2023 NanoDay Station Setup
By Livia Gong

Background: I was first introduced to National Nanotechnology Day (a.k.a. NanoDay; October 9th of each year) in June 2022 when I attended a 2-day Nanoscience Workshop at Virginia Tech. The organizers did a fantastic job of introducing teachers to Nanoscience and letting us explore materials and activities for a variety of subtopics, many of which became the inspiration for these lab stations. My goal was to provide hands-on exposure and appreciation for Nanotechnology and its applications in Chemistry. These stations were designed to be brief (~10 mins), but there are *plenty* of resources for activities and experiments that allow for deep exploration and experimentation of the topics (see "other resources" below). As students toured each station, they recorded things they learned or questions they had on an "exit ticket" that was collected at the end of the class period. Students were asked to visit as many stations as they could, but I did not expect them to visit them all.

Whole-Class Introduction (purposefully kept brief so there'd be more time for station exploration):

- https://nnci.net/sites/default/files/inline-files/intro_nano_1_1.pdf

Learning Stations:

Station 1: Nano Size and Scale Card Sort Activity

- Materials:
  - Copies of directions (page 10 of https://nanosense.sri.com/activities/sizematters/sizeandscale/SM_Lesson2Student.pdf)
  - Item Card Sets (page 12-13 of https://nanosense.sri.com/activities/sizematters/sizeandscale/SM_Lesson2Student.pdf)
  - Scale Card Sets (page 14 of https://nanosense.sri.com/activities/sizematters/sizeandscale/SM_Lesson2Student.pdfhttps://nanosense.sri.com/activities/sizematters/sizeandscale/SM_Lesson2Student.pdf)
  - Copies of "Answer Key" to be looked at *after* students finish sorting (page 9 of https://nanosense.sri.com/activities/sizematters/sizeandscale/SM_Lesson2Student.pdf)
- More Info
  - Teacher Guide (https://nanosense.sri.com/activities/sizematters/sizeandscale/SM_Lesson2Teacher.pdf)
  - Full 5 Lesson Unit Plan for Size Matters: Introduction to Nanoscience (https://nanosense.sri.com/activities/sizematters/)

Station 2: Memory Metal

- Materials:
  - Directions (I used the first part of the first page for the station's directions): https://nnci.net/sites/default/files/inline-files/Shape%20memory%20alloys_1_2_1.pdf
  - Hot water bath
  - Tongs/Tweezers/Needle-nose Pliers
  - Nitinol (purchased from Educational Innovations: https://www.teachersource.com/product/818/)
  - Aluminum/Copper Wire
  - Candle & Matches (optional; for "resetting" nitinol)
  - Copies of "Explain Materials" for after Exploration activity
    - Shape Metal Alloys Brochure (https://nnci.net/sites/default/files/2016-12/SMA%20brochure.pdf)
    - Mechanics of the Nitinol Shape Memory Effect (page 3 of https://cdn.commercev3.net/cdn.teachersource.com/downloads/lesson_pdf/HS-6.pdf)
- More Info
  - NNCI- Smart Materials—Shape-Metal Alloys (https://nnci.net/node/5320)
  - Educational Innovations Nitinol Memory Wire Instructional Sheet (https://cdn.commercev3.net/cdn.teachersource.com/downloads/lesson_pdf/HS-6.pdf)

Station 3: 2023 Nobel Prize in Chemistry—Quantum Dots

- Copies of The Nobel Prize in Chemistry 2023 Popular Science Background: https://www.nobelprize.org/uploads/2023/10/popular-chemistryprize2023.pdf
- Color-changing LED lamp (optional)

Station 4: Hydrophobicity & Magic Sand

- Materials :
  - Copies of student guide/directions (https://nnci.net/sites/default/files/2020-02/magic_sand_SG.pdf)
  - Petri Dishes
  - Water
  - Regular Sand
  - Magic Sand
  - Surfactant bottle (oil)
  - Mat for under petri dishes (https://nnci.net/sites/default/files/2020-02/Magic_sand_mat_2.pdf)
  - 3 Waste beakers (Regular Sand + Water; Magic Sand + Water; Magic Sand + Water +Surfactant)
- More Info (other mats and Teacher's Guide): https://nnci.net/node/5372

Station 5: Thin Films

- Materials:
  - Copies of directions and explanation (note: I've found that dropping the nail polish on the surface of the water and then dipping the paper on top is just as easy): https://nnci.net/sites/default/files/inline-files/Thin%20film_1_2_1.pdf
  - Nail polish
  - Petri dishes
  - Black cardstock
  - Tweezers
  - iPad or other device to show MIT Nano Day 2021 Video (a part of the video shows how they generate nano-thin films on Silicon wafers; optional; https://www.youtube.com/watch?v=Gdlz6trQvFA&t=9s)

Station 6: Nanoproducts

- Materials:
  - Copies of directions: https://nnci.net/sites/default/files/inline-files/nanoproducts_1.pdf
  - Printouts of Nanoproducts listed here: https://nnci.net/node/5373

100 Billion Nanometer Dash

- Materials:
  - Promotional Flyer: https://www.nano.gov/sites/default/files/nanometer%20dash%20flyer%202021.pdf
  - Certificate (need to revise date): https://www.nano.gov/NNDPrintables
  - Timer
  - Measuring Tape
  - Marking Flags?
  - Camera!

Ideas for Future Stations:

- Encapsulation (https://nnci.net/sites/default/files/inline-files/encapsulation1_2_1.pdf)
- Silver Nanoparticles
  - Creating and Testing Silver Nanoparticle Socks (https://nnci.net/node/5331)
  - Inhibition of Bacteria by Silver Colloid Impregnated Bandages (https://nnci.net/node/5333)

Other Resources:

- Virginia Tech Summer Professional Development Workshops featuring Nanoscience: https://www.science.vt.edu/get-involved/teacher-workshops.html
- Nanooze Magazine (free printed copies available upon request): https://www.nanooze.org/
- https://www.nano.gov/resources/education-and-outreach/teacher-resources

- National Nanotechnology Coordinated Infrastructure Education Website (excellent resource for lesson plans, demos, and info sheets): https://nnci.net/welcome-nnci-learn-and-explore
- (subpage of NNCI.net; great for demos) https://nnci.net/demo-guide-and-information-sheets
- (subpage of NNCI.net for searchable lessons) https://nnci.net/search/curriculum
- https://nanosense.sri.com/activities.html