Introduction for teachers

This is a recommended core lesson. The purpose of the lesson is to introduce the topic of nanoscience. This is done through the use of PowerPoint, video, discussion and journal work. Additional aspects of nanoscience introduced in this lesson are explored further throughout the 9 lessons in this resource pack e.g. scale, nano and nature. Nanoscience is a relatively new field of science and therefore it is new to almost all teachers. Teachers may not know all the answers to students' (and possibly their own) questions, but that's ok, this material is aimed at planting a seed for the individual child to question and challenge. Nanoscientists themselves don't have all the answers; experimenting and investigating is tentative and on-going. Where appropriate, we provide relevant ICT links and further weblinks to useful resources, which will help build your understanding.

ICT links

There is a link to the below, short animated video 3 minutes 26 seconds **on the 1st PowerPoint slide. The video is a brief introduction to nanoscience and an exploration of the size of a nanometer. Teachers could choose to show it at the beginning of the lesson as an introduction, in the middle of the lesson or at the end of the lesson to reinforce what has been learned. e.d.Films: Do You Know What Nano Means? Part I:** www.youtube.com/watch?v=wV0t6smYm8M

The following video could be shown to inspire the children about what a potential phone of the future might look like 3 minutes 25 seconds.

Nokia Morph Concept (short):
www.youtube.com/watch?v=Zto6aTZM9t0

Curriculum links

Science Strand: Materials
Strand Unit: Properties and characteristics of materials, materials and change

Curriculum Aims:
To develop knowledge and understanding of scientific and technological concepts through the exploration of human, natural and physical aspects of the environment.
To help the child to appreciate the contribution of science and technology to the social, economic, cultural and other dimensions of society.

WALT

- **Understand that nano is the science of the very small**
- **Understand that we cannot see things on the nanoscale with our eyes**
- **Know that nature can teach us about nanoscience**
- **Understand that nanoscience is helping us to make better technologies**
- **Know that there are lots of different types of jobs in science**

Background Information

Nano is a relatively new word in the scientific community. The word is used a lot more in society and in products, such as the iPod nano. It has also been in the news with increasing regularity because governments and private organisations are beginning to spend more and more money on nanoscale research.

What is the difference between nanoscience and nanotechnology?

Nanoscience is about studying how materials behave at a very small scale – at the nanoscale. A nanometre is one millionth of a millimetre. It is not just one science, but a platform that includes biology, chemistry, physics, medicine, materials science and engineering!

Nanotechnology on the other hand is the manufacture and development of materials and devices by applying what is learned about how the properties of materials behave at the nanoscale. Several commercial examples of nanotechnology are on the market already, such as: **cheap, printable solar cells, stronger and lighter sports equipment and self-cleaning glass, and many more promising applications of nanotechnology are being investigated e.g. more sophisticated medical diagnostics and treatments. It is predicted that nanotechnology will impact virtually every industry in the future.**

The terms nanoscience and nanotechnology are often used interchangeably. 'Nano' by itself, is often used as shorthand to refer to these activities.

nano wow

Journal suggestions

- The children could make their own nano journal (please see journal guidelines in Introduction to NanoWOW section).
- Under the title **'What is nanoscience?'** the children could list bullet points of information they have learned from the presentation slides (this could serve as a form of assessment for the teacher).
- They could draw and label their own 'Phone of the future' idea.

Extension Activity

- The **'Phone of the future' brainstorm** (Slide 17) can be further developed. The children could be asked to design a phone to solve a problem for a particular section of society, for example, for teenagers or the elderly. Here teachers can explicitly show the children the link between science and society.
- The children could be asked to develop a pictorial history of computers or phones on the Internet, inserting a question mark at the end representing the unknown future.

Useful resources

Nanooze
www.nanooze.org/main/Nanooze/English.html

Nano Kids
www.nanokids.rice.edu

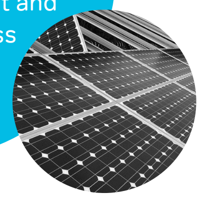
Nano Zone
www. nanozone.org

Nanopinion
www. nanopinion.eu

Nano You
www. nanoyou.eu/

CRANN Infographic: 10 years of nanoscience in Ireland
www.crann.tcd.ie/Education-Outreach/Nanofacts-and-Useful-links/Nano-Infographic.aspx

Nanotechnology on the market: cheap, printable solar cells, stronger and lighter sports equipment and self-cleaning glass



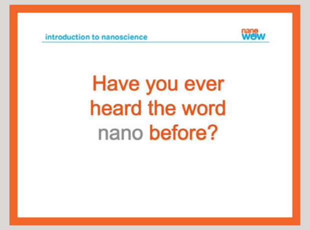
AMBER

01

nano wow

introduction to nanoscience

Notes to accompany powerpoint



slide 3

This slide provides the learning intentions for the lesson (WALT). There is also a link to a short animated YouTube video which will provide the children with a basic introduction to nanoscience.

slides 4

This slide encourages a class discussion on what the children already know about nanoscience.

slide 5

The children will have most likely heard the word 'nano' before. An item such as an iPod nano contains nanomaterials but it is not a nano size item. The word nano is used with this item simply because it is small. You cannot see something on the nanoscale; it is so small it is invisible to the naked eye.

slides 6, 7 and 8

Items on the nanoscale are so small we cannot see them. It is difficult to imagine how small something is if you cannot see a concrete example. Some of the activities and ICT links throughout the lessons provided are intended to give the children a greater grasp of just how small nano size items are.

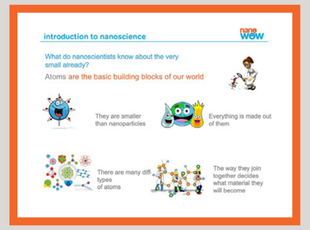
slides 9 and 10

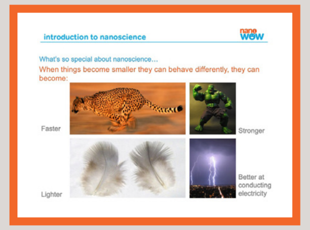
The 'nano fact' slides give the children the chance to investigate how small the nanoscale is for themselves. They give the children the opportunity to think about the nanoscale and relate it to their hair and nails, items they can identify with.

slides 11 and 12

These slides show the children that nanoscientists need special equipment to explore our world at the nanoscale. Here, they are introduced to the electron microscope. These specialised microscopes are very expensive and scientists need a lot of training to learn how to use them. There are different types of electron microscopes that explore the nanoscale in different ways. Nanoscientists in Trinity College are using these microscopes every day to explore new materials. Some of the world's most powerful microscopes can be found in the 'microscopy' department of CRANN in Trinity College, Dublin.

Notes to accompany powerpoint





slide 13

This slide provides the children with an introduction to atoms. Some of the children may have heard the word 'atom' before and could discuss what they already know about the topic. This slide presents an opportunity for the teacher to reinforce that we cannot see things on the nanoscale – we cannot see atoms, yet they are our smallest units of matter and the building blocks of our world.

Some extra notes on atoms:

Atoms are the basic building blocks of our world – they are smaller than a nanometre (about 4 or 5 atoms in a row would be about the length of one nanometre) and everything is made out of them. There are many different types of atoms as they are the smallest amount of anything that exists. Atoms can join together with other atoms and this forms a molecule. The way that atoms join together, the types of atoms that join together and the conditions in which they do this will determine what material will be made. For example, a 3-D structure of carbon atoms will give us a diamond. These structures can be explored more in the lesson on graphene, lesson #5. The world around us is full of atoms and they are so small that if you make a dot with the tip of a sharp pencil, that little dot would have billions of carbon atoms in it. There are more atoms in an average glass of water then there are glasses of water in all the oceans, lakes and seas on Earth! Nanoscientists are capable of picking up atoms, one at a time, and creating new materials and structures out of them using special equipment, which can be found in the CRANN institute.

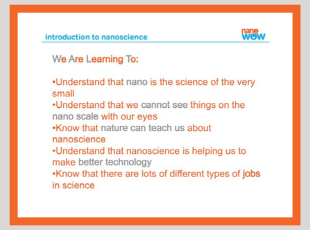
slide 14

This is a brief introduction to the properties of materials and how they behave on the nanoscale. In lesson #3, properties will be explored in more detail – the children will be asked to identify the properties of everyday materials and then introduced to the idea that properties change when materials get very small.

slide 15

This slide will introduce the children to the fact that nanoscience is all around us. Gecko's feet have nano size hairs on their feet that allow them to stick to any surface. Lotus flowers have a nano coating on the surface of their petals that keeps the flower dry, even after being submerged in water. Nanoscientists have taken ideas from nature and applied them to products that the children themselves use every day like computers and sports equipment.

Notes to accompany powerpoint



slides 16, 17 and 18

These slides focus on how nanoscience is impacting technology. The pictures reinforce the changing nature of science; they show the children the huge changes that have occurred with computers and phones over a relatively short period of time. These slides are intended to spark discussion about the technologies of the future.

slide 19

This slide shows the children the range of jobs that are available in nanoscience and presents the idea that they could choose a job in science themselves. Teachers could use this slide to breakdown any misconceptions the children might have about what a scientist looks like (which usually comes from cartoons!!). This slide could be used as a tool to show the children that there are many different fields of science to be explored. (The moving picture on the screen is a tiny nano robot).

slide 20

This is a quick recap on the previous slides to reinforce what nanoscience is all about. It gives the children the opportunity to discuss nanoscience and ask questions about the lesson. This slide gives teachers the opportunity to remind their students that although scientists have been talking about nanoscience for many years, because of advancements in technology, scientists are only recently able to really explore materials on the nanoscale. The children need to understand that because nanoscience is a relatively new field of science there might not be answers available for all of their questions yet.

slide 21

The WALT objectives can be edited/adapted by teachers to suit their own classes.