STEM Curriculum Planning Guide

This instructional design guide serves as the template for the design and development of STEM units of instruction at the Dayton Regional STEM Center in Dayton, Ohio. The guide is anchored to the *STEM Education Quality Framework* also developed at the Dayton Regional STEM Center.

STEM Unit Title	**Slime Time**
Economic Cluster	Environmental Engineering Advanced Manufacturing and Materials
Targeted Grades	4
STEM Disciplines	Science Technology Engineering Math
Non-STEM Disciplines	English Language Arts

Section I: STEM Unit Overview

Unit Overview	Students compare the characteristics of simple physical and chemical changes. Materials have many different characteristics and during the creation of their bouncy slime, students will identify these differences and be able to observe them at various states. By using the engineering process to design slime for maximum bounce students will use fractions, record measurements, and analyze data to understand how and why chemical and physical changes occur.
Essential Question	How can slime be produced and used to gain understanding of chemical and physical changes? How can using the engineering design process help with maximizing the bounce of slime?
Enduring Understanding	Everything is made of matter, a fundamental concept that links the small world under the microscope to the vast reaches of space revealed by telescopes.
Engineering Design Challenge	

Time and Activity Overview

Day	Time Allotment	Actvities
1	50 minutes	Pretest Introduce Scenario and Vocabulary Ask Essential Question Discuss Physical and Chemical Changes Introduce Engineering Design Process
2	50 minutes	Discuss Physical Properties Solid Materials Sorting Activity
3	50 minutes	Discuss Physical Properties Liquid Materials Sorting Activity
4	50 minutes	Discuss Physical Changes Physical Changes Station Activity
5	50 minutes	Discuss Chemical Changes Chemical Changes Station Activity
6	50 minutes	Research Properties of Individual Ingredients Research properties of Combined Ingredients
7	50 minutes	KWL Chart Based on Research Use proportions of ingredients to Solve the Problem Record Properties of Products With Various Proportions

8	50 minutes	Propose use for Products not Meeting Requirements Create Sales Pitch for Proposed Use
9	50 minutes	Present Sales Pitches Wrap-Up Discussion
10	50 minutes	Post-Test
11	50 minutes	

Pre-requisite Knowledge & Skill

Students should be able to identify physical and chemical properties of different materials. Additionally, they should have experience with setting up a controlled experiment, recording observations, measuring to the nearest centimeter and milliliter, and creating bar graphs. Finally, students should understand the meaning of a fraction's denominator as the number of equal-sized parts that make up a whole, and its numerator as a particular quantity of those parts

Academic Content Standards

Add Standard	Mathematics	
Grade/Conceptual Category	4	
Domain	Measurement and Data	
Cluster	Represent and interpret data.	
Standards	Make a line plot to display a data set of measurements in fractions of a unit (1/2, 1/4, 1/8). Solve problems involving addition and subtraction of fractions by using information presented in line plots. For example, from a line plot find and interpret the difference in length between the longest and shortest specimens in an insect collection.	

Add Standard	Mathematics	
Grade/Conceptual Category	4	
Domain	Operations and Algebraic Thinking	
Cluster	Use the four operations with whole numbers to solve problems.	
Standards	2. Multiply or divide to solve word problems involving multiplicative comparison, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem, distinguishing multiplicative comparison from additive comparison.1 3. Solve multistep word problems posed with whole numbers and having whole-number answers using the four operations, including problems in which remainders must be interpreted. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding.	

Add Standard	Mathematics
Grade/Conceptual Category	
Domain	
Cluster	
Standards	

Add Standard	Mathematics
Grade	
Standard	
Benchmark	
Indicator	

Add Standard	English Language Arts
Grade	4
Strand	Writing
Topic	Write informative/explanatory texts to examine a topic and convey ideas and information clearly.
Standard	a. Introduce a topic clearly and group related information in paragraphs and sections; include formatting (e.g., headings), illustrations, and multimedia when useful to aiding comprehension. b. Develop the topic with facts, definitions, concrete details, quotations, or other information and examples related to the topic. c. Link ideas within categories of information using words and phrases (e.g., another, for example, also, because). d. Use precise language and domain-specific vocabulary to inform about or explain the topic. e. Provide a concluding statement or section related to

Add Standard	English Language Arts
Grade	
Standard	
Benchmark	
Indicator	

Add Standard	Social Studies
Grade	
Theme	
Strand (pk-8 only)	
Topic	
Content Standard	

Add Standard	Social Studies
Grade	
Standard	
Benchmark	
Indicator	

Add Standard	Science
Grade	4
Theme	Interconnections within Systems
Topic	Electricity, Heat and Matter
Content Standard	The total amount of matter is conserved when it undergoes a change. When an object is broken into smaller pieces, when a solid is dissolved in a liquid or when matter changes state (solid, liquid, gas), the total amount of matter remains constant.

Add Standard	Science
Strand	
Course Content	
Content Elaboration	

Add Standard	Science
Grade	
Standard	
Benchmark	
Indicator	

Add Standard	Fine Arts
Grade	
Subject	
Standard	
Benchmark	
Indicator	

Add Standard	Technology
Grade	
Standard	
Benchmark	
Indicator	

Assessment Plan

What evidence will show that students have acquired the enduring understandings for this STEM unit?

Performance Task, Projects	Creation of Slime
Quizzes, Tests, Academic Prompts	Pre/Post-Test Rubric
Other Evidence (e.g. observations, work samples, student artifacts, etc.)	Completion of Student Guide
Student Self- Assessment	Rubric

Technology Integration

ADISC Technology Integration Model*

	Type of Integration	Application(s) in this STEM Unit
A	Technology tools and resources that support students and teachers in ***adjusting, adapting, or augmenting*** teaching and learning to meet the needs of individual learners or groups of learners.	Students needing more practice with identifying and naming fractions can go to http://www.visualfractions.com/, http://jmathpage.com/, or http://nlvm.usu.edu/en/nav/topic_t_1.html
D	Technology tools and resources that support students and teachers in ***dealing effectively with data***, including data management, manipulation, and display.	Temperature probes or thermometers should be used to measure temperature changes of some chemical changes on Day 5. Students can use Excel to input their data as they test each slime recipe they have developed. Excel can also be used to graph particular data (i.e. bounce height or length of stretch before breaking).
I	Technology tools and resources that support students and teachers in conducting ***inquiry***, including the effective use of Internet research methods.	Students can visit the following website, which gives a young person's perspective on polymers with many definitions and activities: http://www.pslc.ws/macrog/kidsmac/wiap.htm Students might search the internet as a springboard for thinking about other slime applications or products they could design from one of their slime recipes.
S	Technology tools and resources that support students and teachers in ***simulating*** real world phenomena including the modeling of physical, social, economic, and mathematical relationships.	BBC – KS2 Bitesize Activity – Characteristics of Material: http://www.bbc.co.uk/bitesize/ks2/science/materials/material_properties/play/ Strange Matter: http://www.scilinks.org/Handlers/GoToWebsite.ashx?EntPt=EPW_POST_SCI&Enc=1&SiteID=YzMUwWmVvVIg=&Scilink=YForzE+MB57I= Reversible and Irreversible Changes: http://www.scilinks.org/Handlers/GoToWebsite.ashx?EntPt=EPW_POST_SCI&Enc=1&SiteID=YitOryP4+1ac=&Scilink=Y3V1/DWIyv2c=

C	Technology tools and resources that support students and teachers in ***communicating and collaborating*** including the effective use of multimedia tools and online collaboration.	Students can use a variety of technologies such as video camera, digital camera, Microsoft Publisher, Word, or Publisher to create the brochure for their group's creative slime application or product.
	**The ADISC Model was developed by James Rowley PhD, Executive Director of the Institute for Technology-Enhanced Learning at the University of Dayton*	

Career Description

Chemist
study the properties of matter and the physical and chemical changes that matter can undergo. Chemists interested in finding new substances that perform useful functions study polymers

Chemical Engineer
apply the known properties of polymers to solve real-world problems

Medical Researcher
polymers have applications in many industrial uses, several of which have been applied to the field of medical research. Polymers have been used to create better bandages that stop bleeding faster and to provide better ways to administer medication.

AFRL field of research
AFRL is the Air Force's only organization wholly dedicated to leading the discovery, development, and integration of war fighting technologies for our air, space and cyberspace forces. We trace our roots to the vision of airpower pioneers who understood science as key to air supremacy. The passionate commitment of AFRL people to realize this vision has helped create the world's best air, space and cyberspace force.
AFRL has a designated branch that specifically studies polymers and their use in the AF.

Nonmetallic Materials Division (RXB) and Their Physical Properties
A variety of professionals including engineers and scientists focus on: polymers; specialty coating and treatments; structural materials; thin films; solid lubricants; and water resistant coatings all of which require individuals with a diverse knowledge of properties of matter, phase changes, and the engineering design process.

Section II: STEM Lesson Plan

Title of Lesson	**Day 1**
Time Required	50 minutes
Materials	Appendix A: Pre-Test (one per student) Appendix E: Engineering Design Process Appendix G: Technical Brief

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Objectives

Students will be able to identify both the steps in the engineering design process as well as various for polymers in the real world.

Instructional Process

1. Administer the Pre-Test.
2. Explain what a polymer is and provide several examples of different ways polymers are used in the real world (See Technical Brief).
3. View and discuss video: "Princeton University: Polymers" http://www.princeton.edu/main/news/archive/S28/13/77M08/index.xml?section=mm-featured (3m28s)
4. Explain that people often consult with to scientists and engineers with a problem: they have an idea about something they either want or need but do not know how to make it themselves. The scientists or engineers then try to invent a solution using steps of the scientific method or engineering design process.
5. Present an overview of the engineering design process.
6. Introduce the scenario:
   Tell students that they are going to act as engineers who have been contacted by the toy company, Mattel, who would like to be able to sell a type of polymer called "Bouncy Slime."
7. Explain that students will work in teams as they go through the engineering design process in order develop the formula that results in the highest bouncing slime. (design, build, test, redesign)

• More information will come regarding this design challenge, but like all engineers, they will first need to go through training. This training will involve four days of hands-on learning about matter classification, physical properties, and chemical properties.

6. Review any vocabulary as need for individual classes.

Differentiation

Modify Pre-Test as needed.

Assessments	Use the Pre-Test as a formative assessment of students' prior knowledge. The results of this test can be used to guide the instructor in modifying this unit as necessary for a particular class or individual students.

Section II: STEM Lesson Plan

Title of Lesson	**Day 2**
Time Required	50 minutes
Materials	Appendix C: Student Guide (one per student) ruler scale magnifying glass 10 solids (choose materials readily available)- The solids list on the student sheet includes: glass, paper, plastic, wood, metal, foam, cloth, leather, etc. You may substitute others items for those listed, but keep in mind that the goal is to have a variety of material types.

Objectives	Students will be able to identify physical properties of various solid materials and then sort the objects into various groups based on their physical properties.
Instructional Process	1. Have the materials for "Sorting Solids" prepared in advance. *Note: it may be easier to prepare bins for each student group that contains a ruler, a scale, a magnifying glass, the "Sorting Solids" lab sheet, and the 10 solids students will be working with. 2. Present the definition of physical property and ask students to name some physical properties of their desks. Focus students' attention on significant physical properties, meaning the properties that are natural to a material rather than those purposefully controlled by a person (e.g., pliability, hardness, resiliency, slipperiness, malleability). 3. Allow students to gather their materials and go over the directions for "Sorting Solids" in the student guide. 4. While students are working, walk around the room and question students about the physical properties of different objects, ask them to explain their reasoning behind their different groupings, and watch them measure an object.
Differentiation	Provide guidance and ask leading questions as necessary.

Assessments	Completion of "Sorting Solids" section of the Student Guide Observation of team experimentation.

Section II: STEM Lesson Plan

Title of Lesson	**Day 3**
Time Required	50 minutes
Materials	Appendix C: Student Guide ruler scale magnifying glass 10 liquids (choose materials readily available)- Examples: Water, juice, soda, milk, liquid laundry detergent, dishwasher soap, pancake, syrup, broth, vinegar, vegetable oil, corn syrup, liquid hand soap, liquid pancake mix You may substitute others items for those listed, but keep in mind that the goal is to have a variety of material types.

Objectives	Students will identify physical properties of various liquid materials and then sort the objects into various groups based on their physical properties.
Instructional Process	1. Have the materials for "Sorting Liquids" in the Student Guide prepared in advance. * it may be easier to prepare bins for each student group that contains a ruler, a scale, a magnifying glass, the "Sorting Liquids" student guide, and the 10 liquids students will be working with. 2. Review the definition of physical property. 3. Allow students to get their materials and go over the directions for "Sorting Liquids" student sheets. 4. While students are working, walk around the room and question students about the physical properties of different substances and ask them to explain their reasoning behind their different groupings.
Differentiation	Provide guidance and ask leading questions as necessary.

Assessments	Completion of "Sorting Liquids" section of the Student Guide Observation of team experimentation.

Section II: STEM Lesson Plan

Title of Lesson **Day 4**

Time Required 50 minutes

Materials
Appendix C: Student Guide
boiling water
salt
paper (on sheet per team)
markers (one pack per class)
ice
drinking class (one per class)
orange (1/4 per team)
rubber band (one per team)
water and oil mixture in a sealed water bottle (one per class)

Objectives

Students will identify physical changes as changes that result in a change of one or more physical properties where the original substance does not change into a new substance. Students will also recognize that some physical changes are easily reversed, which is strong evidence that a change was indeed physical.

Instructional Process

1. Go over what happens during a physical change: one or more of a substance's physical properties is changed, but the substance itself does not change into something new.

Teacher's Note: Many times students are taught that physical changes are reversible in the sense that one can easily "undo" the change. It is also common for students to learn that when the change involves combining two or more ingredients that the original ingredients can be separated out again. Consider the example of stirring together the ingredients needed to make cookies. According to the two "rules" of physical changes above, many times students mistakenly believe that a chemical change has taken place when the mixture is still in its uncooked batter form. (See the link under Additional Resources for a more in-depth discussion about identifying chemical and physical changes.)

2. Set up physical change stations that show students different examples of physical changes.
   a. The number of stations will depend on how many student groups you have and the availability of materials.
   b. Any of the stations can be substituted with a different example of a chemical change. It is suggested that students observe a phase change and think why

such a change is a physical one since a common misconception is that phase changes are chemical changes.

c. You may want to provide instructions at each station.

Here are some suggestions.

i. dissolving salt in water or water boiling
ii. paper and markers
iii. melting and/or condensation
iv. squeezing juice out of an orange
v. stretching a rubber band
vi. mixing water and oil

3. Assign student groups to stations and present the Physical Changes from Student Guide.

Differentiation	Modify student guide as needed.
Assessments	Completion of "Physical Properties" section of the Student Guide Observation of team experimentation.

Section II: STEM Lesson Plan

Title of Lesson	**Day 5**
Time Required	50 minutes
Materials	Appendix C: Student Guide Suggested materials: milk (1/2 gallon per class) vinegar (1 small bottle per class) baking soda (1 box per class) Alka-Seltzer tablet (1/4 per team) water Kool-aid (one packet per class) yeast (one packet per class) hydrogen peroxide (one bottle per class ammonium nitrate (plant fertilizer) (one cup per class) green banana (one per class) ripe banana (one per class) apple (one or two per class

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Objectives

Students will be able to identify indications of a chemical change, understanding there are some chemical changes which are not accompanied by any of these indications. Students will also understand that during a chemical change, the original substance(s) is/are changed into one or more different substances, with different physical properties than the original substance(s).

Instructional Process

1. Go over what happens during a chemical change: one or more brand new substances are formed from the material in the original “ingredient(s).” The new substance(s) have properties that are very different from the original substance(s) it came from.
   a. Sodium (a hard, dark metal) combining with chlorine (a poisonous green gas) to make salt (a crystalline solid that is safe to eat) is a good example of this.
2. Tell students that there are sometimes signs that a chemical change has happened or is in the process of happening, such as a temperature change (heat is given off or there is cooling); formation of a solid from liquids; a color change; an order develops; light is given off; or a gas forms (indicated by fizzing or bubbling).
   a. Emphasize that it is the unexpectedness of any of these that would indicate a chemical change. When a person purposefully causes those things to

happens, it is usually a physical change. For example, if a person puts on perfume, it is expected that her skin would have a smell; her skin is still skin and thus it is a physical change. The odor of spoiled eggs though is not created on purpose; a chemical change has taken place at that point.

3. Go over lab safety rules related to proper attire; warnings about touching, smelling, and tasting lab chemicals; mixing chemicals; and safe disposal.
   a. Goggles and gloves should be worn at all times.
   b. Unless the teacher has researched a chemical and knows that it is safe to touch, do allow lab chemicals to come into contact with your skin; when trying to observe odors, never inhale directly over the substance, but instead waft any fumes toward the nose with the substance away from you; do not put lab chemicals, or even food that is in the lab, into your mouth.
   c. Exercise caution when mixing substances together as sometimes a chemical reaction with potentially dangerous effects takes place. For example, when bleach and some cleaners are mixed together, a chemical reaction takes place that gives off poisonous fumes.
   d. Do not pour lab chemicals down the sink.
4. Set up chemical change stations that show students different signs of a chemical change.
   a. The number of stations will depend on how many student groups you have and the availability of materials.
   b. Provide instructions with each station.
   c. Any of the stations can be substituted with a different example of a chemical change. Here are some suggestions (some show multiple signs):

i. Formation of a solid:
   1. milk + vinegar (have students swirl these together in a glass)

ii. Formation of a gas (students will infer the formation of a gas by observing fizzing or bubbling):
   1. vinegar + baking soda
   2. Alka-Seltzer tablet + water
   3. Kool-aid + baking soda + water

iii. Heat given off (have students measure temperature before and after mixing):
   1. yeast + hydrogen peroxide

iv. Cooling (have students measure temperature before and after mixing):
   1. milk + ammonium nitrate (plant fertilizer)

v. Color change:
   1. green banana placed next to a ripe banana to show students the change that would occur over time
   2. a freshly sliced apple next to a slice of apple that has been sitting out for awhile

5. Assign student groups to stations and pass out the chemical changes activity sheet (See Appendix C).

Differentiation	Modify student guide as needed. Some chemical changes can be shown through teacher demonstration if time is a constraint.
Assessments	Completion of "Chemical Properties" section of the Student Guide Observation of team experimentation.

Section II: STEM Lesson Plan

Title of Lesson	**Day 6**
Time Required	50 minutes
Materials	Appendix C: Student Guide Appendix F: Slime Recipe Borax (one box per class) water (from faucet, or one bucket per class) Elmer's glue (one gallon per class) metric measuring device such as graduated cylinder (one per team) zip-lock sandwich bag (one per team) plastic spoon (one per team) 5 oz. dixie cup (one per team)

Objectives

Students will investigate the physical properties of the ingredients they will use to create their slime: borax and glue and water. Next, students will follow a recipe to create slime and apply their knowledge of chemical and physical changes to identify whether a chemical or physical change takes place when doing so.

Students will alter the recipe for making slime and test and record the physical properties of the slime that results from each changed recipe using observation and controlled experimentation procedures.

Instructional Process

1. Share the story about the accidental creation of Post-it notes so students will understand the value of recording more than simply bounce height for each slime recipe.

Post-It Note Story:

Dr. Spencer Silver worked at 3M trying to develop a strong glue. One of his "recipes" ended up being a rather weak adhesive that enabled someone to move what they stuck one place over to a new place where it still gently stuck again. Spencer thought his accidental adhesive would work for something, but he didn't know what. When someone asked him if he had made a mistake, Silver responded that he had stumbled up on 'solution looking for a problem'"(Garud & Warren, 2006). So he showed the adhesive to his colleagues at 3M, and 6 years later, one of them, Dr. Art Fry, remembered it when we wanted a bookmark to save his place without damaging the book. After a little more time and work, the idea of Post-its was developed! (If interested in a more complete history, please visit the websites under Additional Resources near the end of the lesson.)

2. After providing students with an overview of the tasks they will be involved in this day, have students brainstorm different properties they should measure or observe so they can record the physical properties for the slime they will create from the recipe provided to them (i.e. bounce height, length of stretch before breaking).
3. Provide students an overview of the next half of the unit:
   a. Students will investigate the properties of the ingredients for slime.
   b. Students will follow a recipe for their first batch of slime. (If following the story line, inform the students that the recipe came from Mattel; it is the one they would like improved.)
   c. They will analyze their results and brainstorm how to improve the bounciness of the slime.

Teacher's Note: Students will test the resulting slime in terms of bounce height, but will also run tests and record other observations so that (like Dr. Spencer) they can turn one of their "failing" recipes based on bounciness into a success when applied for a different purpose.

   d. The students will develop different slime recipes, looking for the one that will result in the bounciest slime, while examining and recording other characteristics and capabilities as well
   e. Students will choose one of their recipes and develop some useful application that would work well for that slime's physical properties and characteristics and then create a brochure to try to sell their idea to investors (their fellow classmates).

3. Explain the Project Report student sheets in the Student Guide.
4. Ask students to list variables that will need to be controlled for each property that requires a test and measurement of some kind. Make sure that students have a procedure (developed in small groups or as a whole group) for running each test so that conditions are the same between trials and different slime recipes. Direct students to write their ideas in the Project Report.
5. Go over lab safety rules listed in Day 4, which apply for Day 6 as well.
6. Provide each student group with 30 mL of Elmer's glue, 150 mL of water, and 2.5 mL of borax.
7. Allow time for the students to investigate and record the physical properties of the glue and the borax.
8. After checking that the lists of physical properties from Step C are is satisfactory, provide the student groups with the recipe provided in Appendix F to make their own slime:

Note: To keep in line with story, you can tell students this is the recipe the Mattel manufacturer has brought to them so that they can improve the formula by creating slime will bounce higher.

9. Allow time for the students to investigate and record the physical properties of the slime they created. Emphasize the importance of creating organized notes with

specific detail when recording the properties.
10. After groups clean up, ask them to make a KWL chart based on their research (can also be assigned as homework).

Differentiation

Modify student guide as needed.

Assessments

Completion of "Chemical Properties" section of the Student Guide
Observation of team experimentation.

Section II: STEM Lesson Plan

Title of Lesson **Day 7**

Time Required 50 minutes

Materials Materials from day 6

Objectives

Students will draw upon their prior knowledge of physical and chemical changes to refine the recipe in order to create the "bounciest" slime ball.

Instructional Process

1. Have students place slime in zip lock bags in order to retain moisture.
2. Explain to students that they will be modifying the recipe they worked with the previous day and investigate and record the same physical properties as they did the previous day for each new batch of slime they create. Stress the importance of following all safety guidelines. (Important: See “Instructional Tips” under Techinical Brief: Appendix: G.)
3. Have student complete their Project Reports in the Student Guide.
4. Inform students of the following minimums and maximums regarding the amount of borax solution and glue they may use in each recipe: 1-50 mL glue; 1-20 mL of borax.
5. As students work, walk around to check the thoroughness of student’s logs in terms of documenting the amount of each ingredient they use and the physical properties of their resulting slime.
6. Also, ask students to explain their reasoning behind selecting the amount of each ingredient in a new recipe.

Differentiation

Modify student guides as necessary

Assessments	Completion of "Refine Design" section of the Student Guide Observation of team experimentation.

Title of Lesson	**Day 8**
Time Required	50 minutes
Materials	Appendix C: Student Guide Appendix D: Rubric Materials from Day 6
Objectives	Students will create a use for one of their recipes that did not meet the requirement for highest bounce, based on various capability, leading to the realization that "failure" in on context can be "success" in another. Students will create a sales pitch to present to the class.
Instructional Process	Explain the students' challenge. 1. Inform the students that this part of the unit is really focused on developing their creativity- both in terms of the product they will develop with their slime as well as how to advertise it. Provide the remainder of the class period for the groups to develop their product ideas and advertisement brochures. Note: Students do not actually have to create a working prototype of their product; they may only be able to draw a picture and provide an explanation of what the slime will do and why the particular recipe they chose is particularly suited to that specific application. 2. If time permits, allow students who cannot think of a product to research different uses of slime-like polymers for some inspiration. 3. If possible, provide students with art supplies and allow use of technology. 4. Have students score themselves and reflect on their work using the rubric, then provide a teacher rubric score.
Differentiation	Modify the rubric to allow for more challenge or scaffolding as need for particular students.
Assessments	Rubric

Section II: STEM Lesson Plan

Title of Lesson	**Day 9**
Time Required	50 minutes
Materials	Appendix A: Post-Test
Objectives	Student will show their realization that "failure" in on context can be "success" in another. Students will create a sales pitch to present to the class. Students will demonstrate their understanding of physical and chemical changes of matter through completion of Post-Test
Instructional Process	1. Have teams present their sales pitch to the class. 2. Administer Post-Test
Differentiation	Modify Post-Test as need.
Assessments	Team sales pitches Post-Test

Section III: Unit Resources

Materials and Resource Master List

Appendices
ruler
scale
magnifying glass
10 solids (choose materials readily available)-
The solids list on the student sheet includes:
glass, paper, plastic, wood, metal, foam, cloth, leather, etc.
10 liquids (choose materials readily available)-
Examples:
Water, juice, soda, milk, liquid laundry detergent, dishwasher soap, pancake, syrup, broth, vinegar, vegetable oil, corn syrup, liquid hand soap, liquid pancake mix
Borax (one box per class)
water (from faucet, or one bucket per class)
Elmer's glue (one gallon per class)
metric measuring device such as graduated cylinder (one per team)
zip-lock sandwich bag (one per team)
plastic spoon (one per team)
5 oz. dixie cup (one per team)

Suggested materials:
boiling water
salt
paper (on sheet per team)
markers (one pack per class)
ice
drinking class (one per class)
orange (1/4 per team)
rubber band (one per team)
water and oil mixture in a sealed water bottle (one per class)
milk (1/2 gallon per class)
vinegar (1 small bottle per class)
baking soda (1 box per class)
Alka-Seltzer tablet (1/4 per team)
water
Kool-aid (one packet per class)
yeast (one packet per class)
hydrogen peroxide (one bottle per class
ammonium nitrate (plant fertilizer) (one cup per class)
green banana (one per class)
ripe banana (one per class)
apple (one or two per class

You may substitute others items for those listed, but keep in mind that the goal is to have a variety of material types.

Key Vocabulary

Chemical Change
the change of a substance into a different substance with different properties

Chemical Equation
a formula that describes a chemical reaction

Chemical Reaction
a chemical change in which one or more substances are changed into one or more new substances

Combustion
the process of burning

Control
a quantity that stays the same

Engineering Design Process
a series of steps that engineers use to guide them as they solve problems.\

Liquid
matter that has no definite shape

Material
the matter from which a thing is or can be made

Matter
something that has mass which can exist in the form of a solid, liquid, gas or plasma

Mixture
combination of two or more materials that keep their own properties

Numerator
tells how many equal parts are described

Physical Change
a change in some properties of matter without forming a different kind of matter

Physical Properties
A property of a material that can be observed without changing the chemical makeup of the material.

Plasma
a very hot, gas-like state of matter

Polymer
a large molecule made of many connected smaller units

Property
a quality or trait belonging to an individual or thing

Product
a substance made during a chemical reaction

Reactant
a substance used in a chemical reaction

Scale
consists of numbers that show the units used on a graph

Solid
matter that keeps its shape

Trend
the pattern in the data showing an increase or decrease

Variable
a quantity that may assume any one of a set of values

Technical Brief

See Appendices

Safety and Disposal

The slime is safe to handle and may be removed from the plastic bags. Slime will eventually mold and collect bacteria once it is handled and comes in contact with tables and floor. Slime should be thrown away that is used in this experiment. Students should wash their hands after handling the slime. If food coloring is used, it may rub off on hands. Slime may damage carpet or fabrics after long exposure (overnight) (Lee, 1997).

Students should only handle the borax solution with latex, rubber or nitrile gloves (some people are allergic to latex). Borax is toxic if ingested. Contact with skin or eyes may cause irritation. Avoid contact with dust and keep container closed when not in use. Read the safety directions on the borax box before use.

First Aid: If borax comes in contact with skin, remove any contaminated clothing and wash with soap and water. If borax comes in contact with eyes, flush with water for at least 15 min. Seek medical attention if irritation occurs. If exposed to borax fumes, remove to fresh air and if not breathing, give artificial respiration. Seek medical attention. If borax is swallowed, give 2 glasses of water and induce vomiting (Science Stuff, Inc. 2006).

Disposal: Slime and plastic bags may be put in the regular trash. Leftover borax solutions may be put down the sink drain flushed with water.

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Curriculum Developers

Sharon Blizzard: Contributing Author
Cadance Cowell: Contributing Author
Melissa Cox: Contributing Author
Patty Deaton: Contributing Author
Derek Flatter: Contributing Author
Patty Huber: Contributing Author
Mollie Mallin: Contributing Author
Pricila Martinez: Contributing Author
Doug Meador: Contributing Author
Jeanette McNally: Editor
Elizabeth Pitzer: Contributing Author

Section IV: Appendices

Appendix A: Physical and Chemical Changes Pre / Post-Test

Appendix B: Physical and Chemical Changes Pre / Post-Test KEY

Appendix C: Student Guide

Appendix D: Rubric

Appendix E: Engineering Design Process

Appendix F: Slime Recipe