Name Date

Welcome to the world of Nanotechnology! What is it? On one hand, it is not Physics, Biology, or Chemistry. On the other hand, it is ALL of them. Answer the questions below:

1. Nanotechnology is:

2. A nanometer is a measurement which is a part of the metric system. The metric system is based on units of

3. How many centimeters (cm) are in a meter?

4. How many millimeters (mm) are in a centimeter?

5. A nanometer (nm) is_____of a meter.

a. a human hair is _____

b. a fingernail grows _____

c. a two-meter person is_____or_____

d. an oxygen atom is less than _____

6. Using your ruler, measure three things in the classroom in both centimeters and nanometers. Write the name of the object followed by its size.

Scientists use scannmg probe microscopy to see the nano-world

The scanning probe microscope does not really allow us to see things the way we are used to seeing the world we live in. Instead, it measures forces or electricity to build up a pattern that we CAN then see using a computer.

In one example of a scanning probe microscope, a very sharp needle is dragged across the surface we want to look at. The tip of the needle is so sharp that it is made up of just a few atoms. If the tip is moved across a surface it will bump into other atoms that stick out and the tip moves upwards. This movement of the probe tip is detected and used to make a picture of the surface. Think of the way a blind person might use braille to 'read' a book. Their fingers feel the very small bumps on the page and they can spell out the words. They are using a different sense (touch) to read a word that they can no longer see with their eyes. The scanning probe microscope works in a similar way, allowing us to understand what the world looks like at the nanometer scale.

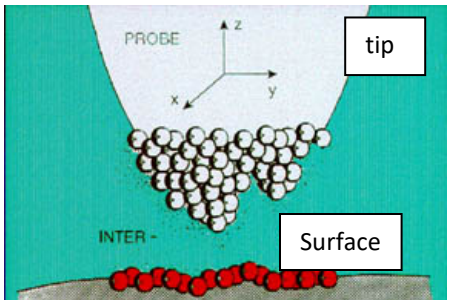
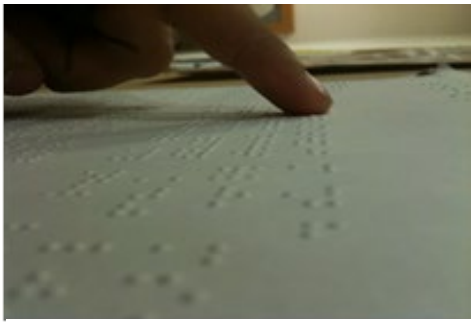
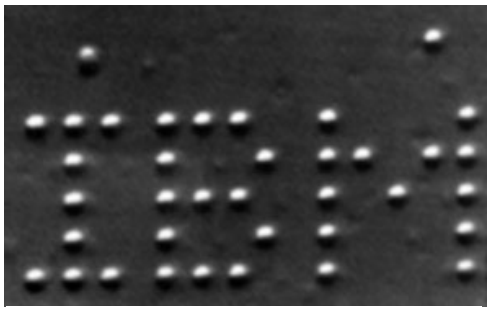


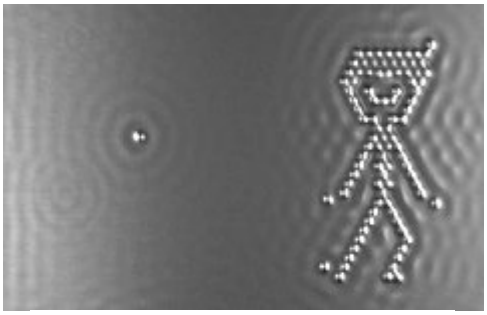
Image adapted from Arizona State University https://www.asu.edu/courses/phs208/patternsbb/PiN/rdg/spm/spm.shtml



Person reading braille. From Wikipedia https://commons.wikimedia.org/wiki/File:IMG_0086_Braille_finger.JPG



IBM image Wikipedia: https://en.wikipedia.org/wiki/IBM_(atoms)



IBM image Wikipedia: https://en.wikipedia.org/wiki/A_Boy_and_His_Atom

In 1989 Scientists and engineers at IBM used scanning probes to write the company name using 35 Xenon atoms. The picture above left was taken using a scanning probe microscope. In 2012, IBM made a movie that holds the Guinness World Records™ record for the World's Smallest Stop-Motion Film. The image on the right is from the movie. You can see the movie at: https://www.youtube.com/watch?v=oSCX78-8-q0