Magnetic Variables!

Description

Students will learn about variables and magnets by making magnetic slime! Groups of students will work together to change the amount of ingredients in magnetic slime to see what variables affect the magnetism of the slime.

Packet Contents

Introduction

This is a two-day lesson that incorporates direct instruction about variables with a hands-on experiment for students to conduct. The lesson teaches students about variables and how they contribute to the results of an experiment or process. To introduce students to variables, they will make paper airplanes to understand independent and dependent variables, as well as control groups. The lesson also integrates what students already know about magnets and magnetism with an experiment on day two. Groups of students will change different variables in a magnetic slime recipe. Then as a class they will compare the magnetism, viscosity, and other elements of the slime to see how changing the different variables affects the slime. Students will learn how to document their process and assess the data at the end of the experiment. To assess understanding, students will complete an assessment, demonstrating their knowledge of experimental design and variables.

Curriculum Alignment

NC Essential Standards, 3-5 Science

4.P.1.1 Explain how magnets interact with all things made of iron and with other magnets to produce motion without touching them.

4.P.2.1. Compare the physical properties of samples of matter (strength, hardness, flexibility, ability to conduct heat, ability to conduct electricity, ability to be attracted by magnets, reactions to water and fire).

W 4.2 Write informative/explanatory texts to examine a topic and convey ideas and information clearly.

SL 4.4 Report on a topic or text, tell a story, or recount an experience in an organized manner, using appropriate facts and relevant, descriptive details to support main ideas or themes; speak clearly at an understandable pace.

Objectives

- Students will be able to understand how different variables affect outcomes
- Students will be able to explain how varying amounts of iron affect how magnets interact
- Students will be able to explain the process of an experiment

Time & Location

This lesson will take two, 45-minute class periods to complete. All activities can be done in a regular classroom. If a lab space is available, day two may be completed in a lab.

Teacher Materials

- 1 ream of White Copy Paper
- 2 pieces of Chart Paper or use of a computer
- Markers
- 1 Pencil
- Magnetic Slime Recipes
- Copies of Assessment

Student Materials

- Science Notebook (or place to record data and take notes)
- Copy Paper (cut into various sizes for paper airplanes) - 5 per group (or pair)
- Yard Stick/Meter Stick (1 per group or pair)
- ¼ cup (per group) Liquid Starch
- ¼ cup (per group) Elmer's Glue
- 1 lb. bag Iron Oxide Powder
- 10 Disposable Bowls (1 per group)
- 10 Popsicle Sticks (1 per group)
- 1 per group Neodymium (rare earth) Magnets
- Paper Towels
- Magnetic Slime Recipes (1 per group or student).

Safety

This lesson is safe and has few precautions to note. The main safety concern is the use of the iron oxide powder. The powder should not be inhaled, tasted, etc. by students or adults. It may be necessary for the teacher to prepare the iron oxide powder in advance for students. The Safety Data Sheet for the iron oxide powder is available for reference. Students should not put the slime in their mouths after it has been made; it is safe for them to touch.
Iron Oxide Powder - Safety Data Sheet

Student Prior Knowledge

Students should already have a base knowledge of magnets and magnetism before starting this lesson.

Teacher Preparations

On Day 1 the teacher needs to have the anchor chart (Appendix A) for variables prepared. The teacher needs to have copy paper cut into different sizes and sorted for pairs of students. The teacher needs to assign pairs of students if they are not choosing their partner on their own. A sample of the chart and information for students' science notebooks should be prepared.

On Day 2 the teacher needs to have the materials and stations prepared for students before beginning the lesson. The teacher needs to assign groups of 3-4 students for Day 2 if the students are not choosing their own groups. Printouts (and copies if you want students to glue them in their notebooks) of magnetic slime recipes should also be provided for each group.

Activities

Day 1:

- The teacher will begin the lesson by talking with students about baking a cake and ask students to raise their hand if they have ever baked a cake. Make a list of the important things to do before, during, and after baking a cake. (This could be adapted to have students Think-Pair-Share instead of discussing as a whole class first).
- Then the teacher will discuss with the class that no matter if you are baking a cake at home, are a professional baker, a scientist, engineer, teacher, etc. that you must consider **variables** when making or doing something.
- The teacher will define a variable as: "Anything that can change. Any factor, trait, or condition that can exist in different amounts." The definition could be on a pre-made anchor chart or presentation slide. Students should think about when you bake a cake, the amount of any ingredient can be a variable which would change the taste of the cake. Also, the baking temperature could be a variable that would affect how quickly or how well the cake bakes.
- The teacher will explain how there are three different types of variables (independent, dependent, and controlled) that scientists consider when doing an experiment. See chart below (Appendix A).
- The teacher will tell students they are going to think about variables like scientists today by making paper airplanes. They will demonstrate the independent variable by using different sizes of paper to test the dependent variable (the distance that the paper airplane flies). The controlled variables (constants) will be paper type and force exerted to fly the plane. This lesson could be

more inquiry-based if students try and guess the different variables, rather than providing them with a pre-made list.

- The students will make a chart in their science notebooks noting the different variables to be used in the experiment. Then they will make a chart to record the results of the experiment. A sample or template may be provided.
- The students will work in pairs to create paper airplanes; airplanes should utilize the same design within the same group. Different groups may make different designs - as long as the designs within the group are the same. If comparing results as a whole class, all groups' designs should be the same. This lesson could be adapted by having students work individually or in small groups, instead of in pairs.
- The students will record their results as they fly each paper airplane. The students should make a test 5 paper airplanes. The students may test their airplanes in the classroom or in the hallway. Students can measure in standards units of measure with meter or yard sticks or nonstandard units of measure by measuring how many tile lengths the paper airplane flies.
- Discuss as a class what the students noticed about the results of their testing (this can be done on day 2 if there is no more time).

Day 2:

- Before the lesson, the teacher will set up a station for each group of students with the following: liquid starch, Elmer's glue, iron oxide powder, disposable bowl, popsicle stick, paper towels, and recipe card. The materials may be measured ahead of time by the teacher or the students can measure if the teacher wants students to work on measurement. Measurements for each of the above items may be found in the Materials List.
- The teacher will review with students the 3 different types of variables from Day 1.
- The students will share what they learned about the 3 different kinds of variables; what they are, examples, etc.
- The teacher will show the students magnets and ask them to recall what they know about how magnets work. Students should already have some background knowledge about force and motion with magnets.
- The teacher will explain to students that they will apply their knowledge of variables and magnets and use that information to make magnetic slime!
- The teacher will explain that there are recipes for magnetic slime where various ingredient ratios/amounts have been altered. The different groups will make different slime recipes and then compare the magnetism of the slime with different ingredient amounts as a class. The teacher can assign groups ahead of time or allow students to make their own groups of 3-4 students, based on student need.
- The students will form groups and take their science notebooks to a work station. In their science notebooks, the students need to write down the recipe for magnetic slime that they will be making. To save time, the teacher may print out multiple copies of the card so that students can glue them into their notebooks, rather than writing them down.
- Students will work in their groups to make their magnetic slime. The teacher will circulate to assist students.
- Once all batches of magnetic slime are prepared, students will be given a rare earth magnet to test how magnetic their slime is, if at all. Students should record this data in their science notebook. They will use qualitative descriptions to discuss the strength of the magnetic slime.
- As a class the teacher will lead a discussion, comparing the groups' magnetic slimes and their strengths.

- As a class, students should chart the amount of iron oxide powder and relate it to the strength of the slime. The teacher should facilitate a discussion about how the different variables affected the magnetic slime.
- The students will write about the process of making magnetic slime in their science notebooks by integrating the variable vocabulary and a discussion of how the variables affected the slime.

Assessment

The teacher may use each student's reflection (in their science notebook) as a formative assessment tool.

Standards addressed:
4.P.1.1 Explain how magnets interact with all things made of iron and with other magnets to produce motion without touching them.

4.P.2.1. Compare the physical properties of samples of matter (strength, hardness, flexibility, ability to conduct heat, ability to conduct electricity, ability to be attracted by magnets, reactions to water and fire).

W 4.2 Write informative/explanatory texts to examine a topic and convey ideas and information clearly.

SL 4.4 Report on a topic or text, tell a story, or recount an experience in an organized manner, using appropriate facts and relevant, descriptive details to support main ideas or themes; speak clearly at an understandable pace.

For a summative assessment, the students will answer an open ended prompt where they have to apply their knowledge of variables to a hypothetical experiment. See Appendix B. The answer key can be found in Appendix C.

The assessment will demonstrate to the teacher if the student understands how to distinguish between dependent, independent, and controlled variables. It also will show if the student understands the relationships between the three different types of variables.

Standards addressed:
From DPI - They must have experiences that allow them to recognize patterns in data and use data to create reasonable explanations of results of an experiment or investigation. They should be encouraged to employ more sophisticated language, drawings, models, charts and graphs to communicate results and explanations.

4. L. 1.1 Give examples of changes in an organism's environment that are beneficial to it and some that are harmful.

*The summative assessment could be adjusted to include a word bank for students if need be.

Critical Vocabulary

Variable, Independent, Dependent, Controlled, Data, Magnetic,

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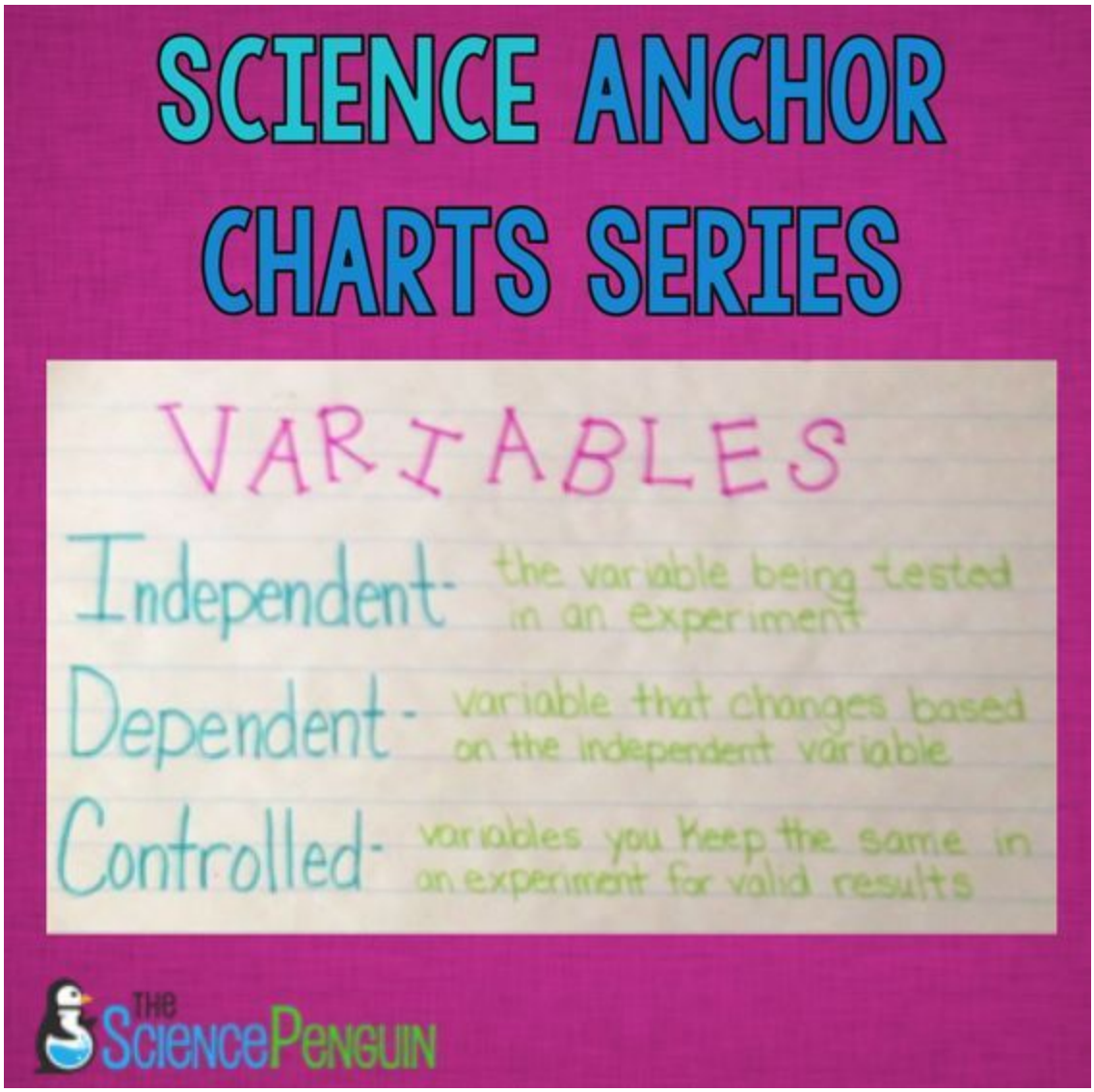
Appendix A


SCIENCE ANCHOR CHARTS SERIES
VARIABLES
Independent- the variable being tested in an experiment
Dependent- variable that changes based on the independent variable
Controlled- variables you keep the same in an experiment for valid results
THE SciencePenguin

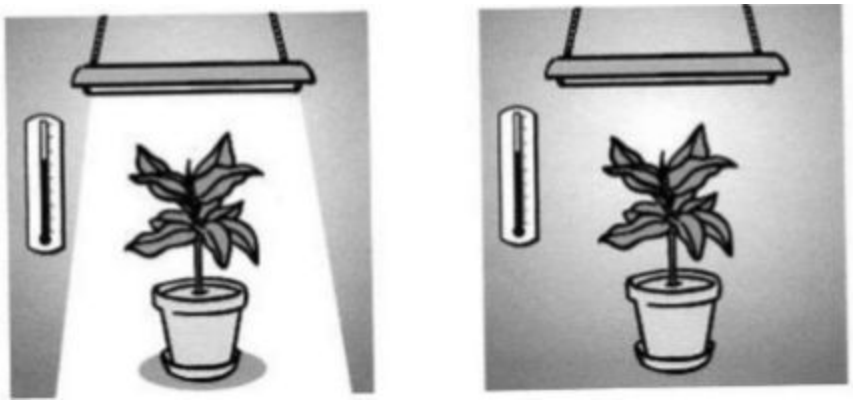
Appendix B

Name: _____

Date: _____

Variable Assessment

Lucy is investigating plant height growth. The picture below shows the two different ways that Lucy is experimenting with plant growth.



1. What is Lucy's independent variable?

   _____

2. What is Lucy's dependent variable?

   _____

3. Explain what different variables (at least 2) Lucy should control for. Why should Lucy control these variables?

_____

_____

_____

_____

4. Lucy's friend Jason thinks that she should pick a different independent variable to investigate plant growth. Draw a diagram to show what variable Lucy could use for an independent variable and then explain your thinking. What data should lucy collect and why?

Diagram:

Explanation:

Appendix C

Answer Key

1. Amount of light
2. Growth of plant
3. Possible answers: temperature, amount of water, time watered, type of plant. Explanation should show student understanding of variables and how not keep these variables constant may affect the results of the experiment.
4. Possible answers: temperature, amount of water, time watered, type of plant. The diagram should show a change in one of these new independent variables. Explanation should show understanding of variables and their relationships. Student should answer that Lucy is still collecting data about how tall the plant grows because the dependent variable is not changing.

Appendix D

Magnetic Slime Recipe A

Ingredients

¼ cup Liquid Starch
¼ cup Elmer's Glue
2 tablespoons Iron Oxide Powder
Disposable Bowl
Popsicle Stick
Paper Towels

Directions

Put ¼ cup of liquid starch into the bowl.
Add 2 tablespoons of iron oxide powder. Stir until well mixed.
Add ¼ cup of Elmer's glue and mix.
Keep stirring into slime starts to form. Then take the slime out of the bowl and mix with your hands. Squish until it is well mixed.
Pat the slime dry with a paper towel to remove extra liquid.

Magnetic Slime Recipe B

Ingredients

½ cup Liquid Starch
¼ cup Elmer's Glue
2 tablespoons Iron Oxide Powder
Disposable Bowl
Popsicle Stick
Paper Towels

Directions

Put ½ cup of liquid starch into the bowl.
Add 2 tablespoons of iron oxide powder. Stir until well mixed.
Add ¼ cup of Elmer's glue and mix.
Keep stirring into slime starts to form. Then take the slime out of the bowl and mix with your hands. Squish until it is well mixed.
Pat the slime dry with a paper towel to remove extra liquid.

Magnetic Slime Recipe C

Ingredients

¼ cup Liquid Starch
½ cup Elmer's Glue
2 tablespoons Iron Oxide Powder
Disposable Bowl
Popsicle Stick
Paper Towels

Directions

Put ¼ cup of liquid starch into the bowl.

Add 2 tablespoons of iron oxide powder. Stir until well mixed.

Add ½ cup of Elmer's glue and mix.

Keep stirring into slime starts to form. Then take the slime out of the bowl and mix with your hands. Squish until it is well mixed.

~~Pat the slime dry with a paper towel to remove extra~~ liquid.

Magnetic Slime Recipe D

Ingredients

¼ cup Liquid Starch
¼ cup Elmer's Glue
3 tablespoons Iron Oxide Powder
Disposable Bowl
Popsicle Stick
Paper Towels

Directions

Put ¼ cup of liquid starch into the bowl.

Add 3 tablespoons of iron oxide powder. Stir until well mixed.

Add ¼ cup of Elmer's glue and mix.

Keep stirring into slime starts to form. Then take the slime out of the bowl and mix with your hands. Squish until it is well mixed.

~~Pat the slime dry with a paper towel to remove extra~~ liquid.

Magnetic Slime Recipe E

Ingredients

¼ cup Liquid Starch
¼ cup Elmer's Glue
1 tablespoon Iron Oxide Powder
Disposable Bowl
Popsicle Stick
Paper Towels

Directions

Put ¼ cup of liquid starch into the bowl.

Add 1 tablespoon of iron oxide powder. Stir until well mixed.

Add ¼ cup of Elmer's glue and mix.

Keep stirring into slime starts to form. Then take the slime out of the bowl and mix with your hands. Squish until it is well mixed.

Pat the slime dry with a paper towel to remove extra liquid.

Magnetic Slime Recipe F

Ingredients

¼ cup Liquid Starch
¼ cup Elmer's Glue
½ tablespoons Iron Oxide Powder
Disposable Bowl
Popsicle Stick
Paper Towels

Directions

Put ¼ cup of liquid starch into the bowl.

Add ½ tablespoon of iron oxide powder. Stir until well mixed.

Add ¼ cup of Elmer's glue and mix.

Keep stirring into slime starts to form. Then take the slime out of the bowl and mix with your hands. Squish until it is well mixed.

Pat the slime dry with a paper towel to remove extra liquid.

Magnetic Slime Recipe G

Ingredients

⅓ cup Liquid Starch
⅓ cup Elmer's Glue
4 tablespoons Iron Oxide Powder
Disposable Bowl
Popsicle Stick
Paper Towels

Directions

Put ⅓ cup of liquid starch into the bowl.

Add 4 tablespoons of iron oxide powder. Stir until well mixed.

Add ⅓ cup of Elmer's glue and mix.

Keep stirring into slime starts to form. Then take the slime out of the bowl and mix with your hands. Squish until it is well mixed.

Pat the slime dry with a paper towel to remove extra liquid.