

Goodie Bag #9: Polymers

Handed out on 12.3.18 | Quiz #9 on 12.6.18

3.91

Do yourself a solid.

Please treat all contents of every Goodie Bag with care, and be cognizant that any item may be dangerous if improperly used. You are responsible for your own actions. Make sure to carry out any activities with items in this bag in an appropriate environment.



This bag contains:

- 1 bottle of Elmer's slime mix (glue)
- 1 baggie containing Borax laundry detergent booster and cleaner
- 1 awesome Silly Putty egg
- 2 precision containers
- 2 measuring/stirring devices

What to bring to the quiz: for this one, just your deep knowledge!

Introduction

This goodie bag will explore the topic of polymers and cross-linking. We will study a cross-linking reaction as well as some special properties of Silly Putty.

NOTE: when done, dispose of everything in the trash – NOT the sink!

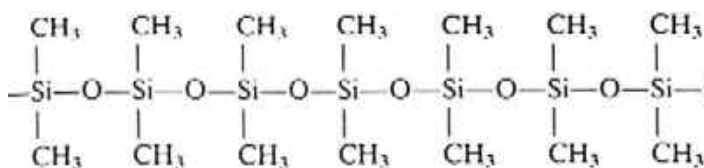
Instructions

1. Fill your cup about 1/4 of the way with Elmer's glue, then another 1/4 of the way with tap water so it is now 1/2 full. Mix this solution with your spoon.
2. Fill your cup near to the top with water and mix 1 teaspoon of Borax powder in.
3. Mix until solid putty forms in your cup.
4. Spoon out your putty and let it dry.
5. Play with it! Stretch it, try to bounce it, compare it to your Silly Putty.
6. **IMPORTANT: DO NOT** pour any solution or putty down the drain! Throw it in the trash!
7. Repeat the above steps, but use 2 teaspoons of Borax powder rather than one. Now you have 2 batches of home-made putty!

Questions

Question 1: Identifying monomers

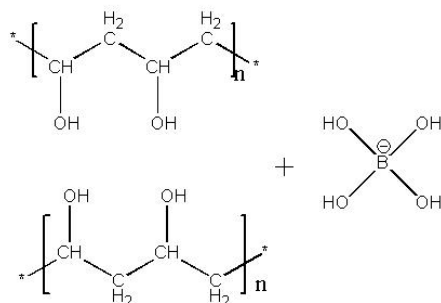
Circle the monomer in the methyl silicone chain, a polymer used to make silly putty:



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Question 2: Why does the polymer form?

- a) Why does the strand of polymer form and hold together once you add the sodium alginate?
- b) Sketch the polymer that results from the reaction between the boric acid in the Borax powder and the polyvinyl acetate in the Elmer's glue:



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Question 3: Different amounts of Borax

You made two batches of silly putty with two different amounts of Borax powder. Is there a difference in consistency of the two? Why or why not?

Question 4: Elasticity

- a) What happens to the cross-linking bridges in the silly putty when you pull it apart very quickly? What about when you stretch it slowly? Why is there a different result for the two actions?
- b) Draw a stress-strain plot with two curves on it—one representing the silly putty being stretched quickly and the other representing the silly putty being stretched slowly.

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