

STATIONS FOR BOSTON GLOBE LESSON PLAN #1

Station 1

“TYPES OF ADHESIVES”

General information about adhesives

Adhesion- Adhesion is the tendency for *unlike* particles to “stick” or cling to one another.

Cohesion- Cohesion is the tendency for like particles to “stick” or cling to one another.

Adhesive- An adhesive is any substance that binds two surfaces together.

Adhesives work by joining together two objects called substrates. At the macroscopic scale we observe the two substrates “stuck” together. At the particulate level we envision the molecules of the adhesive and substrate attracted together through intermolecular forces.

You Try:

Perform a group internet search for the following types of adhesives:

Birch-Bark-Tar Adhesive

Pitch

Resin

Rosin

Yellow and White Glue

Instant Glue

Contact Cement

Polyurethane Glue

Epoxy Glue

Spray Adhesive

Construction Glue

Hot Glue

Watch the Lace-front Wigs Adhesive video

<https://www.youtube.com/watch?v=FWpY5d9RUd4>

1. What types of properties do you think the wig glue should have?

Station 2

“Intermolecular Forces and Adhesives”

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Intermolecular forces occur between:

substrate molecules - substrate molecules

adhesive molecules – adhesive molecules

adhesive molecules- substrate molecules

Adhesives will cover or “wet” the surface of a substrate when the intermolecular forces between the substrate and adhesive are stronger than the intermolecular forces between the adhesive – adhesive molecules and substrate-substrate molecules.

Read the article from MIT engineering found below:

<http://engineering.mit.edu/ask/what-are-basic-forces-behind-tape-and-glue>

1. In addition to strong adhesive forces between glue and a substrate, why do you think the cohesive forces within the glue need to be strong too?
2. Briefly discuss the pressure sensitive adhesive forces that hold tape in place?

You try:

Take a small amount of white glue and wet the surface of the red construction paper. Explain what must be happening at the particulate level for the glue to wet the surface.

Station 3

“Wetting, Surface Tension and Viscosity of Adhesives”

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You Try:

Surface Tension

Watch the MIT paper clips and water video found here:

<http://video.mit.edu/watch/surface-tension-8413/>

Write a brief summary about the video.

Wetting

Wetting is the measure of the ability of a liquid to stay in contact with a substrate (surface). Wetting depends on the intermolecular forces between the liquid and the substrate when they are placed together.

Take a small amount of white glue and place it on the construction paper.

Why do you think the glue doesn’t spread out by itself?

Take a wood applicator and spread the glue thinly and uniformly across the paper.

Viscosity

Viscosity is the measure of a liquid’s resistance to flow.

Open the following activity in your computer’s browser:

<http://www.planetseed.com/laboratory/viscosity-explorer>

Rank the liquids in order of increasing viscosity.

Station 4

“Curing, drying and heat”

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Curing

Curing is the process of making an adhesive harder by cross-linking polymer chains induced by heat or added chemicals or UV light beams.

Watch this video on UV curing

<https://www.youtube.com/watch?v=uGTu7J-xRNM>

1. Why do you think one of the substrates (solids) needs to be transparent for UV curing to work?

Drying

Drying adhesives contain a liquid solvent that is evaporated or is absorbed by the substrate (solid).

Solvent based Adhesives

Solvent based adhesives include white glue, rubber cement and contact adhesives.

Emulsion Adhesives (polymer dispersion adhesives)

Polymer dispersion adhesives are liquid dispersions commonly known as PVAc's or Polyvinyl acetates and can include Elmer's glue and wood glue.

You Try:

Make your own silly putty with Borax and PVAc

Station 5

“Adhesive chemical reactions and moisture”

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Adhesive curing chemical reactions and moisture

Single component chemical adhesives

Single component adhesives form solids through a chemical reaction when an outside source such as moisture, heat or UV light is added.

Heat

Hot adhesives are applied in molten (liquid) form and become solid as the melt is cooled. As the adhesive forms a solid strong bonds are created between many different types of materials. Hot adhesives are often called thermoplastics.

Take the glue gun and try applying hot adhesive to join several different substances.

Caution: Be sure that the teacher demonstrates proper use of the glue gun and that goggles, gloves and a safety apron are worn.

1. Carefully record your observations and write a brief summary of your investigation.

Two component chemical adhesives

Two components chemical adhesives are nonreactive when the parts are isolated. A bond is formed when the two components are mixed and chemically react. Polymers are cross-linked and various resins can be formed, such as, acrylics, epoxies and urethanes.

You Try:

Follow the instructions for making slime and explore polymer cross-linking

1. Carefully record your observations and write a brief summary of your investigation.

Station 6

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UV cure and anaerobic adhesives

UV Curing

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1. Why do you think one of the substrates (solids) needs to be transparent for UV curing to work?

Anaerobic Adhesives

Anaerobic adhesives cure without the presence of oxygen gas. These adhesives need to be applied in an oxygen free environment.

Check out information about the adhesives company called Loctite at the link below:

<http://en.wikipedia.org/wiki/Loctite>

1. How were anaerobic adhesives discovered?

2. Why are anaerobic adhesives useful?