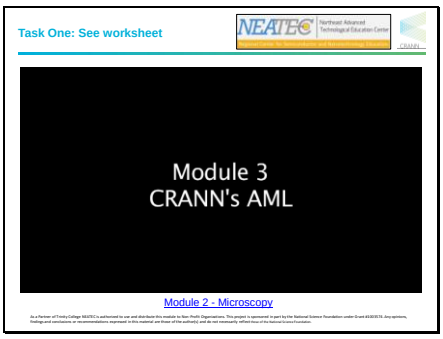
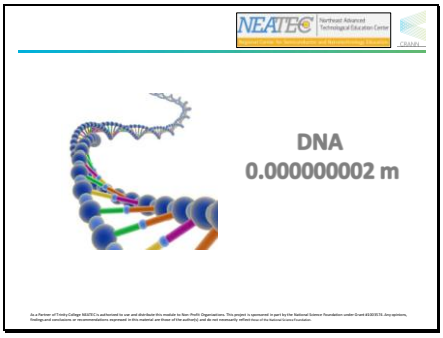
Slide 2



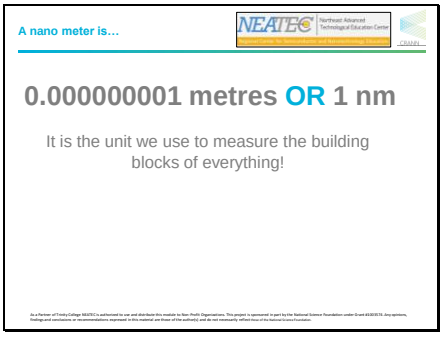
Slide 2: Video Clip form Nano in my life DVD introducing CRANN's AML (Click on video to start). This slide is link to the first task on the accompanying worksheet. Students should watch the clip and take one key point or question from it. This can be discussed in class. http://www.youtube.com/user/tcdnanoscience#p/a/556DA4E9D467F799/2/SPF-2zNDPWk

Slide 3



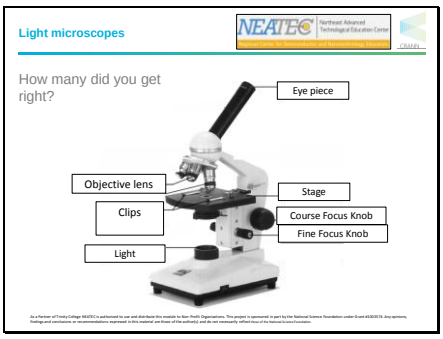
Slide 3: Reminding the students of the scale of nano. If the students have completed the introductory module this will serve as a revision.
Image: © clker.com//dailymail.co.uk//homebiology.blogspot//bacteriapictures.net//health.howstuffworks//faqs.org

Slide 4



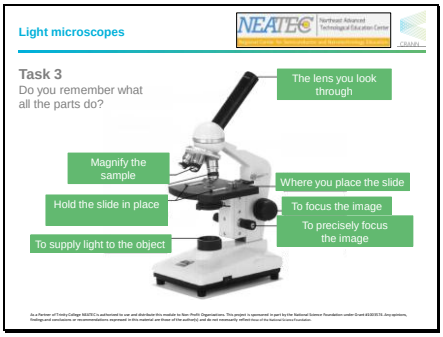
Converting nanometres to metres.

Slide 5



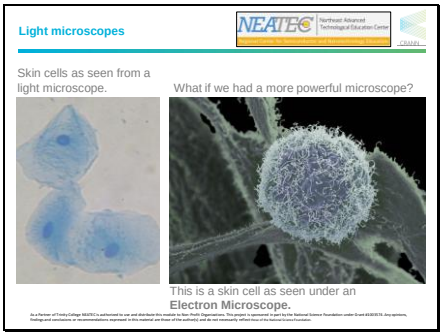
Slides 5 and 6 are linked to the worksheet and are aimed at familiarising the students with the parts and functions of a light microscope. Click to reveal answers.

Slide 6



Link to worksheet task, click to reveal answers.

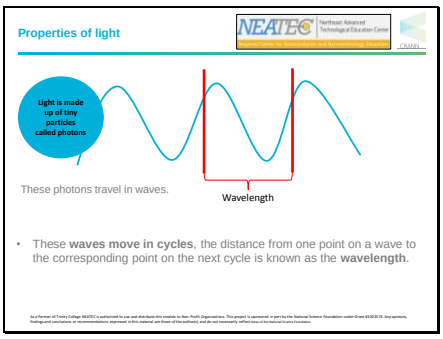
Slide 7



Slide 7: The difference between how skin cells appear under both a light and electron microscope. In this slide the emphasis should be placed on the clarity and added detail that can be seen when using an electron microscope.

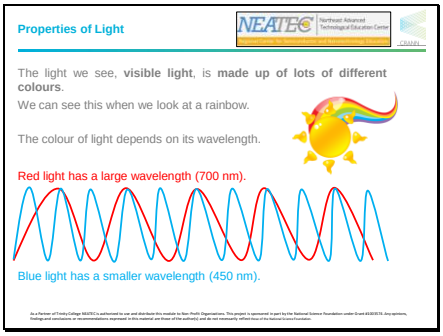
Images: © biotechnologie.de and homebiology.blogspot

Slide 8



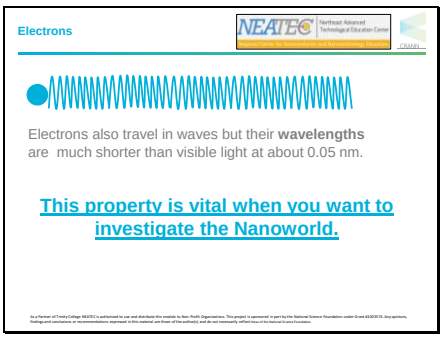
Slide 8: The next few slides focus on the wavelength of light and electrons. The wave properties of light are a topic not on the junior certificate syllabus and so we do not explore it in great depth. Slide 8 demonstrates how light wave and particle properties behave. For the purpose of this module we will focus on the wave properties. The slide also contains a simple explanation of wavelength.
Click to start animation and reveal text.

Slide 9



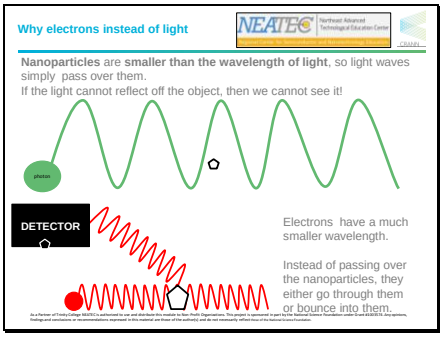
Slide 9: This slide looks further at the properties of light. Students who have completed the junior cert science course will be familiar with the concept that light is made up of many colours. Here we link the colour of the light to its wavelength focusing on red and blue light. Here the emphasis should be placed on the size in nanometres of a wavelength of light (red – 700 nm) and how it compares to a strand of DNA (2 nm).
Text Reveals in 4 sections (click to reveal).
Image: © Microsoft clipart

Slide 10



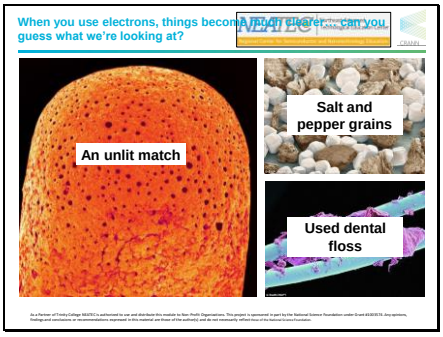
Slide 10: In this slide we discuss that electrons also travel in waves but the wavelength of an electron is much shorter (the cycles are closer together). One click starts animation, text follows automatically.

Slide 11



Slide 11: In this slide the focus is on why we use electrons instead of light to view tiny structures. It is important the students understand that in order to be able to see something light needs to reflect off it. This simple animation shows how light waves travel over nanostructures whereas with electrons, because their wavelengths are much smaller, they interact with the nanostructures.
Full slide revealed over three sections.

Slide 12



Slide 12: Quick quiz slide showing 3 everyday items under an electron microscope - see if your class can guess the items.

Click for answers (x3)
Images: © http://www.dailymail.co.uk/sciencetech/article-1346751/Getting-nitty-gritty-Amazing-microscopic-images-household-objects.html

Slide 13

Slide 13: Summary of what we've learned so far. There is also a link on this slide to an online animation which provides an excellent explanation of SEM (part 1 and 2).

Starts automatically

Slide 14

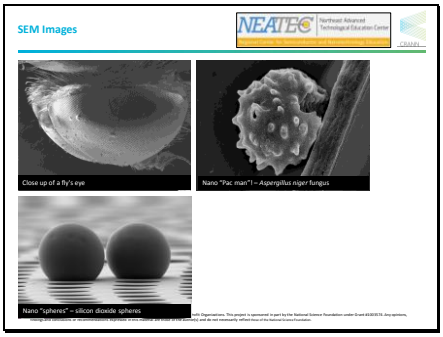
Slide 14 is a simple overview of how a Scanning Electron Microscope (SEM) works. It is important to emphasize that samples need to be good conductors to be "viewed" e.g. computer "chip". Biological samples thus need to be coated in a very thin layer of gold or silver before being scanned. Unlike a light microscope, samples do not need to be thin as we are only looking at the surface and not the internal structure. Slide 15 + 16 shows some images taken on the SEM at CRANN.

Slide in 3 sections click to reveal each one

Slide 15

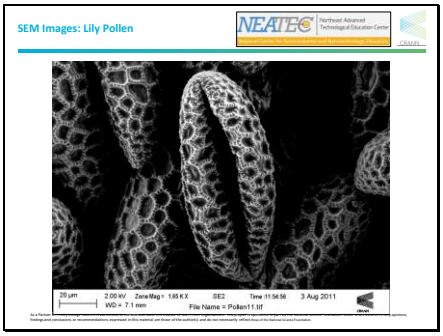
Dog Hair (Click to reveal)

Slide 16

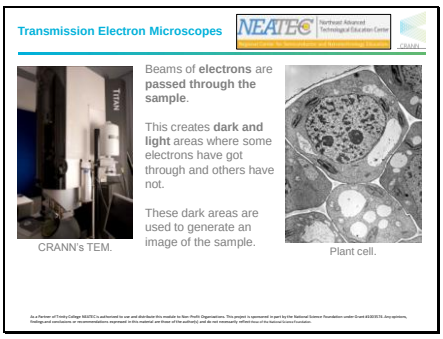


The silicon dioxide spheres are sitting on a porous film made using a self-organisation technique in CRANN. The image was taken using the Zeiss ULTRA SEM.

Slide 17



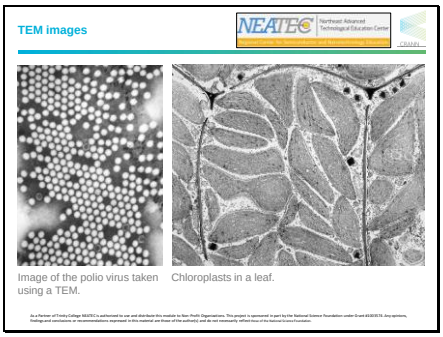
Slide 18



Slide 18 is a simple overview of how a Transmission Electron Microscope (TEM) works. The TEM fires electrons through a sample in order to look at the internal structure and so differs from the SEM in two ways - firstly the sample does not need to be coated in a metal, and secondly the sample needs to be thin. It is important to emphasise these differences or alternatively to have the class discuss the differences. Slide 19 shows some images taken on a TEM.

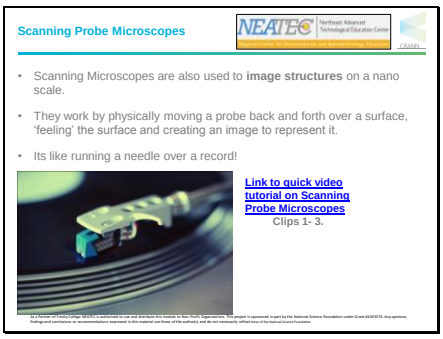
Image: biotech.iastate.edu

Slide 19



Images: Polio image CDC/ Dr. Fred Murphy, Sylvia Whitfield
Chloroplast image
http://www.uga.edu/caur/

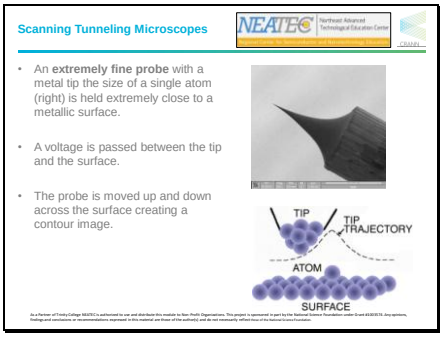
Slide 20



Slide 20 gives a brief and simple introduction to Scanning Probe Microscopes. There is a link on this slide to an online animation which provides an excellent explanation of the two techniques about to be covered (parts 1 - 3). The important difference between scanning probes and the previous methods is that you are not taking a direct image of the surface, instead you are feeling the surface and creating an image. It might be useful to mention contour maps in geography.

Image: © Microsoft clipart

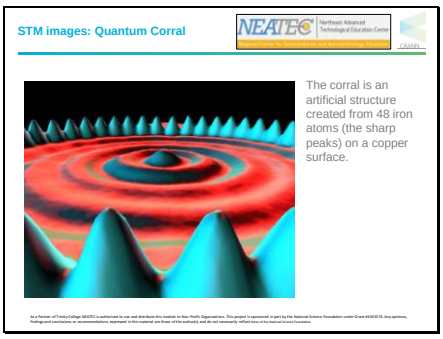
Slide 21



Slide 23 + 24: Simple overview of how a Scanning Tunnelling Microscope (STM) works. Here you can talk about the main difference between the two techniques i.e. AFM uses a needle to contour the surface; STM uses a current.

Images: © mrsec.wisc.edu and mse.engin.umich.edu

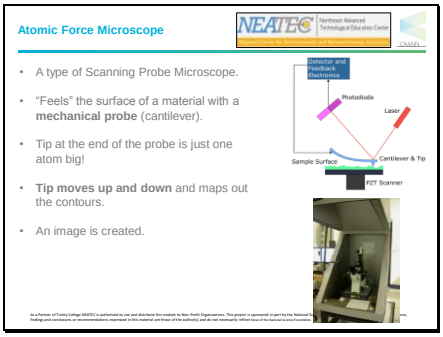
Slide 22



This is an image of iron and copper taken with an STM.

Image: D.Eigler, IBM Almaden Research Center.

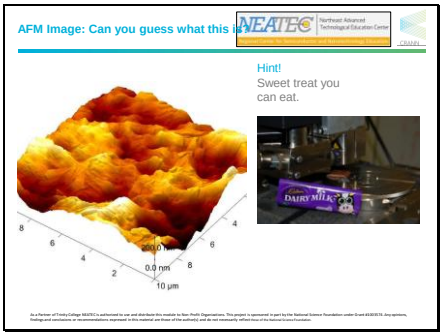
Slide 23



Simple overview of how an Atomic Force Microscope (AFM) works followed by image on slide 22 of chocolate taken using an AFM in CRANN.

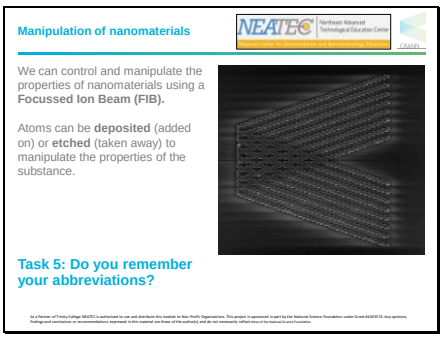
Image: © The Exploratorium, www.exploratorium.edu

Slide 24



Click to reveal answer

Slide 25



Slide 25: Here the class are introduced to a Focused Ion Beam, one method used to manipulate nanomaterials. Ion guns are used to either blast remove or add atoms to a sample.

The image is an etching of the CRANN logo.

Task 5 can be carried out here (see Worksheet).

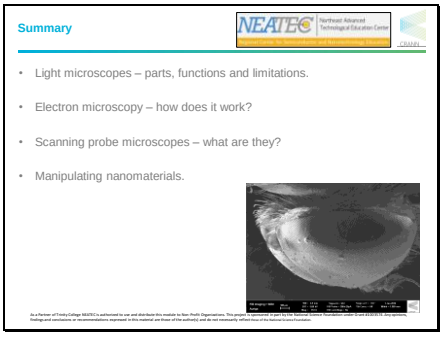
Images: © http://fibics.com/Micromachining.html

Slide 26

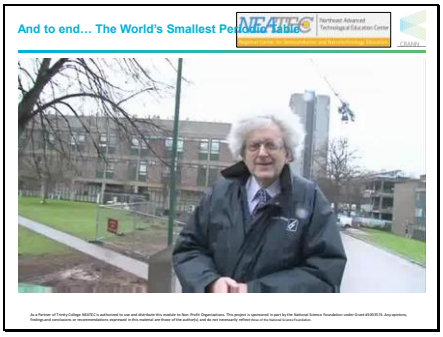
Slide 26: this is linked to the final task on the worksheet and asks the class to think about why it is important to keep nanomaterials as clean as possible. The class will hopefully be able to discuss how dust on the nanoscale is quite big and could block the view of the nanostructures.

Click to Reveal answer.

Slide 27



Slide 28



Slide 27: Video 'The world's smallest periodic table'. To end on a light note this is a clip showing a periodic table being drawn onto a human hair using an ion beam.
Click to start video or follow the YouTube link.
Original Link: Periodic Videos http://www.youtube.com/watch?v=cQU2IAsQak8