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| **The Rotten Truth: Carbon-Huh-What is it good for?** |
| **Your Name** | Jeanette Utter | **Date: TBA** |  |
| **Subject/ Course**  | Environmental Science | **Grade 11-12** |  |
| **Unit Topic or Theme** | The Rotten Truth: A Unit on Decomposition | **# of Students** **22** | Classroom 319 |
| **Class Length** | 46 minutes | **Day 1 of 20** |  |  |
| **Central Focus/Concept, Essential Question, or Enduring Understanding**  |
| **Essential Question:**  What role does cellular respiration play in the carbon cycle?  |
| **Lesson Rationale and Summary** |
| Often my students are guided by misconceptions about the process of decomposition. Typically students explain decomposition as a purely physical process, not understanding the vital role that decomposition plays in the cycling of materials such as carbon, nitrogen, and other nutrients between the abiotic and biotic components of the ecosystem. This introductory activity is meant to display the biochemical process of cellular respiration as it is occurring in microorganisms during decomposition. During this process the chemical energy of organic molecules is converted into a form immediately usable by organisms.  |
| **Common Core Standards**  |
| **Ohio Department of Education Model Curriculum Environmental Science Content Standards:** * Organisms interact with and respond to their environment, exchanging matter and energy, and adapt to changing environmental conditions.
* Biochemical cycles-Importance of transformations, cycles, processes and availability of nutrients (N,P,C) through living/non-living systems.
* Abiotic factors that influence regional ecosystems/biomes are the result in part, of geologic processes.

**Ohio Department of Education Model Curriculum Environmental Science As Inquiry Standards:** * Science is a process that involves making observations, designing and conducting experiments, collecting and analyzing data, and drawing conclusions based upon the data and observations. Technology involves using these conclusions to solve everyday problems.
 |
| **Learning Objectives** |
| * Each student will be able to compare and contrast the movement of carbon during cellular respiration.
* Each student will be able to explain how living organisms convert carbon through the processes of cellular respiration.
* Each student will be able to identify patterns in data and relate them to models of carbon cycle and cellular respiration.
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| **Academic Language** |
| * Cellular respiration
* equation: C6H12O6 + 6O2 🡪 6 H2O + 6 CO2 + energy
* decomposition
* microbes
* aerobic
* abiotic
* biotic
* biochemical
* carbon cycle
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| **Planned Assessments** |
| **Pre-Assessment:** * Students will have already completed a pre-assessment for the entire unit. Based on this a daily opener will be used to pre-assess the students’ understanding of decomposition. These are collected on tickets at the end of the first 5 minutes of class.

**Formative Assessment:** * Throughout the lesson questioning will be used to assess the development of students’ content knowledge, as well as an exit ticket

**Summative Assessment:** * Analysis questions for the interactive website will be collected to show students understanding of the lesson. These questions are located on the website ([Carbon Transfer Through Snails and Elodea](http://www.classzone.com/cz/books/bio_07/resources/htmls/virtual_labs/virtualLabs.html) [Cell Respiration](http://www.phschool.com/science/biology_place/labbench/lab5/intro.html))and can be printed to turn in.
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| **List Resources.** |
| * ***Power Point: Carbon Cycle Revisited: Carbon-Huh- What is it good for?***
* ***Reading guides from previous night’s homework***
* ***Computers with internet access***
* ***Cellular Respiration WS***
* ***Websites:***
	+ [Carbon Transfer Through Snails and Elodea](http://www.classzone.com/cz/books/bio_07/resources/htmls/virtual_labs/virtualLabs.html) : A virtual lab dealing with cell cycle
	+ [Cell Respiration](http://www.phschool.com/science/biology_place/labbench/lab5/intro.html) : A virtual lab on aerobic respiration
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| **THE LESSON PROCEDURES** |
| **1. READINESS (also called “Motivation” or the “Engage” segment) Allotted Time: 10 min*** Opener will be used to activate previous knowledge of decomposition: A tree falls in the woods. Describe in detail what will happen to that tree after many years. What will it look like? What will happen to its mass?
* This lesson will bring in the ecological concepts of food webs that were taught previously in class.
* This activity will lead into to the power point about the importance of carbon and the carbon cycle.
* The power point—Carbon-Huh- What is it good for?- will be used to revisit the carbon cycle previously studied and link the role of aerobic respiration in decomposition.

**ASSESSMENT:** Opener will serve as a formative assessment and will be used again as the exit slip. This question is pulled from a type of question from the Pre-Assessment given previous to the start of the unit.**2. CENTRAL LESSON OR ACTIVITY Allotted Time: 32 min*** The following websites are virtual lab simulations that students will use to discover the role of cellular respiration in the carbon cycle and the movement of carbon through the cycle via this pathway.
	+ [Carbon Transfer Through Snails and Elodea](http://www.classzone.com/cz/books/bio_07/resources/htmls/virtual_labs/virtualLabs.html) : A virtual lab dealing with cell cycle. This website is created so that students my not move on to the next portion until they have done all parts of the previous section of tutorial. In this way students will not be able to simply skip important information.
	+ [Cell Respiration](http://www.phschool.com/science/biology_place/labbench/lab5/intro.html) : A virtual lab on aerobic respiration. A lab quiz is found at the end of this website and could be collected for assessmentvalue.

 **ASSESSMENT:** Students are guided through the activities and asked to design and carry out experiments online. Each website asks students to fill out virtual notebooks and also includes analysis questions for each activity. These can be printed out and turned in for assessment purposes. Students can also be asked to keep actual notebooks while working through the tutorials that are turned in at end of class. **3. CLOSURE Allotted Time:5 min*** Students will be provided with a note card upon which they will be asked to revisit their opener from the beginning of class. Students will be given an exit ticket asking them to state 1 thing clarified and 1 question still remaining regarding the lessons for the day.

Homework: Energy of Life and Cellular Respiration Worksheet  |

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| **Enrichment/Extension**  |
| Extending the Lesson:As part of the extension for this unit, students will each be responsible for blogging throughout the unit. Students will be assigned one day that they will be responsible for starting the blog, each student will then be asked to respond. These blogs can include discussion type questions proposed by the daily leader or simply focus questions geared towards gathering a better understanding of the concepts taught in class.  [Blogging With Utter](http://kidblog.org/BloggingWithUtter/) |
| **REFLECTION** |

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| **The Rotten Truth: Chemistry of Decomposition** |
| **Your Name** | Jeanette Utter | **Date: TBA** |  |
| **Subject/ Course**  | Environmental Science | **Grade 11-12** |  |
| **Unit Topic or Theme** | The Rotten Truth: A Unit on Decomposition | **# of Students** **22** | Classroom 319 |
| **Class Length** | 46 minutes | **Day 2 -3 of 20** |  |  |
| **Central Focus/Concept, Essential Question, or Enduring Understanding**  |
| **Essential Question:**  What chemical processes take place during decomposition?  |
| **Lesson Rationale and Summary** |
| Carbon and the processes associated with its movement through the ecosystem are essential to life. Most often food webs are taught to student s in 8th grade and 10th grade, but very little importance is given to the process of decomposition and its key role in the carbon cycle. Decomposition is usually treated as a side not to food webs and nutrient cycling. This lesson is being used to help students recognize that these processes recycle carbon in the ecosystem , allowing it to be reused by all of the organisms on earth. |
| **Common Core Standards**  |
| **Ohio Department of Education Model Curriculum Environmental Science Content Standards:** * Organisms interact with and respond to their environment, exchanging matter and energy, and adapt to changing environmental conditions.
* Biochemical cycles-Importance of transformations, cycles, processes and availability of nutrients (N,P,C) through living/non-living systems.
* Abiotic factors that influence regional ecosystems/biomes are the result in part, of geologic processes.

**Ohio Department of Education Model Curriculum Environmental Science As Inquiry Standards:** * Science is a process that involves making observations, designing and conducting experiments, collecting and analyzing data, and drawing conclusions based upon the data and observations. Technology involves using these conclusions to solve everyday problems.
 |
| **Learning Objectives** |
| * Each student will be able to compare and contrast the movement of carbon during decomposition.
* Each student will be able to explain how microorganisms convert carbon through the processes of cellular respiration involved in decomposition.
* Each student will be able to explain the process of decomposition and the factors that affect the rate of decomposition.
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| **Academic Language** |
| * Cellular respiration
* equation: C6H12O6 + 6O2 🡪 6 H2O + 6 CO2 + energy
* decomposition
* rate of reactions
* microbes
* aerobic
* abiotic
* biotic
* biochemical
* carbon cycle
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| **Planned Assessments** |
| **Formative Assessment:** * Throughout the lesson questioning will be used to assess the development of students’ content knowledge, as well as an exit ticket.
* Students will also be asked to turn in a research guide (annotated bibliography) of their research before they begin making poster.

**Summative Assessment:** * Posters and presentations will be used to assess the knowledge gained by the students.
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| **List Resources.** |
| * **Poster boards**
* **Markers and other materials as needed**
* **Computers with internet access**
* **Websites:** The following websites can be used as a resource for student research. However these are not all inclusive and students may also access other sites. These sites are simply meant to get students started looking in the right direction.

 [Factors that affect rates of reactions tutorial](http://www.webchem.net/notes/how_far/kinetics/rate_factors.htm)[Carbon Cycle](http://www.fofweb.com/activelink2.asp?ItemID=WE40&SID=5&iPin=ECCC0005&SingleRecord=True" \t "_self" \o "Record URL)[Biogeochemical cycles and microorganisms](http://www.fofweb.com/activelink2.asp?ItemID=WE40&SID=5&iPin=EMBIO0021&SingleRecord=True" \t "_self" \o "Record URL)[Soil microbiology](http://www.fofweb.com/activelink2.asp?ItemID=WE40&SID=5&iPin=EMBIO0166&SingleRecord=True" \t "_self" \o "Record URL) |

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| **THE LESSON PROCEDURES** |
| **1. READINESS (also called “Motivation” or the “Engage” segment) Allotted Time: 10 min*** Opener will be used to activate previous knowledge of decomposition: The tree that fell in the woods looses mass as it decays? What do you think has happened to the lost mass?
* Time lapsed movie showing decomposition will be used to motivate the students to want to find out what lies behind the process of decomposition.

**ASSESSMENT:** Opener will serve as a formative assessment of the previous day’s lessons.**2. CENTRAL LESSON OR ACTIVITY Allotted Time: 32 min*** Students will be assigned to investigate the process of decomposition as well as the factors that may affect the rates of decomposition using websites provided or those that they find on their own.
* This research will be used to create a poster that will be presented to the class on day 3. The following points need to be discussed on the poster:
	+ How does the process of decomposition relate to cellular respiration?
	+ How might the following factors affect the rates of decomposition: temperature, moisture, pH, and nutrient type?
	+ How can the rate of decomposition be detected?
	+ How do the rates of aerobic and anaerobic decomposition differ?

**ASSESSMENT:** Students will be asked to fill out a research guide for the project that includes notes and bibliography for their work. This is collected before they begin making the posters. The final product, a poster, will act as a summative assessment for this lesson. Student will also be asked to present their findings to the class on day 3 and these posters will be placed around the room to guide the next phase of the unit. **3. CLOSURE Allotted Time:5 min*** Students will be provided with a note card upon which they will be asked to revisit their opener from the beginning of class. Students will be given an exit ticket asking them to state 1 thing clarified and 1 question still remaining regarding the lessons for the day.

Homework: Continue research as needed. |

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| **Enrichment/Extension**  |
| Extending the Lesson:As part of the extension for this unit, students will each be responsible for blogging throughout the unit. Students will be assigned one day that they will be responsible for starting the blog, each student will then be asked to respond. These blogs can include discussion type questions proposed by the daily leader or simply focus questions geared towards gathering a better understanding of the concepts taught in class.  [Blogging With Utter](http://kidblog.org/BloggingWithUtter/) |

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| **The Rotten Truth: Affecting the rates of decomposition** |
| **Your Name** | Jeanette Utter | **Date: TBA** |  |
| **Subject/ Course**  | Environmental Science | **Grade 11-12** |  |
| **Unit Topic or Theme** | The Rotten Truth: A Unit on Decompostion | **# of Students** **22** | Classroom 319 |
| **Class Length** | 46 minutes | **Day 4 of 20** |  |  |
| **Central Focus/Concept, Essential Question, or Enduring Understanding**  |
| **Essential Question:**  What chemical processes take place during decomposition?  |
| **Lesson Rationale and Summary** |
| This lesson is intended to have students use the information gathered to make a hypothesis about what can affect the rate of decomposition and then design an experiment to test their hypothesis. It is important that students experience the way that science is really done and are able to connect the concepts to the real world. Most often student learn to “do science” through cookie cutter activities that end up meaning nothing to the student other than some fun activity. The purpose of this part of the unit is to model the real world application of science. |
| **Common Core Standards**  |
| **Ohio Department of Education Model Curriculum Environmental Science Content Standards:** * Organisms interact with and respond to their environment, exchanging matter and energy, and adapt to changing environmental conditions.
* Biochemical cycles-Importance of transformations, cycles, processes and availability of nutrients (N,P,C) through living/non-living systems.
* Abiotic factors that influence regional ecosystems/biomes are the result in part, of geologic processes.

**Ohio Department of Education Model Curriculum Environmental Science As Inquiry Standards:** * Science is a process that involves making observations, designing and conducting experiments, collecting and analyzing data, and drawing conclusions based upon the data and observations. Technology involves using these conclusions to solve everyday problems.
 |
| **Learning Objectives** |
| * Each student will be able to explain how microorganisms convert carbon through the processes of cellular respiration involved in decomposition.
* Each student will be able to explain the process of decomposition and the factors that affect the rate of decomposition.
* Each student will be able to design and execute an appropriate test for their hypothesis regarding decomposition.
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| **Academic Language** |
| * Cellular respiration
* equation: C6H12O6 + 6O2 🡪 6 H2O + 6 CO2 + energy
* decomposition
* microbes
* aerobic
* abiotic
* biotic
* biochemical
* carbon cycle
* hypothesis
* independent variable
* dependent variable
* lab safety
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| **Planned Assessments** |
| **Formative Assessment:** * Throughout the lesson questioning will be used to assess the development of students’ content knowledge, as well as an exit ticket.
* **Summative Assessment:**
* Students will also be asked to turn in an outline of their experimental procedures for pre approval prior to beginning the experiment.
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| **List Resources.** |
| * Posters from class presentations
* Essay on Biomes: [Biomes](http://www.fofweb.com/activelink2.asp?ItemID=WE40&SID=5&iPin=envrnstud0375&SingleRecord=True" \t "_self" \o "Record URL)
* Computers with internet access
* Website for reference: [Bottle biology](http://www.bottlebiology.org/investigations/decomp_main.html)
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| **THE LESSON PROCEDURES** |
| **1. READINESS (also called “Motivation” or the “Engage” segment) Allotted Time: 10 min*** Opener will be used to activate previous knowledge of decomposition: Looking back at our same tree, how would the rate of decomposition be different if this tree were in the desert? The tundra? The tropical rainforest?

**ASSESSMENT:** Opener will serve as a formative assessment of the previous day’s lessons.**2. CENTRAL LESSON OR ACTIVITY Allotted Time: 32 min*** Using the posters from the previous lesson and the information provided in the essay-[Biomes](http://www.fofweb.com/activelink2.asp?ItemID=WE40&SID=5&iPin=envrnstud0375&SingleRecord=True" \t "_self" \o "Record URL)- students will generate a hypothesis regarding the factors that affect decomposition rates.
	+ Some questions that can be looked at are:
		- Temperature= students could look warm vs cold (students have access to an incubator, heat lamps as well as a refridgerator)
		- Moisture= high, medium, low
		- pH= acidic, neutral, basic
		- nutrients = leaves, no leaves, pine needles, etc.
* Students will be asked to design an experiment that tests a single factor and involves the decomposition of an organic material such as a banana or other food source. The rate of decomposition will be measured as mass loss over time.
* The following website can be used by the students to get ideas about how to design their labs: [Bottle biology](http://www.bottlebiology.org/investigations/decomp_main.html)

**ASSESSMENT:** Students must submit their experimental procedures for approval before they begin.**2. CLOSURE Allotted Time: 5 min*** Students will be provided with a note card upon which they will be asked to revisit their opener from the beginning of class. Students will be given an exit ticket asking them to state 1 thing clarified and 1 question still remaining regarding the lessons for the day.

Homework:  |

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| **Enrichment/Extension**  |
| Extending the Lesson:As part of the extension for this unit, students will each be responsible for blogging throughout the unit. Students will be assigned one day that they will be responsible for starting the blog, each student will then be asked to respond. These blogs can include discussion type questions proposed by the daily leader or simply focus questions geared towards gathering a better understanding of the concepts taught in class.  [Blogging With Utter](http://kidblog.org/BloggingWithUtter/) |

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| **The Rotten Truth: Experimenting with decomposition** |
| **Your Name** | Jeanette Utter | **Date: TBA** |  |
| **Subject/ Course**  | Environmental Science | **Grade 11-12** |  |
| **Unit Topic or Theme** | The Rotten Truth: A Unit on Decompostion | **# of Students** **22** | Classroom 319 |
| **Class Length** | 46 minutes | **Day 5-15 of 20** |  |  |
| **Central Focus/Concept, Essential Question, or Enduring Understanding**  |
| **Essential Question:**  What factors affect the rates of decomposition?  |
| **Lesson Rationale and Summary** |
| This lesson is intended to have students use the information gathered to make a hypothesis about what can affect the rate of decomposition and then design an experiment to test their hypothesis. It is important that students experience the way that science is really done and are able to connect the concepts to the real world. Most often student learn to “do science” through cookie cutter activities that end up meaning nothing to the student other than some fun activity. The purpose of this part of the unit is to model the real world application of science. |
| **Common Core Standards**  |
| **Ohio Department of Education Model Curriculum Environmental Science Content Standards:** * Organisms interact with and respond to their environment, exchanging matter and energy, and adapt to changing environmental conditions.
* Biochemical cycles-Importance of transformations, cycles, processes and availability of nutrients (N,P,C) through living/non-living systems.
* Abiotic factors that influence regional ecosystems/biomes are the result in part, of geologic processes.

**Ohio Department of Education Model Curriculum Environmental Science As Inquiry Standards:** * Science is a process that involves making observations, designing and conducting experiments, collecting and analyzing data, and drawing conclusions based upon the data and observations. Technology involves using these conclusions to solve everyday problems.
 |
| **Learning Objectives** |
| * Each student will be able to explain how microorganisms convert carbon through the processes of cellular respiration involved in decomposition.
* Each student will be able to explain the process of decomposition and the factors that affect the rate of decomposition.
* Each student will be able to design and execute an appropriate test for their hypothesis regarding decomposition.
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| **Academic Language** |
| * Cellular respiration
* equation: C6H12O6 + 6O2 🡪 6 H2O + 6 CO2 + energy
* decomposition
* microbes
* aerobic
* abiotic
* biotic
* biochemical
* carbon cycle
* hypothesis
* independent variable
* dependent variable
* lab safety
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| **Planned Assessments** |
| **Formative Assessment:** * Throughout the lesson questioning will be used to assess the development of students’ content knowledge, as well as an exit ticket.
* Periodically groups will be asked to present an informal discussion of what is going on in their experiment and the initial data they have gathered.

**Summative Assessment:** * Students will keep a lab notebook detailing data collection and any issues arising during the experimentation process.
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| **List Resources.** |
| * **Some materials may vary due to the needs of the students and the designs they have mapped out. Some example material may include:**
	+ Heat lamp, incubator, fridge, or cooler
	+ pH meter, sodium hydroxide, vinegar, water
	+ leaves, pine needles, banana or other material to decompose
	+ scale
	+ soil
	+ thermometers
	+ paper towels
	+ empty 2-liter bottles
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| **THE LESSON PROCEDURES** |
| **1. CENTRAL LESSON OR ACTIVITY Allotted Time: 47 min*** After approval of experimental designs, students will set up experiments and begin the process.
* Students must keep a notebook to record daily measurements and to detail any procedural processes, i.e., addition of water, measurement of pH, etc.
* Students will begin the experiment with an initial mass of the material to be decomposed.
* Each day mass of the material will be taken and recorded in the notebook.
* After the first week, each team will be asked to give a report to the class on the data collected so far and any issues or concerns they may have regarding their experiment. In this way students will be collaborating with one another much as scientists would in the real world.
* 2-weeks have been set aside for the conducting of the experimental aspect. During this time students will also spend time researching the factors associated with different biomes: Essay on Biomes: [Biomes](http://www.fofweb.com/activelink2.asp?ItemID=WE40&SID=5&iPin=envrnstud0375&SingleRecord=True" \t "_self" \o "Record URL)

**ASSESSMENT:** Lab notebook and periodic report outs can be used as assessments. |

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| **Enrichment/Extension**  |
| Extending the Lesson:As part of the extension for this unit, students will each be responsible for blogging throughout the unit. Students will be assigned one day that they will be responsible for starting the blog, each student will then be asked to respond. These blogs can include discussion type questions proposed by the daily leader or simply focus questions geared towards gathering a better understanding of the concepts taught in class.  [Blogging With Utter](http://kidblog.org/BloggingWithUtter/) |

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| **The Rotten Truth: Experimenting with decomposition** |
| **Your Name** | Jeanette Utter | **Date: TBA** |  |
| **Subject/ Course**  | Environmental Science | **Grade 11-12** |  |
| **Unit Topic or Theme** | The Rotten Truth: A Unit on Decompostion | **# of Students** **22** | Classroom 319 |
| **Class Length** | 46 minutes | **Day 16-18 of 20** |  |  |
| **Central Focus/Concept, Essential Question, or Enduring Understanding**  |
| **Essential Question:**  What factors affect the rates of decomposition?  |
| **Lesson Rationale and Summary** |
| This lesson is important in teaching students one of the fundamental steps in doing science, presenting to peers. Here students will develop and present a formal presentation of their data analysis for each of their experiments. They will be questioned by their peers as to the relevance of data and the conclusions based on the data. |
| **Common Core Standards**  |
| **Ohio Department of Education Model Curriculum Environmental Science Content Standards:** * Organisms interact with and respond to their environment, exchanging matter and energy, and adapt to changing environmental conditions.
* Biochemical cycles-Importance of transformations, cycles, processes and availability of nutrients (N,P,C) through living/non-living systems.
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| **Learning Objectives** |
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* Each student will be able to explain the process of decomposition and the factors that affect the rate of decomposition.
* Each student will be able to design and execute an appropriate test for their hypothesis regarding decomposition.
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| **Academic Language** |
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* decomposition
* microbes
* aerobic
* abiotic
* biotic
* biochemical
* carbon cycle
* hypothesis
* independent variable
* dependent variable
* lab safety
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| **Planned Assessments** |
| **Formative Assessment:** * Throughout the lesson questioning will be used to assess the development of students’ content knowledge, as well as an exit ticket.
* **Summative Assessment:**
* Students will be graded on the formal presentation of their experiment.
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| **List Resources.** |
| * Essay on Biomes: [Biomes](http://www.fofweb.com/activelink2.asp?ItemID=WE40&SID=5&iPin=envrnstud0375&SingleRecord=True" \t "_self" \o "Record URL)
* Computers with power point
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| **THE LESSON PROCEDURES** |
| **1. CENTRAL LESSON OR ACTIVITY Allotted Time: 42 min*** Students will be expected to perform analysis of their data: What does the data tell you about the factor that you chose to investigate.
* Students will then prepare a formal presentation in the form of a power point. The power point will be modeled after a formal lab report that is typically done in high school science.
* Students will present these presentations day 19-20.

**2. CLOSURE Allotted Time: 5 min*** Students will be provided with a note card upon which they will be asked to revisit their opener from the beginning of class. Students will be given an exit ticket asking them to state 1 thing clarified and 1 question still remaining regarding the lessons for the day.

Homework:  |

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| **Enrichment/Extension**  |
| Extending the Lesson:As part of the extension for this unit, students will each be responsible for blogging throughout the unit. Students will be assigned one day that they will be responsible for starting the blog, each student will then be asked to respond. These blogs can include discussion type questions proposed by the daily leader or simply focus questions geared towards gathering a better understanding of the concepts taught in class.  [Blogging With Utter](http://kidblog.org/BloggingWithUtter/) |

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| **The Rotten Truth: Affecting the rates of decomposition** |
| **Your Name** | Jeanette Utter | **Date: TBA** |  |
| **Subject/ Course**  | Environmental Science | **Grade 11-12** |  |
| **Unit Topic or Theme** | The Rotten Truth: A Unit on Decompostion | **# of Students** **22** | Classroom 319 |
| **Class Length** | 46 minutes | **Day 19-20 of 20** |  |  |
| **Central Focus/Concept, Essential Question, or Enduring Understanding**  |
| **Essential Question:**  What factors affect the rates of decomposition?  |
| **Lesson Rationale and Summary** |
| This lesson is important in teaching students one of the fundamental steps in doing science, presenting to peers. Here students will develop and present a formal presentation of their data analysis for each of their experiments. They will be questioned by their peers as to the relevance of data and the conclusions based on the data. |
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| **Learning Objectives** |
| * Each student will be able to explain how microorganisms convert carbon through the processes of cellular respiration involved in decomposition.
* Each student will be able to explain the process of decomposition and the factors that affect the rate of decomposition.
* Each student will be able to design and execute an appropriate test for their hypothesis regarding decomposition.
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| **Academic Language** |
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* decomposition
* microbes
* aerobic
* abiotic
* biotic
* biochemical
* carbon cycle
* hypothesis
* independent variable
* dependent variable
* lab safety
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| **Planned Assessments** |
| **Formative Assessment:** * Throughout the presentation students will be evaluated by their peers as to the understanding they develop from the presentation.
* Students will be asked to fill in a graphic organizer for each group as they listen to the presentation so that they may learn how all the factors affect the rates of decomposition.
* **Summative Assessment:**
* Students will present their experimental data to the class as a whole.
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| **List Resources.** |
| * Essay on Biomes: [Biomes](http://www.fofweb.com/activelink2.asp?ItemID=WE40&SID=5&iPin=envrnstud0375&SingleRecord=True" \t "_self" \o "Record URL)
* Computers with power point
* Graphic organizers for audience
* Peer Review Rubric
* Climatographs of different biomes: desert, tundra, tropical rainforest, deciduous forest.
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| **THE LESSON PROCEDURES** |
| **1. CENTRAL LESSON OR ACTIVITY Allotted Time: 42 min*** Students will present their reports to the class and each member of the audience will fill in the graphic organizer so that they now have the information for all of the factors that affect decomposition rates.
* Students will be given climatographs for the major biomes: desert, tundra, rainforest, deciduous forests.
* Students are asked to compare the graphic information (factors affecting decomposition) and the climate information for each biome to analyze the difference in the rates of decomposition between the biomes based on the experiments and the data obtained on biomes.

**ASSESSMENT:** Exit ticket**2. CLOSURE Allotted Time: 5 min*** Students will be provided with a note card upon which they will be asked to revisit their opener from the beginning of class. Students will be given an exit ticket asking them to state 1 thing clarified and 1 question still remaining regarding the lessons for the day.

Homework: Complete the analysis of decomposition rates in each biome. |

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| **Enrichment/Extension**  |
| Extending the Lesson:As part of the extension for this unit, students will each be responsible for blogging throughout the unit. Students will be assigned one day that they will be responsible for starting the blog, each student will then be asked to respond. These blogs can include discussion type questions proposed by the daily leader or simply focus questions geared towards gathering a better understanding of the concepts taught in class.  |

 **Blog Grading Rubric**

**Your Blog**

 Points

5 points – content \_\_\_\_\_\_\_\_\_\_

4-5 pts – topic fully discussed with several examples from

 your experiences and research

2-3 pts – topic only cursorily discussed with only one

example provided

1 pt – topic barely discussed with no examples provided

5 points – coherency and organization \_\_\_\_\_\_\_\_\_\_\_

 4-5 points – coherent and well-organized

 2-3 points – somewhat difficult to follow

 1 point – not organized

5 points – accuracy \_\_\_\_\_\_\_\_\_\_\_

4-5 points – few errors in spelling and grammar

2-3 points – many spelling or grammar errors, but still comprehensible

1 point – meaning unclear due to spelling or grammar errors

5 points – creativity \_\_\_\_\_\_\_\_\_\_\_\_

4-5 points – creative presentation of topic including pictures or links to other

websites

2-3 points – semi-creative presentation without pictures or links

 1 – completely uncreative presentation

 Total Points \_\_\_\_\_/20

**Comments**

 5 points – content \_\_\_\_\_\_\_\_\_\_\_

4-5 points - demonstrated that you read their posting by reacting to or asking

about what your classmate wrote

 2-3 points – questionable whether you read or understood classmate’s posting

 1 point – no demonstration of having read classmate’s posting

 Total Points \_\_\_\_\_/5

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| Blogging Rubric  |  |  |  |  |
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| Teacher Name: **Jeanette Utter** |  |  |  |
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| CATEGORY | 4 | 3 | 2 | 1 |
| Journal/Notebook | Clear, accurate, dated notes are taken regularly. | Dated, clear, accurate notes are taken occassionally. | Dated, notes are taken occassionally, but accuracy of notes might be questionable. | Notes rarely taken or of little use. |
| Experimental Hypothesis | Hypothesized relationship between the variables and the predicted results is clear and reasonable based on what has been studied. | Hypothesized relationship between the variables and the predicted results is reasonable based on general knowledge and observations. | Hypothesized relationship between the variables and the predicted results has been stated, but appears to be based on flawed logic. | No hypothesis has been stated. |
| Data | Professional looking and accurate representation of the data in tables and/or graphs. Graphs and tables are labeled and titled. | Accurate representation of the data in tables and/or graphs. Graphs and tables are labeled and titled. | Accurate representation of the data in written form, but no graphs or tables are presented. | Data are not shown OR are inaccurate. |
| Procedures | Procedures are listed in clear steps. Each step is numbered and is a complete sentence. | Procedures are listed in a logical order, but steps are not numbered and/or are not in complete sentences. | Procedures are listed but are not in a logical order or are difficult to follow. | Procedures do not accurately list the steps of the experiment. |
| Participation | Used time well in lab and focused attention on the experiment. | Used time pretty well. Stayed focused on the experiment most of the time. | Did the lab but did not appear very interested. Focus was lost on several occasions. | Participation was minimal OR student was hostile about participating. |

**The Rotten Truth**

**Unit Test**

**Answer the following questions in complete sentences.**

1. Explain why decomposition is a key process in the Carbon Cycle. **(5 points)**
2. A tree falls in the woods; over time as it rots it looks as if it is disappearing. Describe in detail what is really happening to the material. What will happen to its mass over time? **(10 points)**
3. Explain how the “rotting” of the tree in the above question is related to the processes happening in the cells of the decomposers. Include any relevant equations. **(10 points)**
4. Describe one variable that can affect the rate of decomposition and discuss how this variable may impact that rate. **(5 points)**
5. Compare decomposition rates between the following biomes: Desert, Tropical Rainforest, and Tundra. **(10 points)**

**References:**

Standards can be found at the ODE website: <http://education.ohio.gov/GD/Templates/Pages/ODE/ODEDetail.aspx?Page=3&TopicRelationID=1705&Content=139190>

The following website provided background information on the lab activity associated with the study of decomposition rates: <http://www.all-science-fair-projects.com/science_fair_projects/95/866/a54f1946e3bf3125f00b79fd05b08b24.html>

All rubrics were created using [www.rubistar.com](http://www.rubistar.com)

Conant, Richard T, et al. "Temperature and soil organic matter decomposition rates-sysnthesis of current knowledge and a way forward." Global Change Biology (2011): 3392–3404.

Prescott, C E. "Decomposition and mineralization of nutrients from litter and humus." BassiriRad, H. Nutrient aquisition by plants: an ecological perspective. Berlin: Springer Verlag Ecological Studies series, 2005. 15-41.

Natural Resources Conservation Sources. "US Department of Agriculture." 13 March 2013 <http://soils.usda.gov/sqi/assessment/files/respiration\_guide.pdf>.