In a Pickle

Grade Level: 3-5

Goal

Students conduct an experiment to determine what fraction of vinegar is needed to safely preserve pickles. Students will use math skills to determine volumes needed based on a ratio.

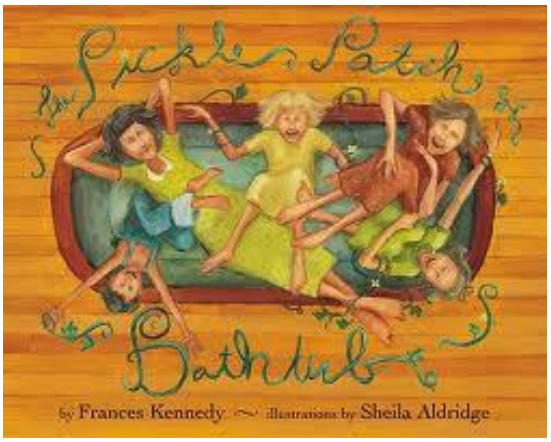
Curriculum Alignment

Find a list of which Common Core State Standards and NC Essential Standards this lesson plan aligns with on the lesson plan page at *www.growing-minds.org*.

Materials

Book to read

The Pickle Patch Bathtub by Frances Kennedy



Activity supplies for each group

Jar with lid
white vinegar
water
measuring spoons
cucumber (cut in half lengthwise)
masking tape
pen
plastic knives
cutting board

Additional activity supplies

Two jars for experiment controls
Cucumbers

Activities

Read a book

Provide the book The Pickle Patch Bathtub for students to read. This book will give them an overview of how cucumbers grow with a great historical perspective.

Make Pickles!

- Students should read *How did we keep food from rotting before we had refrigerators?*

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- Each group will be creating a different pickling solution, break the class up into five groups, assigning each a vinegar fraction. Discuss with students how the change in one variable (vinegar volume) relates to a change in a second variable (water volume).

- Every group needs to make 2 cups (32 Tablespoons) of solution. Have students use the table on the student worksheet to calculate how much vinegar and water they will need. You may want to illustrate an example on the board so that students understand how to use the table. See the teacher's table for calculations:

Total Tablespoons of Solution Needed (A)	**Fraction vinegar (B)**	**Fraction Water (C) (1-B = C)**	**Tablespoons vinegar needed (AxB)**	**Tablespoons water needed (AxC)**
32 Tablespoons (2 cups)	1/2	1/2	32 x 1/2 = 16 Tablespoons	32 x 1/2 = 16 Tablespoons
32 Tablespoons (2 cups)	1/4	3/4	32 x 1/4 = 8 Tablespoons	32 x 3/4 = 24 Tablespoons
32 Tablespoons (2 cups)	1/8	7/8	32 x 1/8 = 4	32 x 7/8 = 28
32 Tablespoons (2 cups)	1/16	15/16	32 x 1/16 = 2	32 x 15/16 = 30
32 Tablespoons (2 cups)	1/32	31/32	32 x 1/32 = 1	32 x 31/32 = 31

- Instruct students to measure and pour calculated amount of vinegar and water into jar and add their cucumber. Students may be frustrated by the number of tablespoons they have to measure, but this is a good opportunity for everyone to get turns measuring and potential discussion for conversion. You may also want to discuss the need for standard units and how using different units (Cups, T. t.) can affect precision (if you had to estimate 1/32 cup would that be as accurate as converting it into T?

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- If one group finishes before others assign them the task of creating the "controls" of all vinegar and all water for the whole class to use as comparisons.

- Instruct students to record observations and make predictions as instructed in steps 5-7 of student version.

- Let jars sit in a window for ten days, giving students class time to record observations (as well as comparisons with other groups' cumbers and controls) at three, seven and ten days in their science notebooks. A window is not critical, but warmth and sunlight encourages microorganism growth. With each observation have students note any changes using all their senses, *except taste*. **Even cucumbers without visible signs of rot or mold may contain harmful bacteria that can't be seen or smelled.**

- You may have students compare their observations to their initial predictions at each of these time periods or at the end of the experiment.

- Discuss the results as a class. Ask students if they think a cucumber/pickle is safe just because you can't see evidence of microorganisms. Explain that some "invisible" microorganisms are the most dangerous. Before there were standard acidity levels and canning methodologies for pickling a lot of folks were sickened. Food scientists (like your class) have conducted a lot of research to determine a safe acidity level and canning processes to make food safe. Most pickling recipes now use a 1:3 vinegar to water ratio to be safe, as well as hot water or pressure canning for pickles that will be stored unrefrigerated

- As a conclusion have students write a recommendation as to what fraction of vinegar to use based on this experiment. They should include facts to back up their reasoning and if they think their fraction of vinegar was too low, too high, or just right, and why.