High School Recycle Right Competition-Paper Edition Lesson Plan
Full-Cornerstone Lesson Plan **Approximately 6 hours of instruction**
Brief Lesson Description: Students will learn that recycling cleanly is key to making recycling efforts environmentally and economically effective and that peer and larger community education is the key to meeting recycling goals. Students will develop a school-wide media plan to improve recycling practice and monitor the progress of the program using authentic data aligned with the DCPS Recycles! ***Recycle Right Competition—Paper Edition*** guide. In 5E lesson format, students will research general and DC-specific recycling issues and programs in order to create narratives that articulate accurate information to the school community regarding effective recycling practice. Using experimental observations and multiple research techniques, they will identify and respond to Quality Indicators, draft public service announcements, engage in peer review against the indicators, revise their message as necessary and present it to the school community. Students will analyze data collected from classrooms to evaluate the effectiveness of their message (to recycle correctly). Resources include text selections at various reading levels with guidance handouts, an on-line recycling video game, a lab activity, and the ***Recycle Right Competition—Paper Edition*** document (DC DGS 2016). **Unit objective: Students will develop a plan that decreases the contamination of recycled paper in all areas of the school. Students will verify the effectiveness of the plan by collecting and analyzing empirical data.**

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Materials and Supplies

Your supply kit contains:

Classroom Supplies to Gather

Item	Purpose	When used
DC Recycle Right Competition – Paper Edition instructions (DC DGS 2016)	Student information	Throughout lesson
Graph paper	Graphing data	Elaborate
Student notebooks, whiteboards	KWL, recording observations	Throughout lesson
Guidance handouts	Development of media and logistics planning	Explore, Explain, Elaborate
Lab materials: sample allotments of contaminated recycled paper, scale, gloves, timepiece, screen, newspapers, blender, tub, rags, sponge, lab instructions, goggles	Completing **The Cost of Contaminant Removal in the Paper-Making Process** Lab	Engage

Technology Resources to prepare

Internet access, Smartboard or other projection device	Student research, teacher presentations	Throughout lesson
Recycling Paper and Cardboard Discovery Channel, 2008. Discovery Education. Web. 9/8/2016. (**Science Techbook**) http://www.discoveryeducation.com. https://app.discoveryeducation.com/learn/videos/53c248fc-deea-4e2c-8fa6-18a0e7ed4986?hasLocalHost=false	Making paper from recycled materials background	Engage
Supersorter on-line video game http://www.iwanttoberecycled.org/game	Background for factors effecting efficient recycling	Explore

Key Standards		
Science and Engineering Practice **Constructing Explanations and Designing Solutions** • Evaluate a solution to a complex real-world problem, based on scientific knowledge, student generated sources of evidence, prioritized criteria, and tradeoff considerations. • Design or refine a solution to a complex real-world problem based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. **Obtaining, Evaluating and Communicating Information** Communicate scientific and technical information (e.g. about the process of development and the design performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically.) **Analyzing and interpreting data** Analyze data using computational models in order to make valid and reliable scientific claims.	**Disciplinary Core Ideas** **ESS3.C Human Impacts on Earth's Systems** Scientists and engineers can make major contributions by developing technologies that produce less pollution and waste and that preclude ecosystem degradation. **PS2.B Types of Interactions** Attraction and repulsion between electrical charges at the atomic scale explain the structure, properties and transformations of matter, as well as the contact forces between material objects. (HS-PS2-6) **ETS1.A Defining and Delimiting Engineering Problems** Humanity faces major global challenges today, such as the need for supplies of clean water and food or for energy sources that minimize pollution, which can be address through engineering. These global challenges also may have manifestations in local communities. **ETS1.B Developing possible solutions** When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and	**Crosscutting Concepts** **Influence of Science, Engineering, and Technology on Society and the Natural World** New technologies can have deep impacts on society and the environment, including some that were not anticipated. **Systems and System Models** When investigating or describing a system, the boundaries and initial conditions of the system need to be defined and their inputs and outputs analyzed and described using models. **Structure and Functions** Investigating or designing new systems or structures requires a detailed examination of the properties of different materials, the structures of different components, and connections of components to reveal the structures function and/or solve a problem.

	aesthetics, and to consider social, cultural, and environmental impacts. **ETS1.C: Optimizing the Design Solution** Criteria may need to be broken down into simpler ones that can be approached systematically, and decisions about the priority of certain criteria over others (tradeoffs) may be needed.	

Performance Expectations
HS-ESS3-4. Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.* Examples for limiting future impacts could range from local efforts (such as reducing, reusing, and recycling resources)
HS-PS1-3 Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles. (for paper-making lab experience)
HS-PS2-6 Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials. (for paper-making lab experience)
HS-ETS1-1 Analyze a major challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.
HS-ETS1-2 Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

HS-ETS1-3 Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.

Lesson Plan

Day 1

ENGAGE

Daily Objective and Summary : Students will state the purpose of the DCPS Recycle Right competition and know their role in the initiative. Students will describe aspects of the recycling process and their participation at the school and personal level. Students will conduct an experiment that demonstrates the effect of contamination on the cost and quality of materials made from recycled sources.

Teacher will need: Smartboard or overhead projector, task description from DGS ***Recycle Right Competition—Paper Edition*** document, materials and instructions for paper-making lab

Students will need: science notebooks, whiteboards and markers, copies of task outline, access to internet, materials and instructions for *The Cost of Contaminant Removal in the Paper-Making Process Lab*

Teacher	Students	Notes
Lesson Block Format: Individual, then small and large group discussion. (10 minutes) Warm up: Direct students to write the title "Recycle Right! Project" in their notebooks and brainstorm the word ***recycling*** **in KWL** format. Develop word list for clarification during conferencing. Facilitate accountable talk.	Warm up: Individually, students list five things that they know about recycling and five questions that they have about recycling. Students share lists with small groups and write prioritized list on white boards for whole class sharing.	Start to develop tier 2 and 3 words for word wall. Leave white boards up for next day or take pictures of them for later display on Smart board.
Whole class (10 minutes) (on Smartboard and student copies) Present task as outlined in **About the Recycle Right Competition—Paper Edition** section. Explain student roles and options within task.	Read task and respond in notebook: • *The overall goal of this project is to…* • *In this project, I (or members of the class) will…*	*Quality Indicators:* • *Sophistication: masterful use of content* Can I clearly articulate (verbally and in writing) the goal of the competition? Can I state and elaborate upon two problems created by contamination in recycled loads?

Lab groups/50 minutes Provide instructions to students for creating a model that represents issues with contamination: The Cost of Contaminant Removal in the Paper-Making Process Lab Prepare contaminated samples for each lab group ahead of time. Prepare lab space for efficient use of time. Circulate to ensure cooperative efforts and clarification of procedures. Ask probing questions and check for understanding	Carefully follow instructions for the removing contaminants and making paper lab activity. Record qualitative and quantitative data. Draw diagram of one step of process and label all aspects. Complete ***analysis*** sections of lab.	• *Craft: Precision, technique, care* *Am I using appropriate and sophisticated vocabulary in descriptions?* • *Voice: conviction, style, power* Are reflections on lab procedure written in scientifically appropriate language (tier one and two vocabulary, identification of equipment) Is diagram adequately labeled and accurately drawn with appropriate detail? **Other notes:** Scaffold lab analysis as necessary. Summary can be written as homework and revisited for warm-up the next class period. Run through lab prior to class to determine timing and to troubleshoot. After drying and mark-up, the paper can be taped into the student notebook with some reserved for classroom display.

Key instructional decisions, evidence, and possible next steps.

Decision	Evidence	Next Steps if "no"
Can students state two problems that contamination in the recycle stream cause?	Written lab response	Go over data to make connection of time and money concerns
Can students state the purpose of the competition?	Notebook response	Review About Recycle Right section of document

Day 2

EXPLORE:

Daily Objective and Summary. Students will research global and local recycling guidelines and initiatives using prompts such as *recycling contamination, DC recycling, recycling costs and benefits.* Students will take notes and cite sources of information. Students play ***Supersorter*** (sorting at the recycling center) game http://www.iwanttoberecycled.org/game in order to identify issues related to contamination in the recycling stream.

Teacher will need:. Smartboard or other projection device, DGS ***Recycle Right Competition—Paper Edition*** document
Students will need: internet access, suggested searches handout, DGS ***Recycle Right Competition—Paper Edition*** document

Teacher	**Students**	**Notes**
Small group research (60 minutes) Teacher will model researching, note-taking, and citing sources Example: Go to Recycling Facts - A	Follow ***Guidelines for Research on Contamination in Recycling (student handout)*** to collect background information about economic and environmental issues of recycling and contamination of recycled materials. Go to	Notes: Students can skim through the University of Michigan site (link in student column) to get insight into what makes people more likely to recycle correctly and reflect on their own

Recycling Revolution www.recycling-revolution.com/recycling-facts.html Show how key questions (provided in handout) can be answered. Provide search prompts/questions and monitor student research. Direct students to the on line game about how recyclables are sorted at a recycling facility.	http://sustainability.umich.edu/environ211/recycling-bin-contamination site to to research strategies that are most successful in getting people to recycle and NOT contaminate. With a partner, play **Supersorter** game (sorting at the recycling center) http://www.iwanttoberecycled.org/game Exit ticket samples: Two problems with contaminated recycling loads… According to _____ it is *problematic* when recycling loads are contaminated because _____. Additionally, _____ DC has a legislated goal of 45% diversion. What does that mean and how does contamination affect that?	recycling behavior. (Based on a campaign similar to ours.) **Supersorte**r game can be used in pairs or individually. It may also be an option—students who opt to play can explain its key points to kids who didn't play it. Q**uality Indicators:** • *Sophistication: masterful use of content* Can I describe at least two benefits of recycling and cite examples? • *Craft: Precision, technique, care* Can I explain two problems with contamination of recycling samples using appropriate vocabulary? Can I describe the economic and environmental aspects of the workings of the recycling center in the **Supersorter** game? • Voice: Conviction, style, power Is my argument convincing enough even though I do not immediately benefit?

Day 3

EXPLAIN

Objective and summary: Students will be able to explain the rationale for and goal of the Recycle Right Competition—Paper Edition and connect bin contamination to DC's diversion goal. Students will complete one or more Level II components of the class-developed Recycle Right! information dissemination plan. (Key components may include presentations in individual classrooms, video announcements on digital outlets, and other communication options to be determined by students. Handout is attached.)

Teacher will need: Smartboard or other projection device, Student Tasks handout
Students will need: computer access, researched information, details of DGS Recycle Right! competition—Paper Edition, Student tasks: handout

Teacher	Students	Notes
Whole group instruction (15 minutes) Monitor discussion of most compelling arguments for recycling the right way. Highlight points made previous day on whiteboard. Explain connection between contamination and diversion goals: *Loads that are picked up and deemed too contaminated are sent to the landfill with no recycling. This means that there has been NO diversion of waste away from the landfill or incinerator.* Lead discussion of key points and suggested strategies in DGS ***Recycle Right***	Warm up: Participate in review of research (from Explore) that can be used for school-wide dissemination Take notes on diversion goals presentation. Interact with peer editors and related student groups as necessary to refine product.	Explicit, direct explanation of waste diversion goals is most efficient here and will connect the issue to the local community. The PARCC rubric can be used to evaluate the students' paragraphs. **Quality Indicators:** • *Sophistication: masterful use of content* Is script/schedule/talking point/lab analysis demonstrating an understanding

Competition—Paper Edition document.		of purpose? Am I thoughtfully incorporating peer feedback in my presentation and other tasks? Can I make a direct connection between contamination of loads and the DC diversion reduction goal? • *Craft: precision, technique, care, beauty* What vocabulary and background documentation have I infused? • *Voice: conviction, style, power* Am I going to convince my audience? How will I know? How can I get feedback if I'm not?
Individual (15 minutes) Direct students to write a paragraph that defines and summarizes the problems created when recycled materials are contaminated.	Write 1-2 paragraph argument that responds to the prompt: Contamination of recycled materials loads cause problems…	
Small group ((45 minutes)	Choose role from **Level II Tasks** handout and form small group or partnership and develop job list and	

Provide handout with list of tasks/roles. Direct students to choose a particular role in information dissemination project and to form working groups. Provide templates and suggested actions for student roles.	time line for group use. (Refer to provided checklist.)	

Key instructional decisions, evidence, and possible next steps.

Decision	Evidence	Next Steps if "no"
Can students explain and cite evidence of problems associated with recycling contamination?	Constructed response assessed with PARCC rubric (link below)	Edit CR and revisit research notes and documents for evidence
Can students present information to school audience according to selected task?	Convincing argument in script or sign	Peer review, edit, modify

PARCC rubric link: https://parcc.pearson.com/resources/practice-tests/english/Grade6-11-ELA-LiteracyScoringRubric-July2015.pdf

Day 4

ELABORATE

Objective and summary: Students will collect and record baseline data and develop graphing strategy appropriate to the current and future data for this Recycle Right! competition. Students will collaborate with peers to modify presentations (with added lab data) as necessary in order to prepare for school-wide media presentations. Students will implement the information dissemination plan according to the schedule.

(Students will collect data weekly for three weeks.)

Teacher will need: Smart board or overhead projector for sharing of data, DGS **Recycle Right Competition—Paper Edition** document, graph paper visual to project
Students will need: DGS **Recycle Right Competition—Paper Edition** document, clipboards and data tables for data collection, prepared presentations, graph paper, results of paper-making lab, **DCPS Recycles! Honor Roll Self-Assessment** http://dgs.dc.gov/sites/default/files/dc/sites/dgs/publication/attachments/DCPS%20Recycles%21%20Honor%20Roll%20Self-Assessment.pdf

Teacher	Students	Notes
Whole group (10 minutes) Distribute **DCPS Recycles! Honor Roll Self Assessment** and explain that the top section has guidelines for what the classrooms and common areas should have. Explain to students that the school will be applying for the DCPS Recycles! Honor Roll at a later time.	Read document and ask clarifying questions as necessary.	Remind students that the dat collection process needs to take place in the least disruptive manner. Make sure that students have made the process clear to all participating teachers and staff in order to maintain good will.

Individual teams (15 minutes) Monitor student data collection.	Go to participating classes to collect baseline data. Option 1: Inspect bins on site, record data on provided table Option 2: Remove bins from room, inspect and return.	The process needs to take place in the least disruptive manner. Make sure that students have made the process clear to all participating teachers and staff in order to maintain good will. Each student team may be in charge of one area of the school. The data collection will take place 3 more times according the competition requirements.
Whole group (45 minutes) Model performing calculations on DGS Scoring worksheet. Explain graphing strategy: Question: What is the best way to graphically represent the type of data that we will be collecting? Model setting up graph. Consider the information that is best shown on the x- and y- axes. What are appropriate titles for graphs? What should be included in the caption?	Analyze data in DGS Scoring worksheet. Consider the information that is best shown on the x- and y- axes. Consider a title for the graph. Create graph and plot baseline data. Continue to graph data as it is collected in the following weeks.	**Quality Indicators:** • *Sophistication: masterful use of content* Is the graphed data in a format that is easily interpreted? Are the caption and title specific to the graph? • Craft: Precision, technique, care, beauty Is the numeric spacing appropriate? Are the points plotted accurately and with appropriate precision? • Voice: Conviction, style, power Does the caption help explain the information shown in the graph? Is the title clear and appropriate for audience?

Day 5

EVALUATE

Objective and summary: Students will review the data to determine the effectiveness of the strategies used to get the school community to recycle correctly. Students will write a report on the experience that includes the purpose, a timeline with examples of tasks, empirical evidence, an evaluation of project success, and next steps.

Teacher needs: report guidelines and scaffolding prompts, recycling quiz
Students need: rubric and report guidance, DGC **Recycle Right Competition—Paper Edition** document, notebook, access to internet

Teacher	**Students**	**Notes**
Individual (30 minutes) Prepare and administer quiz on recycling issues and related vocabulary. Explain guidelines and prompt for writing the report. Provide scaffolding as necessary.	Take recycling quiz. Write report on Competition project.	Quality Indicator notes: • Sophistication: Masterful Use of Content Can students clearly articulate the purpose of the competition? Can students evaluate the results of the project in terms of learning and action? • Craft: Precision, technique, care, beauty Do students use appropriate and sophisticated vocabulary throughout the report? • Voice: Conviction, style, power Is the report written in formal style appropriate to report audience?

Key instructional decisions, evidence, and possible next steps.

Decision	Evidence	Next Steps if "no"
Can students explain and cite evidence of problems associated with recycling contamination using appropriate vocabulary?	Appropriate accuracy on quiz	Review misconceptions and retest with modifications
Has the data been processed correctly and in a way to further the goal of recycling cleanly?	Accurate and evidence-based report to DGS	Review research and DGS document, rewrite
(For chemistry option) Can students articulate the problem with contamination as it relates to chemistry standard? (HS-PS2-6) (optional)	reference to types of intermolecular forces (with citation) and bulk scale forces involved	discuss everyday examples of intermolecular forces that determine properties

Sample project descriptions for ENGAGE:

Our class will be participating in a city-wide competition, the goal of which is to improve recycling practices in schools. Specifically, we will be monitoring the amount of contamination in recycling bins and the amount of recyclable paper that is in the regular trash.

In order to _____, members of the class will develop a multimedia informational plan to include public service announcements, classroom visits, and needs assessment.

Student tasks: (handout)

Everyone will not do everything! You will choose one or two tasks from the LEVEL II provided list, or if you think of something else important that needs to be done, you may propose a different one.

LEVEL I TASKS (all students participate in each task)

1. Collect and record data for baseline from X location.
2. Collect and record data for weeks 2-4.
3. Present results graphically.
4. Analyze results.

LEVEL II TASKS (students choose 1-2 tasks to perform individually or within a group)

1. Write script for classes.
2. Write script for specialty locations (depending upon school needs).
3. Write script for announcement screens.
4. Set up/organize schedule for classroom announcement visits.
5. Edit scripts and preview presentations.
6. Develop survey for teachers to determine barriers and solutions to recycling correctly.
7. Produce documentary of project.
8. Develop logistical plan for classroom visits with minimal interruption.
9. Develop plan for securing access to digital announcements.

10. Develop plan for signage (materials, messages).
11. Conduct the honor roll self-assessment (find at http://dgs.dc.gov/node/1177151)
12. Submit results to DGS in online forms.

Sample templates for starting the class information scripts:

I am _____ and I'm here to explain _____.

Our class is conducting an audit of classroom recycling practices. Many schools will also_____

You already have/will be getting a recycling bin in your class and it is important to _____ because _____

Guidelines for Research on Contamination in Recycling (student handout)

In the lab activity you were able to determine that contamination in a recycling sample created problems/inefficiencies. You will research the topic further in order to develop a message for dissemination throughout the school. Be sure to cite your sources.

Search prompts may include *recycling contamination, DC recycling, recycling costs and benefits*.

A specific site that may be a good place to start is: Recycling Facts - A Recycling Revolution www.recycling-revolution.com/recycling-facts.html

Also read through the **Recycle Right Competition—Paper Edition** document for information.

As you are browsing, consider the questions:

- How will we convince students to recycle correctly in their classrooms and beyond?
- How much energy can be saved by recycling one ton of paper/aluminum/glass…
- What is the problem with contamination of recycled materials?
- What is the problem with incinerating waste?
- How does DC recycle?
- What is ***Sustainable DC***?

Go to following site to research strategies that are most successful in getting people to recycle and NOT contaminate.
http://sustainability.umich.edu/environ211/recycling-bin-contamination

Checklists for development of media campaign (Student Handout)

Use the checklist related to the task or committee you are working on as a guideline. There may be other things that you need to do in order to successfully complete your task.

If you are selecting classrooms and other locations for participation…

- Develop a teacher invitation to participate in the recycle right competition.
- Develop a staff invitation to participate in the recycle right competition.
- Develop discussion points for speaking to custodian and building director.
- Contact teachers (go to classroom or email) to set up time to discuss coming into classroom.
- Create schedule to visit classrooms for collecting baseline data.
- Create schedule for speaker visits.

If you are on the signage committee:

- Develop list of potential classroom supports.
- Complete rough draft of classroom signs.
- Elicit peer input on classroom signs.
- Prepare classroom and common area signs.
- Distribute classroom signs.

If you are working on the Public Service Announcement for digital messages…

- Set up training session for PSA submission.
- Create PSA for placement on school-wide announcement screens.
- Submit edited announcement through appropriate channels.

If you are part of the data collection squad…

- Develop or modify data table for weekly surveys.
- Develop and post schedule for data collection (time and personnel involved).
- Review DGS documents: Bin Survey Submission form.
- Write story for “share a story!” section of submission form.

- Edit and submit story for “share a story!” section of submission form.
- Take pictures of any related activities for submission.

If you are documenting the project…

- Collect photo release documents and note any opt-outs
- Determine recording equipment needs
- Create modified story boards to ensure adequate coverage.
- Make a plan for editing.