



### Lecture-3. Gathering the Tools of the Trade.

Nanotechnology presents you with a world that's normally outside everyday practical experience. Before you take your first (ahem) tiny steps into the world of nano-size objects, it's a good idea to dig out your old physics and chemistry notes from high school and/or college. If you don't have those notes handy (the dog ate them, or you steered clear of chemistry and physics in school), don't worry: We provide the basics right here. First we cover the building blocks of matter, atoms, and molecules, and explain how they stick together. Then we offer enlightening remarks on light — the dominant way most of us perceive things around us — including how researchers can see tiny nanoparticles by using super-duper microscopes (that's a technical term).

One basic that even Einstein started with is that our physical universe is made up of matter and energy. At its root, chemistry is primarily concerned with describing the physical matter in that universe. Chemistry asks questions like these:

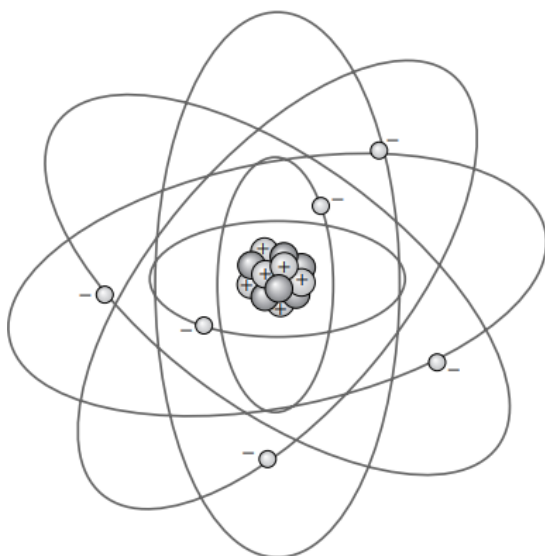
What is matter composed of?

How will a substance behave under certain conditions?

What combinations of substances and conditions allow us to make other substances?

Physics, on the other hand, has its own set of questions to deal with. Physicists spend their time studying the forces that range from those holding each individual atom together to forces that hold the entire universe together by binding matter and energy. A basic grasp of both physics and chemistry is essential equipment if you really want to understand our universe on a tiny scale. To make yourself at home in this nano-realm, for example, you need to understand what matter is composed of.

Start with a basic building block of nature — atoms.

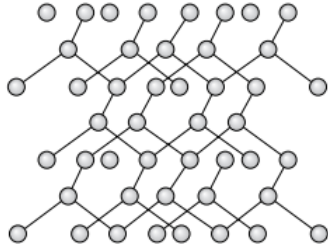


You can visualize the effect of these forces by remembering that time you spent in elementary school messing around with magnets. You tried to get the north poles of two bar magnets to touch each

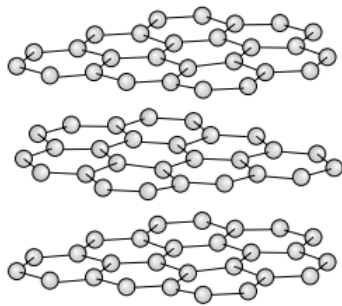


## Basics of Nanotechnology

other and you marveled at feeling an invisible repulsive force hell-bent on pushing them apart. (The coolest part was when you released your grip on the two bar magnets and they skittered away from each other as if possessed.) When you turned one bar magnet around so the north pole of one bar magnet faced the south pole of the other, it was all you could do to keep the magnets from flying out of your hands in their rush to stick together.



Diamond Structure



Graphite Sheets