Lesson Title: *Pumpkin Decomposition*

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Topic: *The focus of this lesson is the process of decomposition. What factors affect decomposition? How can decomposition be accelerated or slowed down?*

Targeted Grade Level: *8th Grade.*

Time Needed: *10 to 12 Class periods.*

Subject Integration: Math, Social Studies, and Technology.

During this unit students will be studying the decomposition of a pumpkin, making the main focus of this lesson science concepts. However, students will integrate social studies through studying methods different civilizations used to preserve foods and how those methods changed over time. Students will also collect data from a decomposing pumpkin over the course of a two week period, recording that information into a data table and identifying the change in the pumpkins weight over time. The project at the end of the unit will require students to research different methods used to slow down the rate at which food spoils, which incorporates technology.

Justification:

Covid 19 has negatively affected my students' content knowledge when discussing cycling of energy in an ecosystem, the role of different organisms within an ecosystem and the chemistry behind decomposition. Through this lesson students gain a firm understanding of the decomposition process, different types of decomposers and the chemical reactions that occur during decomposition. This lesson was developed to be taught cross curriculum addressing math, social studies and technology. It is also relevant to the everyday lives of the students because they live in a high farming county.

Standards:

Science Standards:

MS-PS1-2. Analyze and interpret data on the properties of substances before and after the substance interact to determine if a chemical reaction has occurred.

MS-LS1-5. Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.

MS-LS1-7. Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism.

ELA Standards:

RST.6- 8.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.

Math Standards:

KY.8.F.4 Construct a function to model a linear relationship between two quantities. a. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph.

NGSS Performance Expectations

MS-PS1-2. Analyze and interpret data on the properties of substances before and after the substance interact to determine if a chemical reaction has occurred.

MS-LS1-5. Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.

MS-LS1-7. Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism.

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts:
Analyzing and Interpreting Data *Analyzing data in 6–8 builds on K–5 and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis.* ● *Analyze and interpret data to determine similarities and differences in findings.* Developing and Using Models Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more	***PS1.B: Chemical Reactions*** ● *Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants.* *Within individual organisms, food moves through a series of chemical reactions in which it is broken down and rearranged to form new*	***Cause and Effect*** ● *Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability.* Energy and Matter Matter is conserved because atoms are conserved in physical and chemical processes. (MS-LS1-7)

abstract phenomena and design systems. Develop a model to describe phenomena. (MS-LS2-3) Develop a model to describe unobservable mechanisms. (MS-LS1-7)	*molecules, to support growth, or to release energy. (MS-LS1-7)*	

Connections to other DCIs in this grade-band:
MS.PS3.D ; **MS.LS1.C** ; **MS.ESS2.A**

Articulation of DCIs across grade-bands:
5.PS1.B ; HS.PS1.B

Common Core State Standards Connections:

ELA/Literacy -

RST.6-8.1	**Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.*(MS-PS1-2)***
RST.6-8.7	**Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). (MS-PS1-2)**

Mathematics -

MP.2	**Reason abstractly and quantitatively. (MS-PS1-2)**
6.RP.A.3	**Use ratio and rate reasoning to solve real-world and mathematical problems. *(MS-PS1-2)***

6.SP.B.4	**Display numerical data in plots on a number line, including dot plots, histograms, and box plots.** ***(MS-PS1-2)***
6.SP.B.5	**Summarize numerical data sets in relation to their context. (MS-PS1-2)**

Measurable Student Learning Objectives:

Students will be able to model the three stages of decomposition a pumpkin goes through.

Students will be able to design and investigate a factor that accelerates the decomposition rate of a pumpkin.

Students will be able to research different methods used to decelerate the rate at which food spoils

Nature of STEM:

Students will be able to collect and incorporate data from the decomposition of a pumpkin. Which they will use to explain the rate at which decomposition occurs and what factor can speed up or slow down decomposition. Students model decomposition and research what methods that are used to prevent foods from spoiling and present their information to the class

Engaging Context/Phenomena: . It begins with a time-lapse video of three pumpkins rotting. As students are watching the video, they are sketching what the pumpkins look like at the beginning of the video and what they look like at the end of the video. The students are also explaining what factors affect the decomposition rate and the physical changes that occurr to the pumpkins.

Data Integration:

Students will be using data collected from their decomposition lab to help them model decomposition, determine rate of change and research methods to prevent food from spoiling.

Differentiation of Instruction: *Students will work in groups. Readers and scribes will be provided to students during research and presentation.*

Real-life Connection: *This is a farming county, many students or their parents garden and preserve foods. Also, students see decay in their life in the form of rotten food or in the form of a dead animal on the side of the road. Exploring decomposition in detail, widens students' curiosity and interests in this area. A pumpkin was chosen as the anchoring phenomena to fit the Fall/Autumn season.*

Possible Misconceptions: *Things that die spontaneously break down. The only decomposers are invertebrates and the only method to prevent food from spoiling is to keep it cold.*

5E Model	5E Objectives
Engage *Watch an engaging video and discuss the process ro decomposition.*	**Procedure:** *The teacher will begin class with an "anchoring phenomena" activity. This activity is meant to grab the students' attention, develop interest in today's lesson, and probe their background knowledge. The teacher will turn on the Pumpkins Rotting Time-Lapse video. The teacher after the video will ask the students to think-pair-share. The teacher will tell the students to model in groups of 3-4 on large poster paper the decomposition process of a pumpkin. The teacher has the students do a gallery walk to present their models when they are finished. The students receive credit for effort and not on accuracy during this stage of their mode* **Modifications** *Students will be working in groups. The teacher will walk around the room to assess students' needs and guide discussion with questioning.* **Standards Addressed** MS-PS1-2. *MS-LS1-7*

	Formative/Summative Assessments *Student discussions, think pair share worksheet, and decomposition model.* **Resources** *https://www.youtube.com/watch?v=nRhRUs3fZeU* *https://www.readingrockets.org/sites/default/files/Think-Pair-Share-template.pdf*
Explore *Accelerated pumpkin decomposition lab*	**Procedure:** *The students will explore which factor accelerates the decomposition rate of pumpkins. The teacher will gently guide students as they work on designing and implementing their own experiment using the lab template sheet . Student labs should explore which factors accelerates the decomposition rate of a pumpkin. Each group will choose a factor to explore. Each group has to have a control group. Factors that can be explored: Light, Air, Bugs, Water, Acids. The teacher will buy small pumpkins for students who cannot afford them. The rest of the students will buy them. Each group will get a piece of a pumpkin. The pumpkin pieces will be in plastic containers during the two week experiment period. Students will make daily observations of physical changes that can be seen, touched or smelt and weight changes. The weight changes students will graph and assess the rate of change.* **Modifications:** *Students will be working in groups. The teacher will walk around the room to assess students' needs and guide discussion with questioning.* **Standards Addressed** MS-PS1-2, *MS-LS1-7, MS-LS1-5, KY.8.F.4* *MS-LS1-5.***Formative/SummativeAssessments:** *Student creation, testing, and data collection of an experiment that shows how one of the factors: Light, Air, Bugs, Water, Acids, accelerate decomposition.*

	Resources: ***Pumpkins, acid (vinegar), water.*** *https://docs.google.com/document/d/1uFJlNXVZd3G3_2bD2mYzrUG9dX8iqlLUh3xDzl2PGI4/edit?nativeconvert=1*
Explain *Student presentations*	**Procedure:** *The students will explain their results for their specific factor: Light, Air, Bugs, Water, Acids, from their experiment in the form of PowerPoint slides or Google Slides. The teacher will grade the student's presentation using the rubric as they present it to the class. The teacher will make sure the rest of the students are being respectful to their classmates as they present and recording two things they learned and one improvement for each presentation.* **Modifications** *Students will be working in groups. Students with reading disabilities will be given a reader and a scribe.* **Standards Addressed** MS-PS1-2, *MS-LS1-7, MS-LS1-5* **Formative/Summative Assessments** *Student presentations will be graded using a rubric.* **Resources** *Google slides*
Elaborate *Research Nasa techniques for food preservation and the importance of food preservation. Research other methods of food preservation.*	**Procedure:** *Students will read the space food systems document, then think pair share to identify methods Nasa uses to preserve food for its astronauts and the importance of food preservation for long duration missions. The teacher will monitor the students as they research the different methods that Native Americans and Early Settlers used to slow down the rate in which food spoils. The teacher will have each student explain the method they found to be the most interesting and why.*

	Modifications *Students will be working in groups. Students with reading disabilities will be given a reader and a scribe.* **Standards Addressed** MS-PS1-2, *MS-LS1-7, MS-LS1-5, RST.6- 8.1* **Formative/Summative Assessments** *Student discussions, think pair share worksheet, and food preservation research.* **Resources** *https://www.nasa.gov/content/space-food-systems* *https://www.readingrockets.org/sites/default/files/Think-Pair-Share-template.pdf*
Evaluate *Final lab report on acceleration of decomposition*	**Procedure:** *The teacher is evaluating the students throughout the unit plan. The teacher evaluates the students when they model the stages of decomposition a pumpkin goes through. The teacher evaluates the students when they research the different methods used to keep food from spoiling. The teacher evaluates the students when they submit the final lab report. The final assessment is the final lab report the students will submit on the factor that accelerates decomposition rate of the pumpkin.* **Modifications** *Students will be working in groups. Students with reading disabilities will be given a reader and a scribe.* **Standards Addressed** MS-PS1-2, *MS-LS1-7, MS-LS1-5, KY.8.F.4* **Formative/Summative Assessments** *The final lab report on acceleration of decomposition.*

	Resources *https://docs.google.com/document/d/1uFJINXVZd3G3_2bD2mYzrUG9dX8iqlLUh3xDzl2PGI4/edit?nativeconvert=1*

Teacher Background: *Knowledge of the decomposition process and the different types of decomposers. Teacher also needs to know how to graph data and calculate the rate of change.*

Teacher Resources:

Lab Sheet:

https://www.teacherspayteachers.com/Store/Stem-Shop

Decomposition Lesson plan:

https://www.teacherspayteachers.com/Product/NGSS-Decomposition-Lesson-Plan-4879021

Pumpkin decomposition video:

https://www.youtube.com/watch?v=nRhRUs3fZeU

Think Pair Share :

https://www.readingrockets.org/sites/default/files/Think-Pair-Share-template.pdf

Nasa Data:

https://www.nasa.gov/content/space-food-systems