

## Proposal of Activities

F.E.M.M.E.S

Explore Capstone (4th-6th grade)

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<b>Activity 1</b>	
Title	Making bouncy balls with water and glue – polymers in action!
Description	In this activity, students will be introduced to the basic concepts of polymer science and polymers. As a result of this activity, students will be able to identify different polymeric materials and understand why they are used for different applications based on their mechanical properties (hardness, elasticity, solubility). Students will also partake in an experiment to create a cross-linked polymer system that is elastic and can be molded into a bouncing ball. For this experiment, borax will be mixed with some water and added to a solution of diluted white glue (maybe with some die coloring). A reaction will happen between borax and the glue and make all the polymer strands in the glue stick together by borax molecules – thus creating a cross-linked polymer bouncing ball.
Learning Goals	<ul style="list-style-type: none"><li>• Recognize polymers and polymeric materials used in our daily lives</li><li>• Understand basic concepts of polymer chemistry</li><li>• Recognize mechanical properties of polymers</li><li>• Differentiate between linear and cross-linked polymer</li><li>• Synthesize a cross-linked polymer gel</li></ul>
Delivery	<ol style="list-style-type: none"><li>1. What is Chemical Engineering? (2 min)</li><li>2. What are polymers? (2 min)</li><li>3. What are some properties of polymers? (2 min)</li><li>4. Linear vs. cross-linked? (1 min)</li><li>5. Experimental activity (30 mins)</li><li>6. Summary (5 mins)</li></ol>
Materials	<ul style="list-style-type: none"><li>• Borax (any retail store)</li><li>• Water (warm preferably)</li><li>• White liquid glue</li><li>• Two small cups</li><li>• Stirring stick</li><li>• Coloring die</li></ul>

Amazon List	<ul style="list-style-type: none"> <li>• Plastic cups (5oz x 100) – <b>3 per student</b>  <a href="https://www.amazon.com/Dealmed-Disposable-Clear-Plastic-Cups/dp/B07PRXTVFH/ref=sr_1_3?dchild=1&amp;keywords=small%2Bcups&amp;qid=1633344830&amp;sr=8-3&amp;th=1">https://www.amazon.com/Dealmed-Disposable-Clear-Plastic-Cups/dp/B07PRXTVFH/ref=sr_1_3?dchild=1&amp;keywords=small%2Bcups&amp;qid=1633344830&amp;sr=8-3&amp;th=1</a>)</li>   <li>• Stirring sticks – <b>4 per student</b>  <a href="https://www.amazon.com/Gmark-Premium-Stirrer-2-3mm-Thick/dp/B07WKL5ZVN/ref=sr_1_1_sspa?crd=2ECH4TG30XNZW&amp;dchild=1&amp;keywords=stirring+sticks&amp;qid=1633345035&amp;srefix=stirring+%2Caps%2C194&amp;sr=8-1-spons&amp;psc=1&amp;spLa=ZW5jcnlwdGVkUXVhbGlmaWVyPUEzN01LUDILMk4xRUM1JmVuY3J5cHRlZElkPUEwMjQxNjYxM1VQUVNRTkdJUTBYVYzIbmNyeXB0ZWZlZElkPUEwODg3ODgyM1ZESVBLTIZZUUpFNCZ3aWRnZXROYW1lPjNwX2F0ZiZlY3Rpb249Y2xpY2tSZWRpc mVjdCZkb05vdExvZ0NsaWNrPXRydWU=)">https://www.amazon.com/Gmark-Premium-Stirrer-2-3mm-Thick/dp/B07WKL5ZVN/ref=sr_1_1_sspa?crd=2ECH4TG30XNZW&amp;dchild=1&amp;keywords=stirring+sticks&amp;qid=1633345035&amp;srefix=stirring+%2Caps%2C194&amp;sr=8-1-spons&amp;psc=1&amp;spLa=ZW5jcnlwdGVkUXVhbGlmaWVyPUEzN01LUDILMk4xRUM1JmVuY3J5cHRlZElkPUEwMjQxNjYxM1VQUVNRTkdJUTBYVYzIbmNyeXB0ZWZlZElkPUEwODg3ODgyM1ZESVBLTIZZUUpFNCZ3aWRnZXROYW1lPjNwX2F0ZiZlY3Rpb249Y2xpY2tSZWRpc mVjdCZkb05vdExvZ0NsaWNrPXRydWU=)</a></li>   <li>• Cornstarch – <b>¼ of a cup for each student, stored in a Ziplock bag</b>  <a href="https://www.amazon.com/Argo-Corn-Starch-pack-Gluten/dp/B00INYRCIS/ref=sr_1_6?dchild=1&amp;keywords=cornstarch&amp;qid=1633346567&amp;sr=8-6">https://www.amazon.com/Argo-Corn-Starch-pack-Gluten/dp/B00INYRCIS/ref=sr_1_6?dchild=1&amp;keywords=cornstarch&amp;qid=1633346567&amp;sr=8-6</a>)</li>   <li>• Borax – <b>¼ of a cup for each student, stored in a Ziplock bag</b>  <a href="https://www.amazon.com/Detergent-Booster-patrons-gained-service/dp/B01G3MGWKK/ref=sr_1_12?dchild=1&amp;keywords=borax&amp;qid=1633345228&amp;sr=8-12">https://www.amazon.com/Detergent-Booster-patrons-gained-service/dp/B01G3MGWKK/ref=sr_1_12?dchild=1&amp;keywords=borax&amp;qid=1633345228&amp;sr=8-12</a>)</li>   <li>• Elmer’s School Glue – <b>1 4oz bottle for each student</b>  <a href="https://www.amazon.com/Elmers-Washable-No-Run-School-Bottle/dp/B012UHCYHM/ref=sr_1_5?crd=3IPZHRDJE19M0&amp;dchild=1&amp;keywords=elmers+school+glue&amp;qid=1633345463&amp;srefix=elemer+school+%2Caps%2C191&amp;sr=8-5">https://www.amazon.com/Elmers-Washable-No-Run-School-Bottle/dp/B012UHCYHM/ref=sr_1_5?crd=3IPZHRDJE19M0&amp;dchild=1&amp;keywords=elmers+school+glue&amp;qid=1633345463&amp;srefix=elemer+school+%2Caps%2C191&amp;sr=8-5</a>)</li>   <li>• Food coloring die – <b>1 for each student</b>  <a href="https://www.amazon.com/Coloring-Nomeca-Tasteless-Decorating-Supplies/dp/B07VJM115H/ref=sr_1_9?dchild=1&amp;keywords=coloring+die&amp;qid=1633345726&amp;sr=8-9">https://www.amazon.com/Coloring-Nomeca-Tasteless-Decorating-Supplies/dp/B07VJM115H/ref=sr_1_9?dchild=1&amp;keywords=coloring+die&amp;qid=1633345726&amp;sr=8-9</a>)</li>   <li>• Table spoon – <b>2 for each student</b>  <a href="https://www.amazon.com/AmazonBasics-Heavy-Weight-Plastic-Spoons-250-Pack/dp/B07Y613ZL6/ref=sr_1_1_sspa?dchild=1&amp;keywords=plastic+tablespoons&amp;qid=1633346065&amp;sr=8-1-spons&amp;psc=1&amp;spLa=ZW5jcnlwdGVkUXVhbGlmaWVyPUEzMFk4Vlk0UjJUSEc5JmVuY3J5cHRlZElkPUEwMDUxODYzVENNTE1KMEZDRVg3JmVuY3J5cHRlZEFkSWQ9QTEwMzkxMzQzN0oxUVdSTTkxWUV">https://www.amazon.com/AmazonBasics-Heavy-Weight-Plastic-Spoons-250-Pack/dp/B07Y613ZL6/ref=sr_1_1_sspa?dchild=1&amp;keywords=plastic+tablespoons&amp;qid=1633346065&amp;sr=8-1-spons&amp;psc=1&amp;spLa=ZW5jcnlwdGVkUXVhbGlmaWVyPUEzMFk4Vlk0UjJUSEc5JmVuY3J5cHRlZElkPUEwMDUxODYzVENNTE1KMEZDRVg3JmVuY3J5cHRlZEFkSWQ9QTEwMzkxMzQzN0oxUVdSTTkxWUV</a></li> </ul>
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	<a href="#">JJndpZGdldE5hbWU9c3BfYXRmJmFjdGlvbj1jbGlja1JlZGlyZWNOJmRvTm90TG9nQ2xpY2s9dHJlZQ==)</a>
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