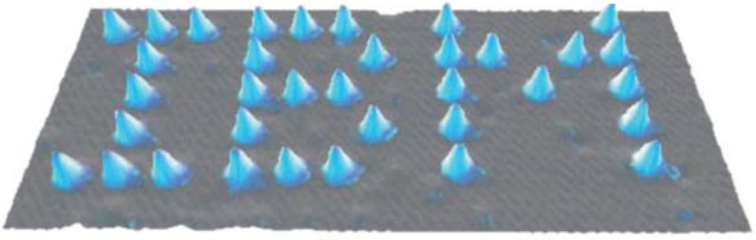
If you look really closely, you might be able to see tiny objects as small as 0.05 mm. But a nanometre is 0.000 000 001 m, which is one billionth of a metre. To put it another way, a human hair is as wide as 50 000 nm. A good light microscope used in schools can let you see details as small as 400 nm. But atoms can be 0.1 nm across, so we need special tools to see details at this scale.

Scanning probe microscopes work by running a probe across the surface of an object and 'feeling' all the bumps and shapes. This information is then fed to a computer which draws an image of the surface.

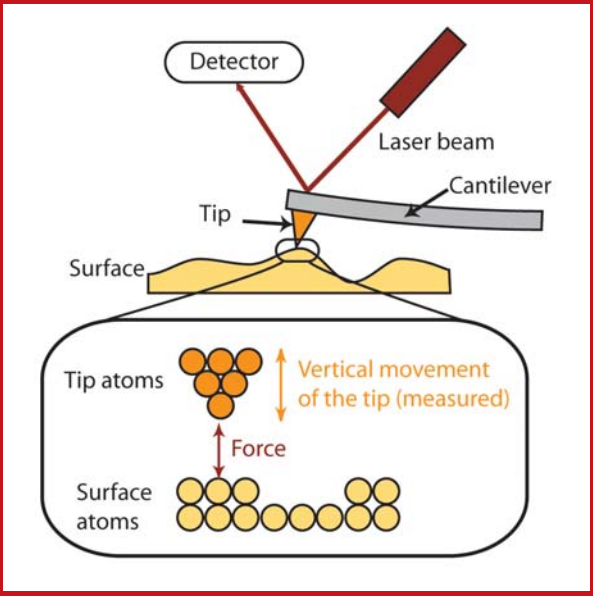
There are many different types of scanning probe microscopes, including:

1. Atomic force microscope
2. Magnetic force microscope

In the experiment you investigate the magnetic surface of your sheet. This is similar to how a real magnetic force microscope works. Using a magnetised probe, magnetic force microscopes are attracted to, or repelled from, the surface being examined. The attractions and repulsions are much weaker than those experienced in this activity. Fortunately, computers can detect the tiny movements of the probe as it is pulled towards and pushed away from the surface. By detecting how the probe moves up and down over the surface the computer can draw an accurate map of the magnetic surface of the specimen it is studying.



http://commons.wikimedia.org/wiki/File:Ibm_nm.PNG


*inspired by*
http://nano.tm.agilent.com/blog/wp-content/uploads/2007/06/how-an-atomic-force-microscope-works.bmp

## Ideas for conducting the activity or discussion

- Ask students to 'probe' their surfaces and think about how the 'magnetic surface' might look different from the physical surface (topography).
- They might like to think about what common objects work by manipulating small magnetic fields; for example, hard disk drives (note that 'solid state' or 'flash' drives, like those found in new iPods, do not work via magnetism).
- Pictures 3 and 4 on the students' worksheet are of a computer hard disk. Picture 3 was taken with an atomic force microscope; picture 4 was taken with a magnetic force microscope.

## Learning objectives or school curriculae

- Building on existing understanding of magnets and magnetism.
- Appreciation that microscopes do not have to detect light, but can detect other things.
- Understanding that objects at the nanoscale exert small local forces.