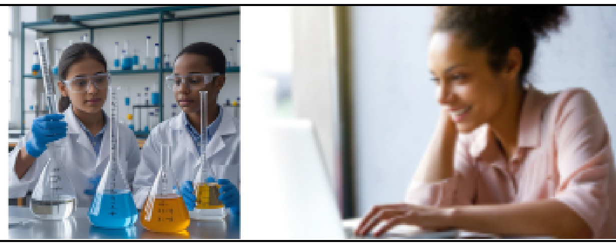
Admin Planning

PS&E



University of Massachusetts Amherst

Polymers All Around Us
Admin Planning Doc

4 months prior to program start identifying the following:

- Volunteers to run the program
- School/organization interested in participating
- Funding sources for buses or food if providing them
- Determine if your organization requires liability release to host minors on campus
- Determine if your organization requires photo releases if you plan on taking photos
- Determine if your organization requires background checks (CORI/SORI) for volunteers

3 months prior

- Contact the participants teacher/leader regarding the following:
    - Day, time, and approximate number & age of participants expected
    - Provide them with the Liability Release if your campus requires
    - Provide them with the Photo Release if you plan on taking pictures
- If you are providing transportation - contact the bus company to ensure they are certified to transport minors

2 months prior

- Put out a call for volunteers from your organization to help plan the program and host the participants
- Submit your volunteers info to the office on your campus in charge of background checks if required for hosting minors
- Reserve space to host your meeting (conference room for presentation)

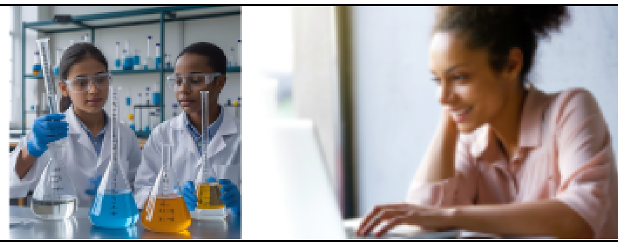
1 month prior

- Organize presentation
- Organize lab demos
    - Confirm with PI it's OK for the students to show a demo in their lab
    - Make sure PPE is provided for all visitors as required by your campus
- Order any needed supplies
- Place reservation at on campus dining common (if you are providing a meal)

2 weeks prior

- Make sure all background checks are completed (if required)
- Check in with participants teacher/leader to make sure liability and photo releases will be completed and signed
- Make sure all supplies are ordered for demos

Activities info & supplies



University of Massachusetts Amherst

Polymers All Around Us
Activities Info

Polymers All Around Us Classroom Demos

- Rubber Crystallinity
    - Balloons
    - Wooden/bamboo skewers
- Super Absorbent Polymers
    - Poly(acrylic acid) (can be purchased as “instant snow” or obtained from diapers)
    - Water
    - Salt
    - Cups
    - Stir sticks

Teaching Lab Demo

Demo Name: Turmeric as a Colometric assay for determining boron concentration

Description: Students will use green chemistry to determine the relative concentration of boron in various solutions, ranging from distilled water to (boric acid 0 mg/L) to concentrated boric acid solutions (boric acid 1 mg/L)

Supplies:

- Curcumin extraction solution (made in Katsumata lab before demonstration)
- Benzene Diboronic Acid
- Chloroform
- Distilled Water
- Acid mixture
- Glass pipettes
- 24 well plates (or 7ml vials)

Procedure:

Preparation (Teacher/Instructor)

1. Prepare six unlabeled vials containing solutions with different concentrations of boric acid.
    - One vial should contain 0 mg/L boric acid (no boron).
    - One vial should contain 1 mg/L boric acid.
    - The remaining vials should have concentrations in between.

2. Give each student group:
    - One 20 mL vial of curcumin solution
    - Enough glass pipettes for each student

Student Procedure

- Take one vial of boric acid solution.
- Using a pipette, add the curcumin solution one drop at a time to the boric acid solution.
- Gently swirl the vial after each drop.
- Continue adding drops until the color stops changing (this is called a *stable color*).
- Repeat this process for all boric acid vials.

Analysis (students, during and after adding curcumin solution)

1. Once all vials have reached a stable color, line them up from darkest to lightest color.
2. Compare the colors and determine:
    - Which vial likely has the highest boric acid concentration
    - Which vial has the lowest concentration
3. Record your observations and reasoning.

Teaching Lab Demo

Impact Testing of 3D Printed Samples

Description: In this demonstration, students learn how polymer materials fracture, emphasizing the importance and distinction of crack formation versus crack propagation.

Supplies:

3 Impact Testing Specimens

- One including a notch, one at the same thickness but excluding the notch, and one that is twice as thick as the others
- Can be made of any 3D printable material (PLA works well)
- If you have enough resources and experience with 3D printing, you can also change the printing orientation to make samples that have their lines printed perpendicular vs parallel to the direction of impact, as these are expected to have dramatically different fracture behavior.

1 Impact Tester

- Can be official/professionally made, or can be homemade (see https://kidizenscience.com/2020/12/06/inexpensive-homemade-materials-testing-jigs/)

Procedure

- Before working, verify that the weight/impact force of the pendulum can actually break your samples. If your impact tester is unable, reduce the thickness of the sample or add more weight to the swinging pendulum.
- First, perform the impact test of the un-notched, standard sample and comment on the amount of energy it absorbed. You can quantify this in a homemade setup as the angle the pendulum reached after it impacted the sample.
- Then, ask the students how much more energy they expect the thicker sample (unnotched) to absorb, then test the thicker sample. It should absorb more energy, but not the intuitive “twice as much” energy.
- Last, ask the students how much energy they anticipate the sample with a notch to absorb, then test it. It should absorb much less energy, ideally substantially less than the first sample.
- Then, discuss how in polymer fracture, forming a crack is more energetically costly than propagating a crack. As an analogy, you can describe how when opening a bag of chips, it is always hard to make the first crack, but as soon as it forms, you can easily tear the rest open.

Teaching Lab Demo

ThermoChromic Slime

Description: Participants make their own thermochromic slime that they can take home with them. Students learn about polymer crosslinking and color changing pigments.

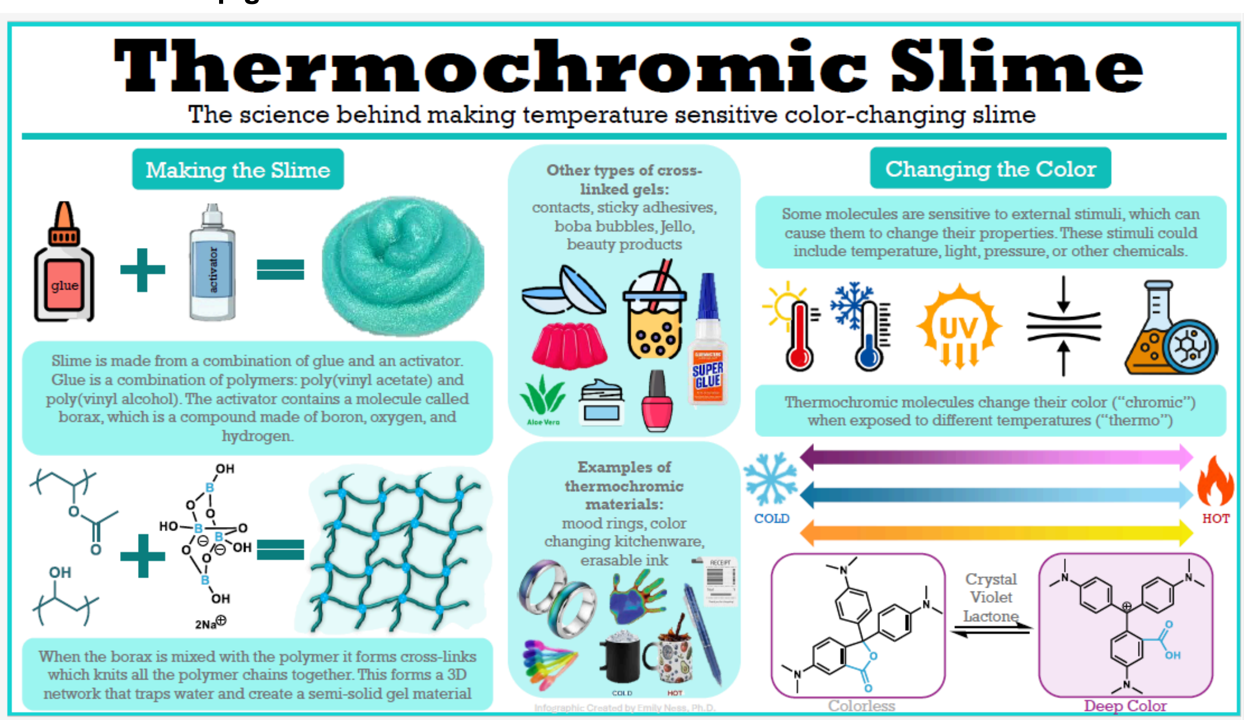
Supplies:

- clear Elmers glue
- Borax solution
- water
- Thermochromic pigment (can be purchased on Amazon)
- small cups
- plastic baggies for take home
- popsicle sticks

Procedure:

- Pre-make Elmers glue solution diluted with water (approx. 2:1 glue to water)
- Pour out glue into half of a Dixie cup
- Pre-pour borax solution into separate cups (approx. 1/3-1/2 dixie cup)
- Have students slowly add in borax solution to glue solution and mix with a popsicle stick
- The more borax is added the harder (more crosslinks) the slime will be
- Once slime is made have students add a pea sized amount of thermochromic powder to the slime
- Mix in the powder by hand
- Have students observe how the color changes as the slime warms in their hands

Handout included for students to take home that describes the science of slime and thermochromic pigment:



Teaching Lab Demo

Separation Science & Automation for a Sustainable Future

Description: Students learned the basics of chromatography in the context of chemical purification and gel electrophoresis for biological macromolecules. They observed a running gel that was separating a food coloring mixture and toured a functioning research lab equipped with liquid-handling robots.

Supplies:

- Gel electrophoresis tank
- Prepared agarose gel (used in DNA purification)
- Gel electrophoresis buffer
- Food coloring
- Eppendorf tubes

Procedure

- Mix varying amounts and colors of food coloring droplets into several Eppendorf tubes beforehand
- Load food coloring mixture into prepared gel electrophoresis tank beforehand
- Apply a voltage to the electrophoresis tank (preferably 5 minutes before the first group)
- Watch the separation of food dyes by the different distinct color smears on the gel!
    - Maybe takes ~45 minutes for food coloring to run off the gel

Note: We chose this demo based on things we had on-hand. This demo probably cannot be easily replicated.

Sample Schedule


Polymers All Around Us High School Field Trip Sample Schedule

9AM School Bus arrives to Conte
9:05-10:15 - PAAU demos, slides, and discussion in A110/111
- 3 volunteers

10:15-10:30 - EM Overview - A110/111
- EM Director

10:30-10:40 - walk to and through EM lab
- EM Director

10:45-11:30 - lab tours (Morris, Crosby, Katsumata)
- Tour Guides*
  - Group 1 - Volunteer 1
  - Group 2 - Volunteer 2
  - Group 3 - Volunteer 3
- Lab Demos
  - Morris Lab (B441) - Volunteer 4
  - Crosby Lab (B322) - Volunteer 5
  - Katsumata Lab (B566) - Volunteer 6

11:40 Lunch at Worcester Dining Commons - All volunteers are welcome to come with us for free!
1PM Bus picks up students from Haigis Mall in front of FAC

*~12 minutes with each group, 3 minutes to pass between labs
Group 1: Morris, Crosby, Katsumata
Group 2: Crosby, Katsumata, Morris
Group 3: Katsumata, Morris, Crosby