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# K-12 Partnership Lesson Plan

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# *Decomposition*

# *The Ultimate Disappearing Act!*

## Overview

Decomposition is a complex process happening all around us. The goal is to identify where decomposition is happening (in the fridge in the forest), examine important factors – biological, chemical and physical, and used an inquiry-based approach for students to set up their own experiments.

**Objectives**

At the conclusion of the lesson, students will be able to:

* Understand the concepts involved in decomposition – physical, chemical and biological.
* Connect these concepts with their everyday experiences and knowledge and relate them to models of food webs and carbon cycling.
* Use concepts to construct a decomposition experiment that unites the above concepts.

**Length of Lesson**

1 class period for introduction (can stand alone); 1 class period to plan experiments, 5 class periods for experimental follow-up (10-15min per period)

Day 1: (20-25 min) videos, demonstration, question; (25 min) examine soil, funnel fauna, litter, decomposition, matter transformation; (10 min) bring together concepts: carbon transformation, food webs, decomposers.

Day 2: (25 min) plan experiments; (15 min) make predictions

**Grade Levels**

7-10

**Standards covered (NGSS)**

Disciplinary Core Ideas:

* **MS-PS1-2**: analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred
* **MS-LS2-3**: develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem

Cross Cutting Concepts:

* Patterns
* Cause and effect
* Systems and system models
* Energy and matter in systems
* Stability and change of systems

Science and Engineering Practices

* Asking questions and defining problems
* Planning and carrying out investigations
* Analyzing and interpreting data

***Previous Michigan Standards Met:***

* **B1**: Inquiry, reflection, and social implications (importance of decomposition- cycling of matter and energy- where it occurs and how)
* **B2**: Organization and development of living systems (soil food webs and how they interact with chemical and physical factors)
* **B3**: Interdependence of living systems and the environment (linking processes such as digestion and agriculture with concepts covered in decomposition)

**Materials**

* Dissecting microscope
* Berlese funnel (light, screen, funnel)
* Petri dishes
* Alcohol
* Soil
* Computer
* Scale
* Food stuffs or plant litter
* Bromothymol blue (optional)
* Nylon 2mm mesh (optional)
* Plastic bags (optional)

**Background**

Decomposition is a complex process happening all around us. The goal is to identify where decomposition is happening (in the fridge in the forest), examine important factors – biological, chemical and physical, and used an inquiry-based approach for students to set up their own experiments.

In this session students explore what happens in decomposition, what factors control decomposition (material being composed, micro and macro-organisms in the soil, temperature, etc.), and why this matters. The session worksheet contains several links to videos of decomposing materials.

### Activities of the session

Part 1- Introducing decomposition

1. Introduce the process of decomposition using the links on the student handout.
2. Answer the reflection questions listed in Decomposition I

Part 2- Decomposition activities

1. Soils
   1. Collect soil from several different locations (sandy, farm soil, forest, etc.)
   2. Record observations of soil in Decomposition II on the student handout
2. Berlese funnel
   1. To construct a Berlese funnel to extract mesofauna from the soil, find a funnel (or top half of a 2 liter soda bottle). Place a screen on the bottom to keep the soil contained and fill the funnel with soil. Place a light/heat source above the soil. The “critters” in the soil will move toward the bottom to escape the light/heat. Place a cup of water, ethanol, or even paper towel to capture the mesofauna to view under a dissecting scope.
   2. Record observations of the soil mesofauna on the student worksheet
3. Microscopes
   1. View organisms from several different soil types under a dissecting microscope (i.e. low power).
   2. Record observation on the student worksheet.
4. Raw materials
   1. Show students various decomposable materials (apple, wheat straw, banana, potato, gummi worms, cabbage, lettuce, etc.)
   2. Have students record predictions about which will decompose the fastest on the student worksheet
5. Rotting materials!
   1. Place a bag of the same decomposable materials in either a hot car or refrigerator for several days.
   2. Record observations of these materials on the student worksheet.

Part 3- Decomposition experiment

1. Use student worksheet to guide students through setting up a decomposition experiment. Students will choose a soil type, decomposable material, and a location
2. Graph the results of the experiment on the student worksheet
3. Apply the lessons from these activities when interpreting the graphs on the last two sheets of the student worksheet

**Resources**

* Activity guide, basic data collection sheet, excel file to help with graphing, and powerpoint presentation listed on the “Decomposition: the ultimate disappearing act” lesson page on the KBS GK-12 website.
* LIDET experiment website: <http://andrewsforest.oregonstate.edu/research/intersite/lidet.htm>
* Videos for reflection questions:
  + Pig: <https://www.youtube.com/watch?v=R1CD6gNmhr0>
  + Fruit: https://www.youtube.com/watch?v=c0En-\_BVbGc
* Other videos:
* <http://www.theguardian.com/environment/video/2014/apr/30/rotting-dead-whale-verge-exploding-canada-video>
* <http://www.youtube.com/watch?v=1_t44siFyb4>
* <https://www.youtube.com/watch?v=rdI3eFrTGs8>

**Extensions and Modifications**

Teachers can use the LIDET website to follow-up with outdoor experiments – measuring decomposition over time in a setting of their choice. Additionally teachers may encase petri dishes in a sealed ziplock bag to allow for accumulations of CO2 which can be measures with a probe, or as a drop in pH of condensate with increase in carbonic acid.

**Assessment**

The lesson provides an excellent opportunity for students to revisit concepts over time by taking new measurements every week or every few weeks and building their graphs of decomposition individually and as a class. At this latter time points teachers can assess how well students recall core concepts from initial lesson.