Table 2. *Connections to the NGSS and Common Core State Standards*

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| **Connections to the NGSS** |
| **5-PS1-1 Matter and Its Interactions:** https://www.nextgenscience.org/dci-arrangement/5-ps1-matter-and-its-interactions**5-PS1-2 Matter and Its Interactions:** https://www.nextgenscience.org/pe/5-ps1-2-matter-and-its-interactions5-LS2-1 Ecosystems: Interactions, Energy, and Dynamics: https://www.nextgenscience.org/dci-arrangement/5-ls2-ecosystems-interactions-energy-and-dynamics  |
| **Performance Expectations** |
| 5-PS1-1 Develop a model to describe that matter is made of particles too small to see.5-PS1-2 Measure and graph quantities to provide evidence that regardless of the type of change that occurs when heating, cooling, or mixing substances, the total weight of matter is conserved.5-LS2-1 Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment. |
| **Science and Engineering Practices**  |
| **SEP *Developing and using models****: Develop and/or use models to describe and/or predict phenomena.*  | Students develop physical, diagrammatic, and computational models of the landfill bottle systems.  |
| **SEP *Constructing an explanation****: Identify the evidence that supports particular points in an explanation.* | Students construct an explanation that microbes break down solid food materials and turn them into gas, which allows matter to be conserved in the closed landfill bottle system.  |
| **Disciplinary Core Ideas**  |
| **DCI *PS1.A****: Matter of any type can be subdivided into particles that are too small to see, but even then, the matter still exists and can be detected by other means. A model showing that gases are made from matter particles that are too small to see and are moving freely around in space can explain many observations, including the inflation and shape of a balloon and the effects of air on larger particles or objects.* | Students figure out that the smell from the landfill bottles is a gas made of particles that are too small to see and are moving around freely.  |
| **DCI *PS1.A****: The amount (weight) of matter is conserved when it changes form, even in transitions in which it seems to vanish.* | Students figure out that the weight of the closed landfill bottle system stays the same, even though food materials appear to vanish.  |
| **DCI *LS2.A*** *(partial DCI): Some organisms, such as fungi and bacteria, break down dead organisms (both plants or plants (sic) parts and animals) and therefore operate as “decomposers...”*  | Students figure out that microbes break down solid food materials and turn them into gas.  |
| **Crosscutting Concepts**  |
| **CCC *Cause and effect - Mechanism and prediction****: Cause and effect relationships are routinely identified, tested, and used to explain change.* | Students explain how microbes cause changes to food materials in the landfill bottles.  |
| **CCC *Energy and matter - Flows, cycles, and conservation****: Matter flows and cycles can be tracked in terms of the weight of the substances before and after a process occurs. The total weight of the substances does not change. This is what is meant by conservation of matter.* | Students figure out that matter (in the form of gas particles) stays inside the closed landfill bottle but flows out of the open landfill bottle. |
| **CCC*****Systems and system models****: A system can be described in terms of its components and their interactions.* | Students observe the open and closed landfill bottle systems over time. |
| **Connections to the Common Core State Standards** |
| **English Language Arts****SL.5.1:** Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 5 topics and texts, building on others' ideas and expressing their own clearly.  | Students engage in discussions with peers and their teacher about different model types to explain a phenomenon and develop science understanding. |
| **Mathematics****5.NBT.3.B:** Compare two decimals to thousandths based on meanings of the digits in each place, using >, =, and < symbols to record the results of comparisons  | Students compare the weight data from their computational models with the weight data from their physical models. |