

## FINAL

### Activity 20: Nano-Boy's

6/01/06

game\_nanobot.swf

Grades 3-6. Key reference: g6, p. 592

#### I. Key concepts

Activity defines:

- nano-scale technology
- challenges to developing this technology
- potential applications and risks

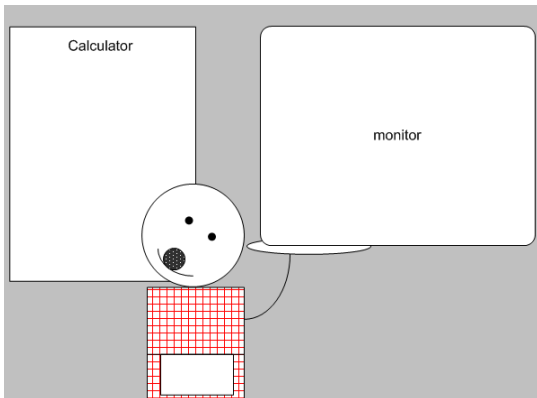
#### II. Main Activity

Interface: Drive-through. Mechanical "Nano-Boy" narrates (via speaker in his face). His platter holds a monitor in which animation plays.

Menu = calculator ([converts centimeters to nanometers](#). 1cm = 10,000,000).

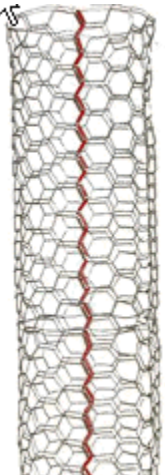
Student navigates activity via:

- Next button = Speech or [thought](#) bubbles (from customer). Play sound effect to introduce bubbles. Add rollover to show that they are clickable. (Refer to *Bob's Bistro*.)
- Replay button. Attach to monitor.



		Monitor	Source
Establish scale	(nano1.wav) Welcome to Nano-Boy's. Here we measure and make nano-sized materials. That's very, very small. [How small?]	Monitor is off.	
	(nano2.wav) (*Click*) A nanometer is one <b>billionth</b> of a meter. About 50,000 nanometers can fit across the width	Monitor turns on. Extend arrow width of a hair.  [Replay]	Source, hair: <a href="http://www.mos.org">www.mos.org</a> , <a href="http://www.nano.gov">www.nano.gov</a>

	of a hair. [How can anything so small help me?]		
	(nano3.wav) [a] Everything in the world is made of building blocks called atoms. Atoms cling together to make molecules, which cling together to make larger substances. [b] If scientists can move atoms around like bricks, they can build things to help people. If scientists rearranged the atoms in dirt, water, and air, they could make potatoes! [Thought: Raining potatoes]	a. [Show 2 H and 1 O atom floating] → [Show bonded molecule] → [Show many bonded water molecules] → [Show water droplet] b. Show neatly stacked blocks → dissolve to potato  [Replay]	Source, potatoes: <a href="http://www.zyvex.com/nano">http://www.zyvex.com/nano</a>
Challenge 1. Place atoms precisely	(nano4.wav) [a] But it's hard to tell an atom what to do. [b] (philosophically) Just like a feather in the wind, it gets bounced around a lot. And sometimes it sticks to things. [c] To build things in nano-scale, scientists must <b>first</b> be able to move atoms <b>and</b> lock them into place. In 1990, researchers moved 35 xenon atoms to form the letters IBM.  [Amazing!]	a. Potato dissolves to messy pile of bricks (no order). b. Show descending feather zipping around at random. Lands in water where it sticks. c. Show xenon image.  [Replay]	
Challenge 2.	(nano5.wav) Truly. But even if we can move atoms, it takes a long, long, long, long time to assemble nano-sized blocks into something big enough to see. We'll need to build <b>nano-machines</b> to do that kind of work! [Which atoms make the best building materials?]	Show bricks being stacked.  [Replay]	
Building blocks	(nano6.wav) Scientists recently discovered carbon molecules that are incredibly <b>strong</b> and <b>light</b> . Carbon is an element in the periodic table. It exists in nature as [a] diamonds and [b] graphite. In 1985, scientists found a carbon molecule with [c] 60 atoms. It looked like a soccer ball. They named it the <b>buckyball</b> . [Is it useful like diamonds or graphite?]	a. Insert and label <b>diamond</b> molecule b. Insert and label <b>graphite</b> molecule c. Insert and label <b>buckyball</b>  [Replay]	
Buckyball	(nano7.wav) Because the buckyball is strong, hollow, <b>and</b> tiny, it may be a perfect container for [a] medicine! [b] Currently, doctors use radiation on an area to kill cancer cells. But	Fade out diamond/graphite molecules so buckyball stands out. a. add contents to buckyball b. [many cells. One is	Source, radiation: <a href="http://www.kidshealth.org/kid/health_problems/cancer/radiation_p2.html">http://www.kidshealth.org/kid/health_problems/cancer/radiation_p2.html</a> Source, radioactive particles: <a href="http://www.strangematterexhibit.co">http://www.strangematterexhibit.co</a>

	<p>this treatment is not precise and can also harm normal cells.  [c] Doctors hope to fill the buckyball with radioactive particles that can be delivered to sick cells only. This targeted treatment would help patients feel better faster.</p> <p><a href="#">[Are there other kinds of carbon molecules?]</a></p>	<p>sick. Make area glow]  c. make sick cell only glow</p> <p>[Replay]</p>	<p><a href="http://www.sciencemuseum.org.uk/antenna/nano/lifestyle/112.asp">m/performance.html</a></p>
Nanotube	<p>(nano8.wav)  Years after finding the buckyball, scientists found a different carbon molecule – [a] the nanotube. The nanotube looks like a sheet of graphite rolled into a tube.  It has astounding properties.</p> <ul style="list-style-type: none"> <li>- [b] It is one hundred times tougher than steel, but only one-sixth the weight.</li> <li>- [c] It can conduct electricity and withstand heat.</li> </ul> <p>There are unlimited uses for this amazing nano-material. We can use it to make:</p> <ul style="list-style-type: none"> <li>- tiny computers</li> <li>- stronger tennis rackets</li> <li>- scaffolds to heal bones</li> <li>- stain-proof shirts</li> <li>- a space elevator</li> </ul> <p>[I'd like billions of nanotubes to go!]</p>	<p>a. Show nanotube  b. Fade in strength meter behind nanotube.  c. Fade out strength meter. Highlight path in tube (see reference image)</p>  <p>[Replay]</p>	<p>Source, uses:  <a href="http://www.sciencemuseum.org.uk/antenna/nano/lifestyle/112.asp">http://www.sciencemuseum.org.uk/antenna/nano/lifestyle/112.asp</a></p>
Risk	<p>(nano9.wav)  Whoa! Before we release these nano-particles, it's important to see how they may affect our environment.  [a] For thousands of years the natural material asbestos was used in products. It was also stronger than steel and could resist heat. Now we know that it can be deadly.  [b] A biologist has shown that buckyballs damage brain cells in fish. How would they affect us?  [c] Come back to Nano-boy's soon! Nanotechnology is growing every day!</p> <p><a href="#">[Thanks, Nano-boy! Start over.]</a></p>	<p>[a] cloud rolls in over Nano-boy, casting a shadow. Nano-boy's brow furls.  [b] TBD  [c] gloom vanishes instantly.</p> <p>[Replay]</p>	<p>Source, asbestos:  <a href="http://dnr.wi.gov/org/aw/air/reg/asbestos/asbes3.htm">http://dnr.wi.gov/org/aw/air/reg/asbestos/asbes3.htm</a>  Source, fish:  <a href="http://www.etcgroup.org/article.asp?newsid=445">http://www.etcgroup.org/article.asp?newsid=445</a></p>