

Grade 9 Physical Science Lesson Plan: Recycle Right – Reducing Contamination in Classroom Bins

Lesson Plan

Approximately 5 hours of instruction

Brief Lesson Description: Students will learn the importance of recycling while minimizing contamination in recycling bins. They will act as ambassadors for correct recycling in the school by visiting other classes, speaking to those classes about the need to minimize contamination, and conducting audits of classroom bins and collecting quantitative data on contamination minimization.

This lesson takes place within the unit on Energy. Prior to the lesson, students have learned about various sources of energy and the concept of transforming energy into work; the lesson thus incorporates these concepts into real-world technological challenges, such as how to manage resource use in the most energy-efficient ways. The lesson precedes the unit on Thermodynamics, wherein students will expand the application of what they've learned and apply it to concepts of the laws of conservation of energy and entropy.

This lesson has been developed specifically with a 9th grade ELL population in mind, many of whom are very recent immigrants, have very limited English proficiency, and have had interrupted formal education. Therefore, it relies heavily on visual cues, hands-on activities, groupings of higher English proficiency students with lower proficiency students, and allowance for students to incorporate their native language when language barriers may lower students' ability to access content. However, many of these strategies may also be applicable to struggling middle school Physical Science students who are below grade level in reading and literacy.

Materials

All should be readily available in science classrooms; recycling bins should be available in all DC public schools.

- Projector or SmartBoard with sound
- Disposable latex gloves
- Variety of recyclables (paper, cardboard, aluminum cans, plastic bottles) and non-recyclable
- Bins for trash, recycled paper, plastic/aluminum
- Colored pens and markers
- Rulers
- Graph paper
- Blank paper
- Large poster paper

Standards		
Performance Standards		
MS-ETS1-2. Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.		
MS-ETS1-3. Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.		
Lesson Plan- 5E Model		
Engage (40 minutes) The Process of Sorting Students participate in a sorting activity in which they must separate recyclable paper, cardboard, aluminum cans, plastic bottles and non-recyclable trash and put them in appropriate containers. Student groups with correctly sorted materials will be “paid” with treats of the teacher’s choice.		
Students will need: Science notebooks, disposable latex gloves, bilingual dictionaries (if available).		
Teacher will need: Projector or smart board with sound, cardboard boxes large enough to hold reasonable amount of trash samples (one box per group), assortment of trash (non-recyclables and recyclable paper, cardboard, aluminum cans, plastic bottles), cereal bars or other means of “payment” for recyclables.		
DAY 1		
Teacher	Students	Notes
Whole Class (in groups) (10 minutes) Divide class into groups of four. Assign roles to group members: recorder, spokesperson, supervisor, materials manager. Provide each group with box full of various items of trash (recyclable paper, cardboard, aluminum cans, plastic bottles, and non-recyclable trash) and disposable latex gloves. Explain that they are to sort the items and put each in proper container (paper and cardboard, bottles and cans, non-	Discuss within group the proper way to sort. When group agrees that it has done the task correctly, group spokesperson informs the teacher.	This part of the lesson hooks student interest with a fun activity that has a clear reward if done correctly. It introduces the idea of the importance of correct sorting without contamination as well as the idea that doing the job correctly has an economic payoff. Treats for paying students are at the teacher’s discretion. I like cereal bars because they are relatively healthy. Alternatively, the teacher can use non-food rewards that the students

<p>recyclable trash). Each group must come to agreement on the result. If correct, each group member is “paid” for the recyclables. Contaminated containers receive no payment.</p>		<p>would appreciate. It is important to enforce the rule that incorrect sorting results in no reward. The teacher may choose to give failing groups a second chance for a reward, in the interest of equity.</p>
<p>Whole Class: (10 minutes) Escort students to the paper compacter, trash compacter and bottle/can pick-up at school loading dock so they can see where the materials from the classroom bins go.</p>	<p>Students accompany teacher to loading dock.</p>	<p>An available member of the custodial staff may be recruited to accompany the class and explain to the students what they do with the classroom trash and recyclable every day, and why proper sorting makes their job easier.</p>
<p>Whole Class (individually, then in groups) (20 minutes) Show class the 5-minute video “Bytesize Science – Beyond the blue bins: The journey of recyclable materials,” which shows a local sorting facility in Montgomery County, Maryland: https://www.youtube.com/watch?v=yzBGGhRpz-U The video can be showed with closed-captioning to assist English language learners.</p> <p>Have students individually answer the two questions on the video in their notebooks.</p> <p>When all students have written <u>some</u> answer, have them share the answers with their group and discuss them. The group recorder should write down answers that the group agrees are the best, and each group will next share out their best answers as teacher writes them on board.</p>	<p>Answer questions on video in notebooks:</p> <ol style="list-style-type: none"> 1. Why are they sorting the trash (or separating it into groups)? 2. Why are the paper, aluminum cans, and plastic bottles valuable? 	<p>Teacher should monitor students to ensure they are working individually and not copying.</p> <p>Students should be prompted to provide in-depth answers (e.g., beyond “to recycle them” as an answer to the first question. Why recycle them?). Teacher should encourage a variety of answers, and if students did not get an answer from the video, they should write what they <u>think</u>. Very low English proficiency students can be encouraged to write words or phrases if unable to write complete sentence; if even this is not possible, they can be allowed to write in their native language and have a partner help to translate.</p> <p>The goal here is to get students to appreciate that recyclables are worth money, and to begin to explore why (they allow new products to be made using less energy and fewer raw materials).</p>



Explore (95 minutes): Benefits of Recycling, Tied to Energy Efficiency.

Students research the benefits of recycling in terms of energy efficiency, and how this is related to economic benefits.

Students will need: Science notebooks, “How Recycling Saves Energy” information sheet and questions, large index cards, markers, paper strips, Sentence Kernel Expansion sheet, dictionaries.

Teacher will need: Copies of “How Recycling Saves Energy” information sheet, copies of “Recycling and Energy” Sentence Kernel Expansion sheet, blank sheets of paper, sample trash, recycled paper and aluminum/plastic bins, variety of items for each (recyclable and non-recyclable).

Teacher	Students	Notes
<p>Whole Class (in groups) (20 minutes) Give each student the information sheet “How Recycling Saves Energy.”</p>	<p>Take turns in group reading the information sheet, then answer the questions in notebook.</p>	<p>To build vocabulary, whenever students are assigned a reading, each member of the group is given a large index card and marker to write one new vocabulary word encountered in the reading for the Word Wall. Each student also receive a paper strip big enough to write a definition and/or draw a picture to help in defining the word. These are added to the Word Wall at the end of class.</p> <p>The “How Recycling Saves Energy” information sheet contains four questions that assess student literacy and proficiency at reading for content. There is also an extra credit challenge question that extends the lesson for higher-level students by requiring deeper reading for comprehension and mathematical calculations. This question may require more teacher explanation; whether to devote class time to this is left to the teacher’s discretion.</p>
<p>Whole Class (in groups) (20 minutes) Give each student the Sentence Kernel Expansion sheet “Recycling and Energy.” There are four different sheets for each group, and they are differentiated in the</p>	<p>Create two sentence using the guidance on the sheet and information from “How Recycling Saves Energy.”</p> <p>When all students in a group finish, take turns</p>	<p>Sentence Kernel Expansion sheets provide a means for students to construct more complex sentences from simple starting (or kernel) sentences, which they will then incorporate into their presentations to other classes. There are</p>

level of difficulty.	sharing with the group. When all in group are satisfied, the spokesperson informs the teacher, who collects the sheets for grading.	four different sheets at various proficiency levels, and they are assigned to each student in a group according to his or her English proficiency level. Students first answer the guiding questions, then use the answers to complete the more complex sentence.
DAY 2		
Whole Class (in groups) (5 minutes) Return graded Sentence Kernel Expansion sheets.	Do-Now: Copy new vocabulary from last class (on Word Wall) into science notebook while teacher passes out graded Sentence Kernel Expansion sheets.	Students should make corrections to their Sentence Kernel Expansion sheets as needed before moving on.
Whole Class (in groups) (20 minutes) Give each student a blank sheet of paper.	Students work in groups to create posters for visual part of presentation. Materials managers are responsible for getting colored pens and markers for groups, and each student in group creates a visual representation to illustrate the idea represented by his or her expanded sentence kernel.	Possible types of illustration could be: <ul style="list-style-type: none"> • For “Recycling is important,” an illustration of what recycling is. • For “Using energy has problems,” an illustration of the problems associated with using energy. • For “We recycle in the classroom,” an illustration of how we recycle in the classroom. • For “It is important not to have contamination in the bins,” an illustration of what contamination looks like.
Whole Class (individually and in groups): (15 minutes) Instruct students to use the “How Recycling Saves Energy” information sheet to add one additional sentence to their Expanded Sentence Kernel which expounds on their idea.	Students copy their Expanded Sentence Kernel in their notebooks and write one additional sentence. They can use information in the “How Recycling Saves Energy” information sheet, or come up with their own idea. They will read or speak these sentences when their group presents to other classes.	Students should be encouraged to create their own original sentence, but some may only be able to paraphrase a sentence from the information sheet. Teacher should circulate to encourage students and offer ideas to those who are stuck (“Why do we want to save money?”, “How does contamination reduce energy efficiency?”, “Why should the other students care?”).

<p>Whole Class: (15 minutes) Teacher demonstrates for class how they will conduct audits when they visit other classes. Enlist student help to go through contents of recycled paper bins and plastic bottle/aluminum can bins.</p>	<p>Students demonstrate that they understand how to audit by saying whether sample bins are correct (no evidence of contamination) or incorrect (evidence of contamination).</p>	<p>Students should understand that even one incorrect item in a bins makes the entire bin incorrect. It should be emphasized that students need to be accurate and honest in recording data.</p>
<p><u>Key instructional decisions, evidence, and possible next steps.</u></p>		
Decision	Evidence	Next Steps if “no”
<p>Do students understand the connection between recycling and energy efficiency?</p>	<p>Performance on “Recycling and Energy” Sentence Kernel Expansion sheets.</p> <p>Written scripts in notebook for presentations.</p>	<p>Review “How Recycling Saves Energy” information sheet.</p> <p>Run through calculations for extra credit question on sheet to support quantitative understanding of the concept.</p>
<p>Do students understand how reducing contamination maximizes energy efficiency in the recycling process?</p>	<p>Presentations to classes; answers to questions after presentation.</p> <p>Presentation support products: posters and illustration.</p>	<p>One-on-one work with groups to identify sources of misunderstanding.</p> <p>“What-if” scenarios with groups or whole class:</p> <ul style="list-style-type: none"> • What if a car gets water contamination in its gas tank? Will the engine be more or less efficient? • What if non-plastics get in the plastic stream? Do they need to be removed? Does that take more work? So does that take more energy?
<p>Do students understand how to do a proper audit?</p>	<p>Student performance during practice audit.</p> <p>Data recording in notebook.</p>	<p>Review procedure for audit again. Have students do practice runs while others grade them on performance.</p>

<p>Explain (45 minutes): Educating Fellow Students About Reducing Contamination in Classroom Bins Students act as ambassadors to other classes, making presentations to classes about the importance of recycling correctly and minimizing contamination.</p> <p>Students will need: Science notebooks, large sheets of poster paper (1 per group) with each group member’s illustration taped or glued to it (four sheets per poster), latex gloves.</p> <p>Teacher will need: List of classrooms prearranged for 10-minute visits.</p>		
DAY 3		
Teacher	Students	Notes
<p>Whole Class (in groups): (45 minutes) Teacher escorts class to pre-selected classes.</p>	<p>Each group makes a presentation to a class. The presentation consists of introducing themselves, taking turns speaking (using Expanded Sentence Kernels and associated sentences from notebooks, referring to notes as needed), and references to poster.</p>	<p>Depending on proficiency levels, students may be able to speak extemporaneously or may have to rely on reading notes. The Presentation Rubric offers a guide in grading presentations, and focuses on professionalism, poise and effort.</p>
<p>Elaborate (90 minutes): Auditing Bins in Classrooms, Before and After Presentations Students conduct audits of classrooms they visit, consolidate the data, then conduct a follow-up audit one week later.</p> <p>Students will need: Science notebooks, latex gloves.</p> <p>Teacher will need: List of classrooms prearranged for 10-minute visits.</p>		
Teacher	Students	Notes
<p>Whole Class (in groups): (45 minutes) After making a presentation, the group conducts a preliminary audit of the classroom’s recycling and trash bins.</p>	<p>Students record the date and room number in their notebooks, as well as number of correct and incorrect recycling and trash bins. Before leaving, they inform the class that they will return in 1 week to do another audit, in which it is hoped that some improvement will be seen.</p>	<p>Each group is responsible for auditing the classroom in which it gives its presentation. All students in group record data, which is simply</p> <ul style="list-style-type: none"> • Number of Correct (and Incorrect) Paper Recycling Bins • Number of Correct (and Incorrect) Plastic/Aluminum Recycling Bins • Number of Correct (and Incorrect) Trash Bins <p>Numbers will most likely be either 1 or 0, or NA if bin is not in classroom.</p>

DAY 4		
<p>Whole Class (in groups): (45 minutes) One week later, teacher conducts groups to same classrooms previously audited.</p>	<p>Conduct follow-up audits, exactly as before, and record data.</p>	
<p>Evaluate (45 minutes): Analyzing Data, Evaluating Success of Model, and Formulating Next Steps to Reduce Contamination School-Wide Students evaluate the data, present it and devise an action plan to minimize contamination in classroom bins throughout the school.</p> <p>Students will need: Science notebooks, graph paper, colored pens or markers, rulers.</p> <p>Teacher will need: White board to post all data.</p>		
DAY 5		
Teacher	Students	Notes
<p>Whole Class: (10 minutes) Teacher creates a data table on board and writes data as each group calls out their results (for 1st audit and 2nd audit, number of correct and incorrect bins).</p>	<p>Spokesperson for each group calls out its data, and all students record the data table in their notebooks.</p>	
<p>Whole Class (in groups and individually): (20 minutes) Demonstrate for class how to calculate percent on white board. Give each student a sheet of graph paper. Demonstrate for class how to set up axes for making bar graph of data (Y axis: % correct, X axis: type of bin and date).</p>	<p>Students calculate total percent bins correct for each type of bin at each audit (1st and 2nd). Students make bar graphs to illustrate data.</p>	<p>Teacher circulates constantly to make sure all students understand task.</p>
<p>Whole Class (in groups) (15 minutes) Have students discuss in groups what next steps to take in minimizing contamination of classroom bins.</p>	<p>Each group supervisor facilitates the discussion while recorder writes down ideas.</p>	<p>Teacher may prompt groups with questions:</p> <ul style="list-style-type: none"> • How can we educate the whole school? Posters in halls? Make a video? Article in paper? • What about a schoolwide competition? How to do it? What prizes? <p>From ideas, further activities (and audits) can be planned to improve school recycling.</p>



<p>Whole class (in groups): (45 minutes, and 1 day per week for next four weeks): Show students the DGS information from the guidance document and go over the procedure, emphasizing the awards for the best performers. Make a four-week plan for gathering data for the Recycle Right Competition – Paper Edition: http://dgs.dc.gov/publication/dc-recycle-right-competition Begin with gathering baseline data from at least 10 classrooms.</p>	<p>Each group decides on which classroom they want to collect data from. Materials manager gathers the appropriate data collection materials (provided by DGS); supervisor leads group in mapping out a plan of action.</p>	<p>This is a four-week final project that will incorporate students’ auditing and data collection skills and their communication skills at encouraging others in the school to recycle right, focusing on paper.</p> <p>Depending upon the number of student groups, if each group is responsible for one classroom, then it may be possible to cover most classrooms in the building.</p>
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