

The Wonders of Polymer Science

Tim Golding and Clara Teijido

With Dr. Joshua Otaigbe

Freshman Honor's Mentorship Program

Project Goals

- Design and perform a set of experiments
 - Digitally photograph and record
 - Perform additional background research
 - Prepare for incorporation into a web-based course on an introduction to polymers and polymer science

Project Goals

- Introduce the students to:
 - The fundamentals and concepts of polymers
 - The methods and procedures used in lab research
 - Presenting a project to an audience

Polymer Demonstrations

- Amorphous and Crystalline Sulfur
- Happy and Sad Balls
- Nylon 6-10
- Borax Slime
- Balloon and Plastic Bag
- Polyurethane Foam

Amorphous and Crystalline Sulfur



Melting Sulfur in Oil Bath

Amorphous and Crystalline Sulfur



Pouring Molten Sulfur into Cold Water - Amorphous

Amorphous and Crystalline Sulfur



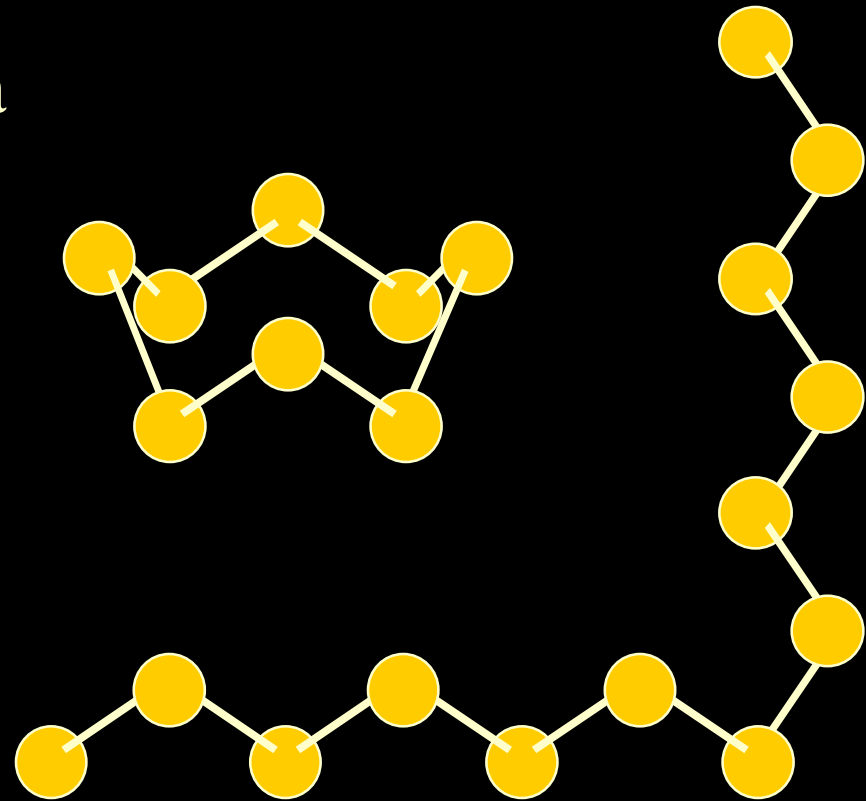
Amorphous Sulfur



Crystalline Sulfur

Amorphous and Crystalline Sulfur

- At room temp sulfur is a crystalline solid
- At MP (113° C), rings slide and becomes fluid
- More heating breaks rings and reforms them into long chains

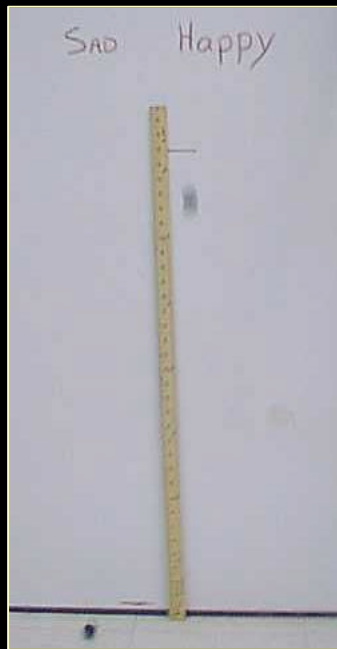


Happy and Sad Balls

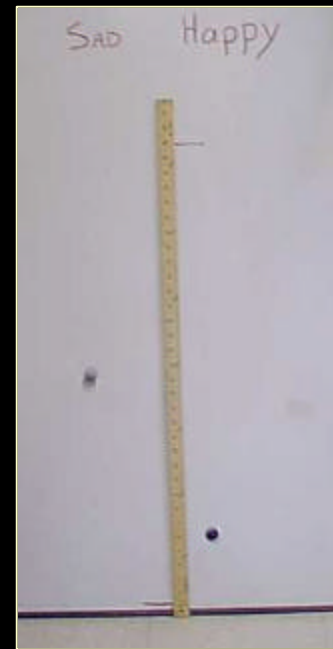


Demonstration of Coefficients of Friction

Happy and Sad Balls



Warm



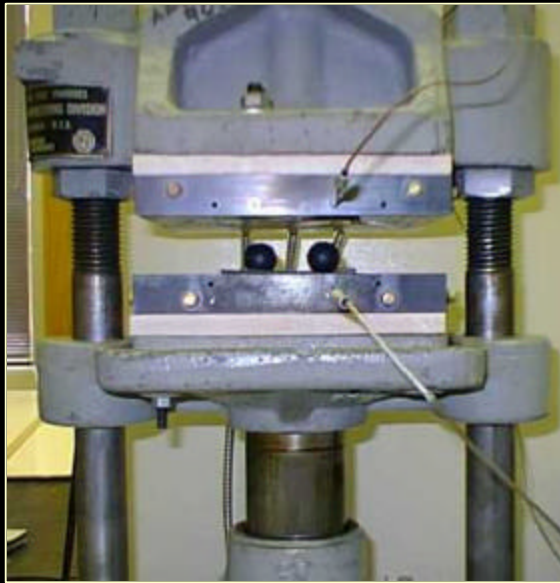
Cold

Rates of Restitution

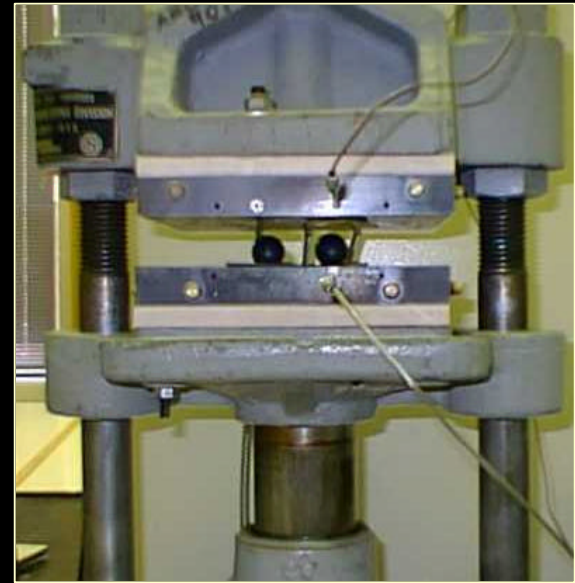
Happy and Sad Balls



Compression



Warm



Cold

Rates of Restitution

Happy and Sad Balls

“Happy”

- Standard Neoprene
- Low Hysteresis
- Low surface friction
- Weaker intermolecular forces

“Sad”

- “Norsorex”
- High Hysteresis
- High surface friction
- Stronger intermolecular forces

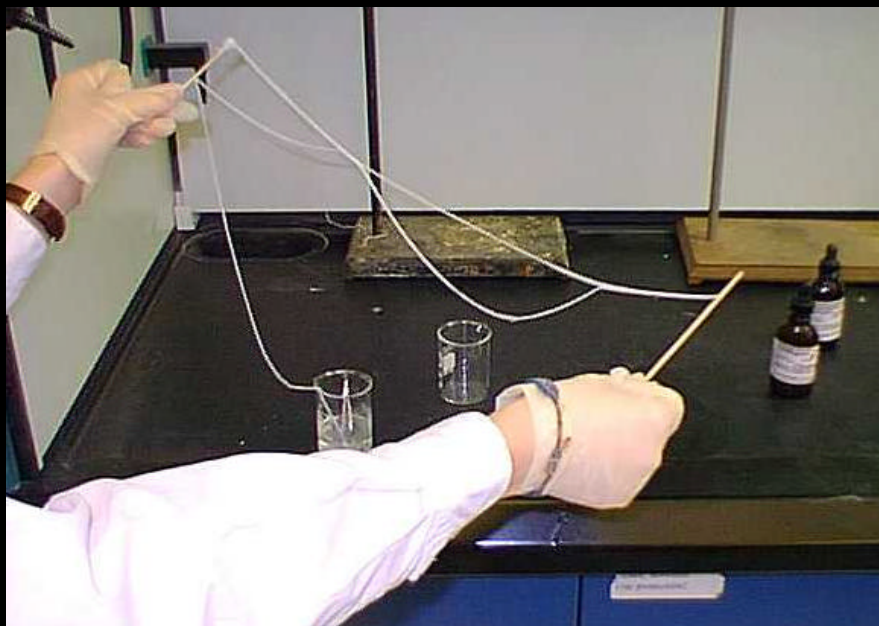
Nylon 6-10



Nylon 6-10

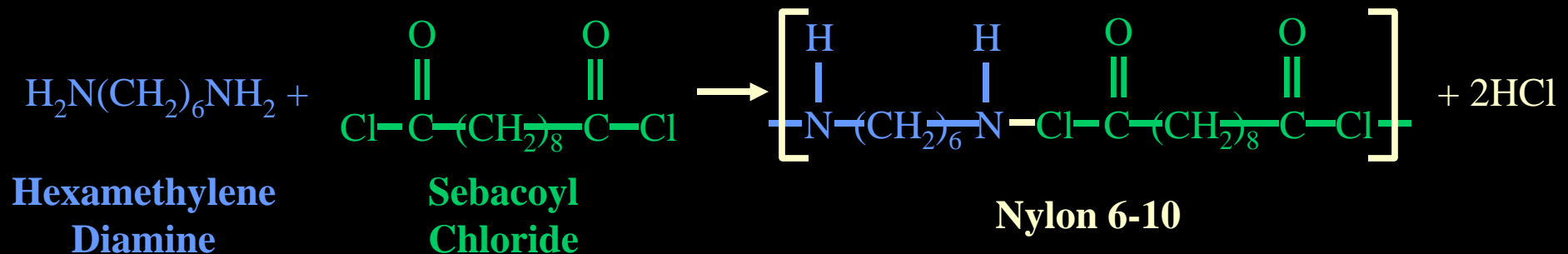


Nylon 6-10

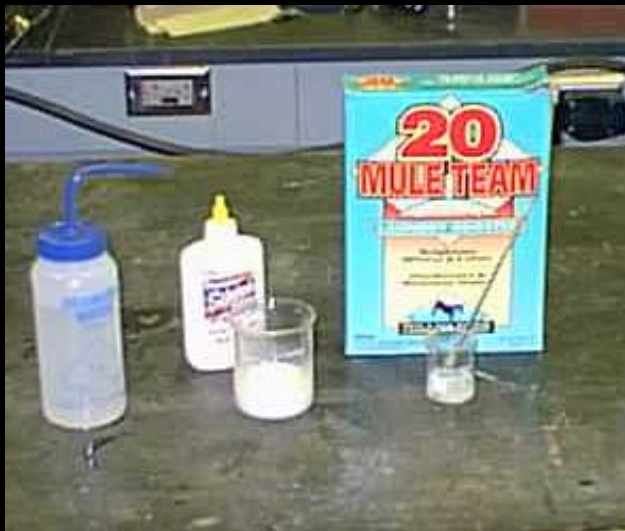


Nylon 6-10

- Nylons are also called polyamides
- They are formed by a reaction between an amine and acid groups
- Although this particular nylon is just for show, nylons have a wide variety of commercial applications



Borax Slime

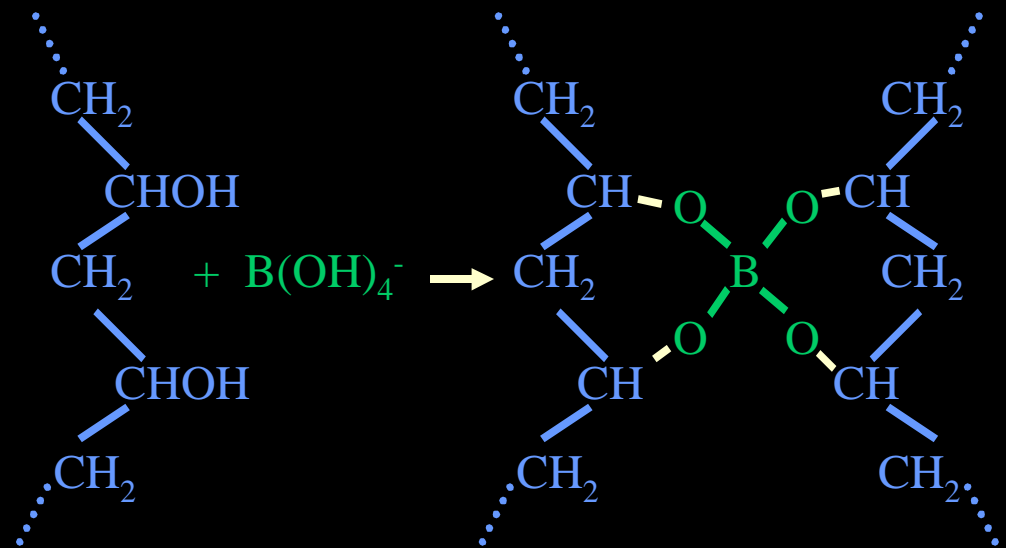


Borax Slime

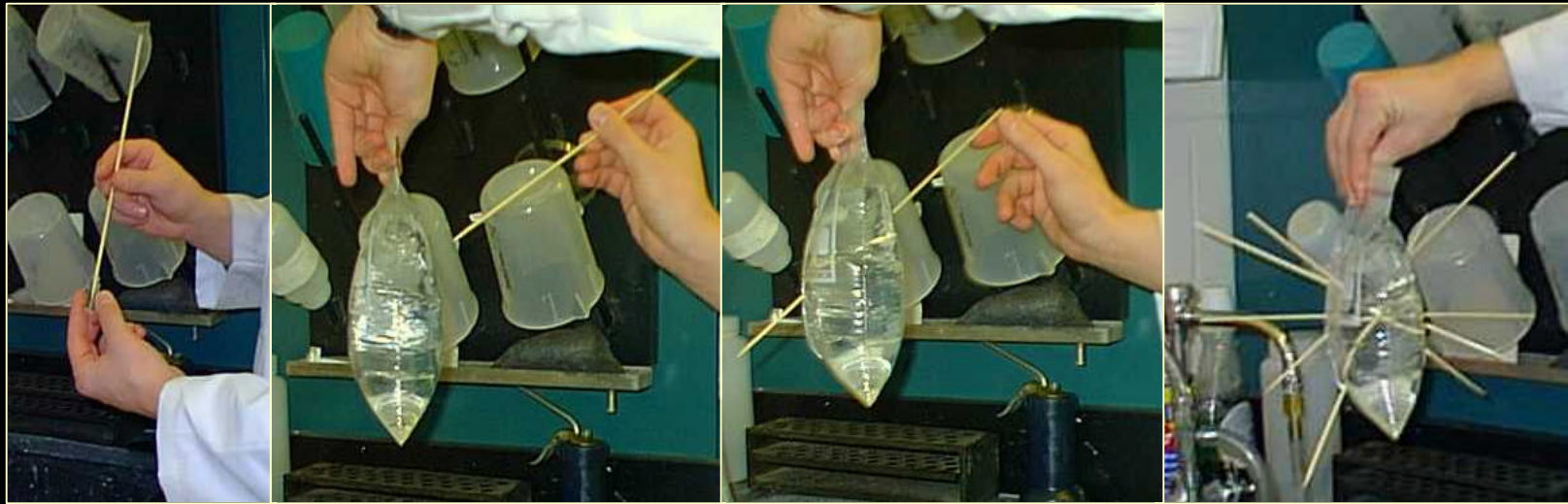


Borax Slime

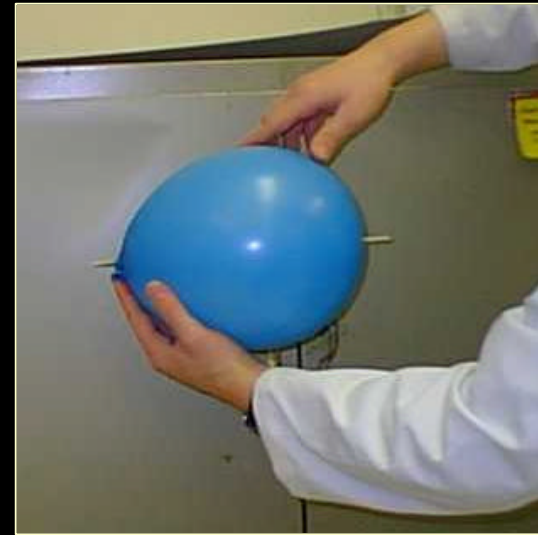
- Elmer's Glue is copolymer PVA
- In water, PVA dissolves from glue
- Borax reacts with PVA to crosslink
- Crosslinking causes irreversible gelation



Balloon and Plastic Bag



Balloon and Plastic Bag

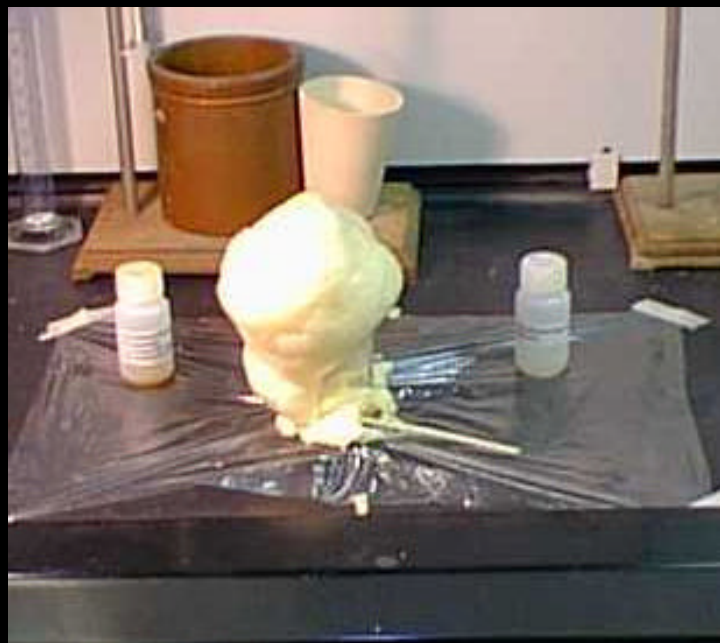


Balloon and Plastic Bag

- A balloon is thin layers of latex
- Rubber exists as a network of flexible polymer chains
- The needle can slide between the chains without popping the balloon



Polyurethane Foam



Polyurethane Foam

- An amber colored viscous liquid that contains a polyether polyol, a blowing agent, silicone surfactant, and a catalyst is mixed with...
- A dark colored viscous liquid containing polyfunctional isocyanate.
- An addition reaction produces isocyanate polymer

