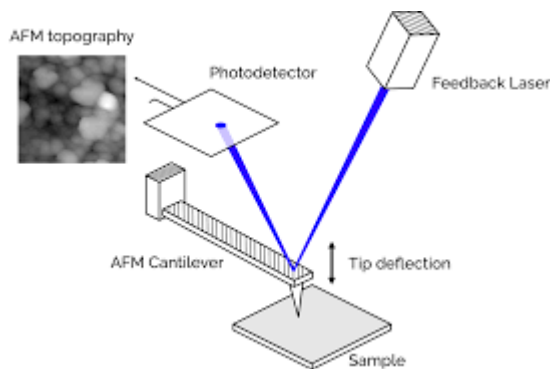


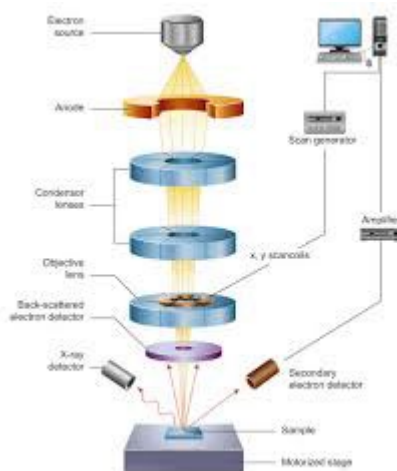
Nanotechnology and nanoscience.

Nanotechnology and nanoscience are a new field of physics. The study involves looking at particles that need extremely specialised equipment to see. All these nanoparticles are measured in nanometres (nm). This is one billionth of a metre or 10 to the power-9. Our fingernails even grow at 1 nanometre a second.

For starters, the equipment that we need to see these particles are extremely complicated pieces of machinery. One example of this machinery is the AFM (Atomic Force Microscope). In this, there is a cantilever, laser, photodiode (detector) and the feedback on a screen. The laser is reflected off the back of the cantilever, which scans the surface. Then the picture is formed by the cantilever, which experiences forces from the surface. This allows us to make a 3D model of the topography (top of the surface) of the sample.

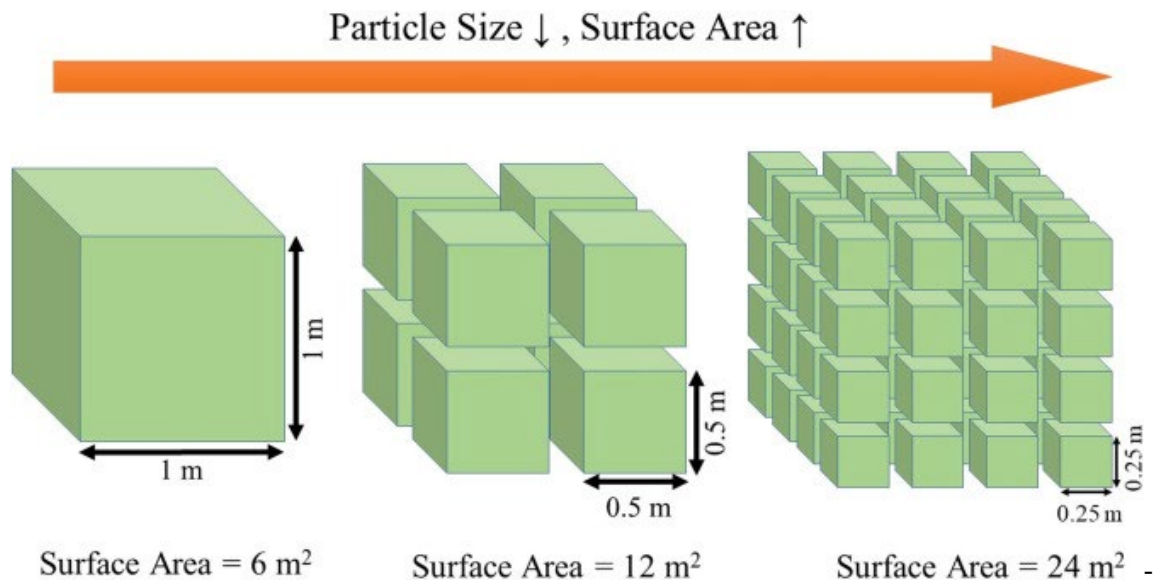


Another machine is the SEM (Scanning Electron Microscope). This is a bigger machine than the AFM containing of an electron beam, electron gun, anode, magnetic lens, scanning coils, backscattered electron detector and a secondary electron detector. This is then linked to a screen. The SEM scans a focused electron beam over a sample to create an image. These electrons then interact with this sample, producing signals that we can use to make information about the topography and the composition of the surface.



Because nanoparticles are so small, the higher surface area to volume area for the same volume of material. Say you have a 10cm-by-10cm big block and 1cm by 1cm blocks that

make up the big block. The 1cm-by-1cm blocks would have more surface area than the big block. This is so more chemical reactions can occur on the blocks. On the nanoscale, many materials are more reactive than something that is not so small. Also, the physical and chemical properties of matter change at the nano level. On the nanoscale nanoparticles have all three of their dimensions on the nanoscale, nanowires can have their diameter on the nanoscale, but they can be several hundred nanometres long. Nanoplates have their thickness at the nanoscale, but their other two dimensions are larger.



sciencedirect.com on how smaller blocks have more surface area than bigger blocks

Nanoscience and technology are now also being used in day-to-day aspects of life. Firstly, nano sensors in packaging can be used to detect contaminants in food. Most of the biggest breakthroughs are medical. these can allow medicine to be more personalised, cheaper, safer, and easier to deliver. Cancer, heart disease, diabetes and other age-related illnesses can all potentially be treated by nanotechnology in the future. For example, 2014 brought nano cages, which theoretically, can deliver cancer killing drugs at a molecular level- (Australian academy of science). Already nanotechnology is used medically to conduct sensitive medical procedures. Next, this technology could be used for the growth of nerve cells and help regenerate damaged spinal nerves. Next, this technology can also be used for energy. This could be used for improving efficiency and cost-effectiveness of solar panels, create new batteries and making the production of fuel from raw materials economical. As well as renewable energy, nanotechnology is also used for to help the environment. These can be used to clean dirty water, and the main goal is to help stop climate change and global warming. In our phones, laptops, and all our common devices have these wonderful little particles in them. Most of these are transistors which are so small that many of them can be put onto a single microchip, and this can increase the speed, memory, and capacity. These are why our devices are getting faster and faster every year.

Now, even though all of these are good for the world, there are a few concerns with this recent technology. First, there are some ethical concerns. They might be able to give us stronger power as we only know a certain amount that has been discovered about them, can lead to undetectable surveillance – which can make wars in the future even more dangerous.

We do not know what would happen if these got out into the environment. There may be the possibility that these particles can move from organism to organism or down the food chain. Economically, in 2022, this study cost the US government between 67 and 83 billion dollars. With the addition of microelectronics and semiconductor industry that adds \$268 – 297 billion – NNI (National Nanotechnology Initiative). Even though these disadvantages most scientists believe that nanoscience and nanotechnology are the next steps and will be the biggest breakthroughs in energy, manufacturing, medicine, and plenty of other areas.

To conclude, from the information that I have gathered I would be open to consider nanoscience and nanotechnology as a subject to study at university as that in 4 years, I believe that this science and technology will be the next steps forward. I have enjoyed researching about this topic and potentially researching this in the future.