

1 First Exercise

Studying at university is different to studying at secondary school/college, for our first exercise I want you to watch two lectures in regards to nanoscience, one new and one old. Take notes while watching the lectures. This will mimic how education takes place at university. The lectures will briefly cover some areas that we will discuss in future sessions and give a nice overview of the subject.

Video 1: Richard Feynman "Tiny Machines" Nanotechnology Lecture - aka "There's Plenty of Room at the Bottom"

Video 2: Nanotechnology: The High-Tech Revolution - with Dave Blank

Questions to think about while watching the lectures:

1. What new technologies were mentioned in the lectures?
2. What materials were discussed, and how do we observe them/understand them?
3. What applications do these nanomaterials have?

2 Question 1:

List 3 nanomaterials, give an overview of their synthesis process, and it's potential applications in new technology. Some examples you could choose from include: graphene, carbon nanotubes, buckminsterfullerene and DNA origami.

3 Question 2:

After synthesis, characterization is key to better understand the materials you have made. Give an example of 3 characterisation techniques, how it works and what samples it can test e.g. (solid, liquid) and what information can be inferred from the technique.

Examples include infrared spectroscopy (IR), nuclear magnetic resonance (NMR), mass spectrometry (MS), electron microscopy (EM), atomic force microscopy (AFM), raman spectroscopy (RS), scanning tunnelling microscopy (STM), or another technique you can think of!

4 Question 3:

What are some of the sizes of these different nanomaterials:

1. Atom
2. DNA
3. Graphene
4. Carbon nanotubes
5. Virus
6. ATP synthase
7. E.coli (bacteria)
8. Human hair

Calculate the aspect ratio (diameter/length) of the channel tunnel, a 1 mm carbon nanotube and a 5cm long piece of human hair.