

Our Nanotechnology Research in 2006

Getting Started

- ◆ We watched Nova's 'Race to Catch a Buckeyball'
- ◆ We listened to a presentation about atoms by Meg
- ◆ We did some simple experiments to demonstrate atomic theory – including observing Brownian motion of pollen and carbon dust with a microscope.
- ◆ We watched portions of 'The Joy of Science' by Robert Hazen
- ◆ We listened to a Nanotechnology presentation by Meg
- ◆ We played Duck Boy in Nanoland, an on-line game that illustrates special properties of matter at nanoscales.
- ◆ We attended a presentation about nanotechnology given by Glen Miller at University of New Hampshire.
- ◆ We read books, magazines, and on-line web pages about nanotechnology.
- ◆ We watched a very short video about nanotechnology and cancer treatment.

Experiments

We did several experiments and many hands on activities. Experiments included studies of fibers, thin films, crystals, carbon nanotubes, and DNA. Hands-on projects included studying bridge design and construction of bridge components with LEGOs.

Fundraiser and Outreach

- ◆ We made a game called "nanomania" and sold it as a fundraiser - it's a little like trivial pursuit.
- ◆ We sold it at the Blueberry Festival in Brookline.
We demonstrated our robots and talked about nanotechnology at the festival.
- ◆ We did thin film projects with festival attendees – catching clear nail polish films atop water. The nail polish has nanoparticles of diamond and calcium to make a smoother stronger polish.

Extended Activity – Bridges and Roads

We studied bridge structures, watching movies, and doing a K'NEX unit, and making stronger bridge structures with legos. Many bridges were built. We created several robots that could run up and across the bridge as well as under the bridge. Next we explored the idea of using nanotechnology to improve roads, bridges, and highways. The group finally narrowed that topic down to the ceiling panel that fell in the big dig project. The epoxy on the tie-back was blamed originally. So we decided to make a nanobased components and epoxies to make a stronger system. But then we learned that the problem wasn't the epoxy but the lack of - apparently many of the bolts are missing epoxy and the inspections didn't reveal these deficiencies.

Project Ideas and Exploration

Textiles and Fibers

Our first thoughts last May were based on Robert Hazen's Joy of Science DVD series. He spoke about nylon and how a rock climbing friend of his died when his favorite nylon rope broke. UV breaks down nylon, so mountain climbers need to be extra cautious. Our solution was to use nanocoatings of TiO₂ or something that strongly absorbs UV and make a stronger rope. We did stress-strain analysis of yarns and of LEGO structures; and studied fibers like wool and cotton. And we got the 'nylon rope-trick' chemistry experiment for making nylon and made some. But we couldn't find a place to help with doing the UV exposures and very sensitive stress-strain measurements.

Alternative Energy

For a week or so, we considered studying alternative energy for our nanotechnology project. In particular we studied making electricity from light, and learned about photodiodes. Our electricity kits have photodiodes. We learned about spray on solar cells that the army is researching for soldiers to use as solar cell blankets.

Adaptive Camouflage

Could nanotechnology be used to make an invisibility cloak like Harry Potter's? We had a solution all worked out for adaptive camouflage and were thinking about how to make it - but then Duke University announced they had done something similar, so some of the kids didn't want to do that anymore because it was already done.

Teeny Tiny Tops

Then, inspired by Smalley's nano car with buckyball wheels, the kids wanted to make the world's smallest top. This top would be wound with a long long carbon nanotube and once set spinning would spin a long time.

Probes and Measurement Devices

Some team members wanted to make a new nanoprobe - one that would drill into the material pushing atoms aside to probe the subsurface atoms. This was an extension of the top idea.

Our Final Project Decision – A Treatment for AIDS

We finally decided to research AIDS and a possible nanotechnology cure. We decided to functionalize CNT-DNA hybrids to prevent AIDS.