

CHEMISTRY IN THE TOY STORE - RECIPES

© 1999, 1994, 1993, 1992, 1991 by David A. Katz, All rights reserved

David A. Katz

Chemist, Educator, Science Communicator, and Consultant
133 N. Desert Stream Dr., Tucson, AZ 85745, USA
voice/fax: 520-624-2207 email: dakatz45@msn.com

Safety Information

These activities are provided for youngsters with adult supervision. Safety goggles should be worn while performing these activities. Wash hands with soap and water after completing the activities.

Bubbles

A simple solution for making soap bubbles or films can easily be prepared by mixing liquid dish washing detergent in some distilled or deionized water. The soap mixture should always be stirred, not shaken, otherwise excessive amounts of suds are produced. Do not use a low suds or "controlled suds" detergent. A solution that is good for making strong, long lasting bubbles consists of:

- 7% liquid dish washing detergent such as Ultra Dawn® or Ultra Joy® by volume.
- 87% water (distilled or deionized)
- 6% glycerin (available at drug store)

A recipe for "super bubbles" (supplied by Fred Juergens, Department of Chemistry, University of Wisconsin-Madison) calls for:

- 4 parts glycerin
- 2 parts liquid Joy®
- 1 part white Karo® Syrup.

There is no water added to this solution. This solution should only be used outdoors.

Balloons

Put a needle through a balloon:

This is the method used by professional magicians.

1. Blow up the balloon to its full size. Release some of the air reducing the balloon to about 2/3 full. Tie the end of the balloon in a knot.
2. Use a cloth or paper towel to coat the needle with a small amount of oil (household oil, cooking oil, or Vaseline petroleum jelly).
3. Insert the needle through the end of the balloon where the rubber is thicker. The needle should come out of the balloon near the knot.
4. Withdraw the needle from the balloon.
5. Throw the balloon into the air and pop it with the needle so nobody will be aware of the holes in the balloon.

Put a bamboo (or wood) skewer through a balloon:

Bamboo skewers contain sufficient natural oil to slide easily through a balloon without additional lubrication. If desired, however, the skewer can be lubricated with a small amount of oil.

1. Blow up the balloon to its full size. Release some of the air reducing the balloon to about 2/3 full. Tie the end of the balloon in a knot.
2. Insert the skewer through the end of the balloon where the rubber is thicker. The skewer should come out of the balloon near the knot.
3. Withdraw the skewer from the balloon.
4. Use the skewer to pop the balloon so nobody will be aware of the holes in the balloon.

Rubber

Natural latex is found in the inner bark of many trees, especially those found in Brazil and the Far East. The white sticky sap of the milkweed is also a latex. Latex will turn into a rubbery mass within 12 hours after it is exposed to the air. The latex protects the tree or plant by covering the wound with a rubbery material like a bandage.

Rubber molecules consist of long polymeric chains which are joined in a network structure and have a high degree of flexibility. Upon application of a stress to a rubber material, such as stretching it, the polymer chain, which is randomly oriented, undergoes bond rotations allowing the chain to be extended or elongated.

Since latex will solidify in air, a stabilizer is added to prevent polymerization if the latex is to be stored or shipped. The stabilizer is usually 0.5 to 1% ammonia. When the ammonia is removed by evaporation or by neutralization, the latex will solidify into rubber.

Make a Rubber Ball from Rubber Latex:

Measure 20 mL (4 tsp) of latex in a paper cup. (Latex is available at some craft shops or hobby shops)

Pour a few drops of latex onto the palm of your hand. Spread it out using your finger. *Carefully*, smell the material. Describe its properties.

Add 20 mL (4 tsp) of water to the latex in the cup and stir.

Pour 20 mL (4 tsp) of vinegar into the cup and stir the mixture.

Remove the mass from the cup and stirring rod with your fingers. Carefully squeeze the mass while washing it under water in a small bucket. Form the mass into a ball. Dry it with a paper towel.

Preparation of a Silly Putty Type Material

Silly Putty® is a silicone polymer, originally made in 1941 in an unsuccessful attempt to manufacture a silicon based synthetic rubber. This recipe makes a Silly Putty-type material from Elmer's Glue and 20 Mule Team Borax.

Measure 25 mL (5 tsp.) of Elmer's Glue-All white glue into a paper cup. Add 20 mL (4 tsp.) of water and stir well. If desired, up to 5 drops of food color can be added. Stir well.

Add 5 mL (1 tsp.) of borax solution (use 1 level Tbs. borax for each one cup water) and stir well.

Remove the solid material. Pull the solid off the stirrer. This material will be sticky for about one or two minutes.

Store the Elmer's Glue putty in a plastic bag.

Gak

Gak is an elastic non-Newtonian fluid made from guar gum, a vegetable material used as a thickener in foods. (Powdered guar gum is available from health food stores, nutrition centers, and some drug stores.) Gak can be stretched, squeezed, twisted, and squished.

Guar Gum Gak

Measure 1 tablespoon (15 mL) of talcum powder into a 5 oz or 7 oz paper cup.

Add 100 mL (a little less than ½ cup) water and 5 mL (1 teaspoon) glycerin. Stir well to mix all ingredients.

Add up to 5 drops of food color and stir well.

Add ½ teaspoon (5 mL) of guar gum and stir well.

Add 10 mL (2 teaspoons) of borax solution (use 1 level tablespoon borax for each one cup water) and stir well.

Remove the Gak from the cup. Pull the solid off the stirrer. The Gak may be sticky at first but will become less sticky after handling. Dispose of the paper cup and any remaining liquid in the trash.

The Gak should stretch and flow easily, but it will tear if pulled hard.

The Gak will dry out and become less stretchy after handling. It can be re-hydrated by mixing with a small amount of water before storage.

Store the Gak in a plastic bag.

Gak can be removed from carpets, furniture, and clothing by first wetting it with vinegar and then washing with soap and water.

Elmer's Glue Gak

Measure 1 teaspoon (5 mL) of talcum powder into a 5 oz paper cup.

Add 25 mL (5 teaspoons) Elmer's glue, and 20 mL (4 teaspoons) water. Stir well to mix all ingredients.

Add up to 5 drops of food color to the materials in the paper cup and stir well.

Add 5 mL (1 teaspoon) of borax solution (use 1 level tablespoon borax for each one cup water) and stir well.

Remove the Gak from the cup. Pull the solid off the stirrer. The Gak may be sticky at first but will become less sticky after handling. Dispose of the paper cup and any remaining liquid in the trash.

Store the Gak in a plastic bag.

Ooze Ball

An Ooze Ball is an elastic non-Newtonian fluid made from thirteen ingredients with a talcum powder base. Some of the major ingredients are water, oil-free moisturizer, and some polymeric material to bind the material together.

Measure 1 teaspoon (5 mL) of talcum powder and place it in a 5 oz paper cup.

Add 10 mL (2 teaspoons) of oil-free moisturizing lotion (Clean & Clear, Aquamarine E), 10 mL (2 teaspoons) of Elmer's glue, and 10 mL (2 teaspoons) water. Stir well to mix all ingredients.

Add up to 5 drops of food color to the materials in the paper cup and stir well.

Add 5 mL (1 teaspoon) of borax solution (use 1 level tablespoon borax for each one cup water) and stir well.

Remove the Ooze Ball from the cup. The Ooze Ball may be sticky at first but will be come less sticky after handling. The Ooze Ball should stretch and flow easily, but it will tear if pulled hard.

Store the Ooze Ball in a plastic bag.

The Ooze Ball will dry out and become less stretchy after handling. It can be re-hydrated by mixing a with small amount of oil free moisturizer or by wetting it with water before storage. The Ooze Ball will absorb water very slowly.

The Ooze Ball can be removed from carpets, furniture, and clothing by washing with soap and water.

Slime

Slime, a product of Mattel Toy Corp., is a reversible cross-linking gel made from guar gum and borax. Powdered guar gum is available from health food stores, nutrition centers, and some drug stores.

Guar Gum Slime

Measure 100 mL of water into a 5 oz or 7 oz plastic or paper cup. Add 5 mL (1 teaspoon) of glycerin and stir.

If desired, add two or three drops of food color to the water.

Measure ½ teaspoon of guar, add it to the water and stir until dissolved. The mixture will thicken within one to two minutes.

Add 10 mL (2 teaspoons) of borax solution (use 1 level tablespoon borax to one cup water) and stir. The mixture should gel within two minutes.

Different grades of guar gum may gel differently. If the Slime does not gel, add an additional 5 mL of borax solution. If the Slime is too thin, start over using more guar until the desired consistency is obtained.

Store the Slime in an air-tight container to keep it from drying out.

If Slime gets on any material, it can be removed by first wetting it with vinegar to break down the gel, followed by soapy water or foam type upholstery cleaner.

Elmer's® Gel Glue Slime

Elmer's® Gel Glue is made from polyvinyl alcohol, a water soluble polymer.

Measure 15 mL (1 Tbs.) Elmer's® Gel Glue into a 5 oz paper cup.

Add 25 mL (5 tsp.) water and stir well.

Add a few drops of food color and stir.

Add 5 mL (1 tsp.) of borax solution (use 1 level tablespoon borax to one cup water) and stir.

Store the Slime in an air-tight container to keep it from drying out.

Instant Glop

Super-absorbent material, sold under the name "Water Grabber" or "Water Lock" is available from garden supply stores and can be found in the garden department of some variety stores.

Measure a level 1/2 teaspoon (2.5 mL) of superabsorbent material. Place the material in a 5 oz paper or plastic cup. Add 100 mL (a little less than ½ cup) of water to the cup and stir.

Store the glop in a sealed plastic bag.

To make Instant Glop From a Disposable Diaper:

Obtain an ultra-absorbent diaper. Spread out some newspaper on a table top or the floor.

Slowly, take the diaper apart. Observe the different layers. What is the function of each layer? Shake the cotton well to remove any superabsorbent material. Throw the waste cotton into the trash. Rub the outside liner of the diaper to remove any superabsorbent material adhering to the plastic.

Transfer the powder and cotton on the newspaper to a 5 oz. plastic or paper cup. Remove any loose cotton, leaving the powder in the cup. Add 50 mL of water to the powder in the cup and stir. Observe the material in the cup for several minutes.

Monster Flesh (Play Dough)

The Mad Scientist Monster Lab from Mattel, Inc., allows the user to "make disgusting, gross monsters...then sizzle the flesh off their bones!"

The green Monster Flesh Compound is a clay-like material made from silica gel, similar in texture to Play Doh (manufactured by - Kenner Products), but not as water soluble. In The Monster Lab, the Monster Flesh is mixed with Secret Froth Formula (sodium bicarbonate or baking soda) and molded onto a monster skeleton. The monster is then placed in a plastic tank containing a water - solution of Monster Flesh Remover (citric acid, commonly sold as sour salt in the supermarket - you can substitute lemon juice or vinegar). The reaction between the sodium bicarbonate and citric acid produces sodium citrate and carbon dioxide resulting in bubbles of gas ("sizzle") and breaking apart of the Monster Flesh into small pieces. The material made in this recipe is actually a play dough material. It can be used as a modeling material by itself or mixed with baking soda and used like Monster Flesh.

To make Monster Flesh (Play Dough):

In a bowl, mix together 1 cup flour, 1/2 cup salt (sodium chloride, NaCl), 1 teaspoon alum (available from grocery or drug stores. This may be ammonium alum, potassium alum, or sodium alum), and 2 tablespoons vegetable oil. Mix well.

Place 1/2 cup water in a separate container. Add 8 to 10 drops of food coloring to the water and stir.

Add the water to the other ingredients *a little bit at a time*, mixing well between additions. Continue to add water until the material feels like dough. Don't worry if you do not use all the water.

Store the Monster Flesh in a plastic bag. It will keep longer if refrigerated.

Using Monster Flesh:

Mix some baking soda (sodium bicarbonate) into a piece of monster flesh. If it gets too dry, add a small amount of water.

Holding the Monster Flesh in the hand, over a sink, pour some vinegar onto the Monster Flesh. The Monster Flesh will sizzle and dissolve.

Mold some Monster Flesh around a small action figure or doll (make sure it is waterproof). Place it in a bowl or in a sink. Pour some vinegar onto the figure.

Thingmaker Chill-A-Tron Lab

The Thingmaker Chill-A-Tron Lab uses Monster Mix and Gooze to make slimy, squishy creatures. Monster mix is unflavored gelatin and the Gooze is composed of glycerin mixed with food color.

Measure 100 mL (a little less than ½ cup) of hot tap water into a 7-ounce paper or plastic cup.

Add 5 mL (1 teaspoon) glycerin (available from a drug store) and a few drops of food color. Mix well.

Add 3 packages (about 21 grams total) of Knox unflavored gelatin to the water mixture and stir well.

Pour the mixture into the Thingmaker molds. Set them on ice and allow to harden for 20 minutes. (Note: The gelatin will set at room temperature in about 30 minutes.)

Remove the hardened creatures from the molds. Let them air dry for about 24 hours. (Occasionally turn them over to obtain even drying.)

Store the dry creatures in a sealable plastic bag when not using them.

(NOTE: The Thingmaker creatures are not edible. To make edible creatures, use the recipe for Jello Jigglers [see Jello package] and pour the Jello mixture into clean, lightly lubricated [cooking spray] Thingmaker molds. Chill in a refrigerator.)

Disappearing Ink

Disappearing ink is a dark blue water-based solution which, when squirted on clothing, table cloths, or other materials, will disappear within minutes leaving only a colorless wet spot that will evaporate slowly. (Note: a small amount of white residue may remain visible on dark clothing.)

The pH of the ink solution is about 10-11 (moderate to strong base). Addition of acid, such as hydrochloric acid, HCl, causes the solution to turn colorless forming a white precipitate while addition of base, such as sodium hydroxide, NaOH, dissolves the precipitate and restores the blue color. If the "ink" is squirted on cloth, the colorless wet spot that remains after the color fades is slightly acidic with a pH of about 5-6. Addition of base to the wet spot causes the blue color to return.

Disappearing ink consists of an acid-base indicator, that is colored in base and colorless in acid, in a solution of water, alcohol, and a base. The reaction in disappearing ink is that of sodium hydroxide, a base, with carbon dioxide in the air to form sodium carbonate. This lowers the pH of the solution with the alcohol acting as an acid to turn the indicator colorless. A similar reaction is used in Hollywood Hair® Barbie® dolls where there is an indicator, phenolphthalein, dispersed in the Barbie's hair. The hair spray is the disappearing ink mixture of water, alcohol, and a base without any added acid-base indicator.

To make Disappearing Ink:

Measure 0.10 gram (1/3 of a 1/8 teaspoon measure) of thymolphthalein into a 150-mL beaker (5 oz cup).

Add 10 mL (2 teaspoons) of ethyl alcohol (or about 14 mL [3 teaspoons] of ethyl rubbing alcohol) and stir to dissolve the solid.

Add 90 mL water and stir. The solution will be milky white.

Add 20 drops of 3 M sodium hydroxide solution (or 10 drops 6 M sodium hydroxide). The solution will turn blue. (A 3 M solution of sodium hydroxide is made by mixing 12 grams of sodium hydroxide [about 1 level tablespoon of lye] with 100 mL (½ cup) of water.

CAUTION: This is a caustic solution. Lye solution should only be handled by an adult. In case of skin contact, wash well with water.]

Place a few drops of the disappearing ink onto a piece of cloth. The color should fade from blue to colorless in about 3 minutes. (Fading time can be extended by adding additional drops of sodium hydroxide. Avoid excess sodium hydroxide solution.)

Store the disappearing ink in an air-tight bottle.

Safety note: Never spray disappearing ink into anyone's face.

(Note: Red disappearing ink can be made using phenolphthalein in place of thymolphthalein.)

Hollywood Hair® Barbie® :

Hollywood Hair® Barbie® was a Barbie doll that came with a small bottle of Magic Hair Mist. When the Magic Hair Mist was sprayed onto the Barbie's hair, her hair would turn pink and then slowly fade back to its original blonde color. This was a disappearing ink reaction.

To make Hollywood Hair® Barbie® Magic Hair Mist:

Place 10 mL (2 teaspoons) of ethyl alcohol (or about 14 mL [3 teaspoons] of ethyl rubbing alcohol) into a 5 oz cup.

Add 90 mL water.

Add 10 drops of 3 M sodium hydroxide solution (recipe above).

Store the Magic Hair Mist in an air-tight bottle.

If Hollywood Hair® Barbie's® hair no longer turns pink, or you don't have a Hollywood Hair® Barbie's®, you can restore the hair, or treat the hair of any Barbie with waterproof hair, by dissolving some phenolphthalein in a small amount of denatured alcohol and lightly spraying some onto Barbie's® hair. Allow the hair to dry before use. (Blue hair can be made by using thymolphthalein in place of the phenolphthalein. Purple hair by mixing phenolphthalein with thymolphthalein.)