Teacher/Facilitator Guide

WAVE OF PLASTIC
Meaningful Watershed Educational
Experience

LESSON ONE:
A PLANET FULL OF PLASTIC

☐ How do we describe, quantify, and communicate about issues related to plastic waste?

☐ What is per-capita consumption and how do our choices and activities regarding the consumption and disposal of materials contribute to plastic waste?

☐ What choices are available for reducing our own personal plastic waste? What are the effects of those choices?

☐ How can we communicate our ideas, inform perspectives, and inspire action?

Unit Driving Question:
How do human choices regarding the consumption and disposal of plastics impact ecosystems and our communities and what actions can we take to minimize those impacts?

Wave of Plastic MWEE Unit Next Generation Science Performance Expectations

Earth and Human Activity

1. **MS-ESS3-4.** Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.

2. **MS-ESS3-3.** Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.

Lesson One Key Ideas

- Increasing human populations impact the consumption and the disposal of plastic products we use in everyday life.
- 'Per capita consumption' refers to the average amount used by a single individual with respect to a larger population.
- Per-capita consumption and disposal of plastic waste has both short-term and long-term effects.
- Mass production of plastic is increasing rapidly. Even as recycling rates increase, the amount of plastic waste that ends up in landfills is increasing at a much faster rate. Other choices, such as reducing the amount we use and refusing to consume items (like single-use plastic), can help to lower consumption rates.
- Students can take action to mitigate the impact of per-capita consumption and disposal of plastic by engaging communities and informing perspectives.

Lesson One Overview

	Goal	Description	Activities
Part 1 Introduction	Building Understanding	Explore the prevalence of plastics and plastic waste in everyday life	1. **Activity:** Personal Waste Inventory 2. **Analyze, Share, & Reflect:** Students present their data graphically, reflect, and discuss it with their peers.
Part 2 Investigation	Integrating Information and Ideas	Investigate issues about **per-capita** consumption and disposal of plastic and consider alternative choices.	3. **Read, Review, & Respond**: Students analyze a variety of resources to make sense of **per-capita** plastic consumption and respond to questions in their Student Workbooks 4. **Activity:** "Waste Reduction Roundabout"
Part 3 Application	Applying What We Learned Through Informed Action	Engage communities with public service announcements.	5. **Engaging Others**: Public Service Announcement Students create posters, flyers, or social media messages to persuade others to consider choices regarding the consumption & disposal of plastic waste.

Part 4 Assessment	Demonstrating Our Understanding	Complete a constructed response using the *Claim, Evidence, Reasoning* model.	6. **Construct an argument supported by evidence:** Students describe the connections between the number of people in a society, the amount of plastic waste that they generate, and why it might be a problem.

Part 1- Introduction: Building Understanding

Objectives:
- o We will ask questions and make observations about how our choices regarding the consumption and disposal of materials contribute to issues of plastic pollution.
- o We will conduct inventories of the amount of waste we create in a given day.

1. Personal Waste Inventory

Students will:	Materials & Resources
☐ Collect an inventory of the waste they produce in one day *(suggested homework activity)*. ☐ Respond to the *Personal Waste Inventory* questions in their Student Workbooks. **NOTE: You might find it productive to have students analyze and reflect on the **sample waste inventory** that is provided in this lesson. Be sure to save the* Personal Waste Inventory *for a follow-up activity in Lesson 2.*	▪ Lesson One: Student Workbook

Whole Group Discussion Questions:

- Why do you think we are keeping track of the amount of trash we create?
- Use your prior experiences and what you know about cause and effect to predict the type of trash you think you and your classmates will produce the most.

2. Analyze, Share, & Reflect

Students will:	Materials & Resources
☐ Use the charts in their Student Workbooks to organize their waste data according to the type of material. ☐ Work with the teacher/facilitator to create a **class tally chart** to draw conclusions about how the amount of waste increases with the number of individuals. ☐ Present their data graphically, reflect, and discuss it with their peers. **NOTE: You might choose to have students graph their own data, the class data, or both.* ☐ Students will reflect on the experience through whole-group discussion and written responses.	▪ *Optional*: Online graphing tools *(such as National Center for Educational Statistics' Create a Graph)*

Whole Group Discussion Questions:

- *Review & Discuss the questions in the Student Workbook*

SAMPLE Personal Waste Inventory

Name: **Antonio**   Day & Date: **Monday, April 13th, 2020**

Items that I Discarded				
Item	**Why was it used?**	**From what type of material was it made?**	**What did I do with it when I was finished using it?**	**Notes**
Chip bag	food	Plastic and metal (foil)	☑ Put it in a garbage bin ☐ Recycled it ☐ Reused it ☐ Composted it ☐ Other	
Soda can	food/snack	Metal	☐ Put it in a garbage bin ☑ Recycled it ☐ Reused it ☐ Composted it ☐ Other	I drank this in the school cafeteria and there was a recycling bin, so I put it the bin
Pudding cup	food/snack	Plastic	☑ Put it in a garbage bin ☐ Recycled it ☐ Reused it ☐ Composted it ☐ Other	I put it in the trash can because there wasn't a recycling bin nearby
Water bottle	food/drink	Plastic	☑ Put it in a garbage bin ☐ Recycled it ☐ Reused it ☐ Composted it ☐ Other	I drank this at basketball practice and there wasn't a recycling bin nearby, so I threw it in the trash can
Paper towel	food	paper	☑ Put it in a garbage bin ☐ Recycled it ☐ Reused it ☐ Composted it ☐ Other	
Old earbuds	fun/ entertainment	plastic and metal	☑ Put it in a garbage bin ☐ Recycled it ☐ Reused it ☐ Composted it ☐ Other	
Half of a sandwich	food	food	☑ Put it in a garbage bin ☐ Recycled it ☐ Reused it ☐ Composted it ☐ Other	
Straw	food/drink	plastic	☐ Put it in a garbage bin ☐ Recycled it ☐ Reused it ☐ Composted it ☑ Other: **put it in my backpack**	
Cup	Food/drink	Styrofoam	☑ Put it in a garbage bin ☐ Recycled it ☐ Reused it ☐ Composted it ☐ Other	I don't know if I can recycle it
Total Number of Items: 9 **Total Number of Plastic Items: 6**			*Number of Items I threw it in a garbage bin*: 8 *Number of Items I recycled*: 2 *Number of Items reused*: 0 *Number of Items composted*: 0 *Other*: 1	

Part 2- Investigation: Integrating Information & Ideas

Objectives:

- o   We will communicate scientific information and ideas about issues of plastic pollution orally, graphically, and textually.

3. Read, Review, & Respond

Students will:	Materials & Resources

☐   Analyze a variety of resources to make sense of per-capita plastic consumption
☐   Students will reflect on the experience through whole-group discussion and written responses
	▪ **Online Article:** "Plastics: Material-Specific Data" (EPA)
	    ▪ Link: https://www.epa.gov/facts-and-figures-about-materials-waste-and-recycling/plastics-material-specific-data
	▪ **Website:** U.S. and World Population Clock. (US Census Bureau)
	    ▪ **Link:** https://www.census.gov/popclock/
	▪ **Website:** Chesapeake Bay Program
	    ▪ **Link:** https://www.chesapeakebay.net/state/population
	    Note: The website links to a spreadsheet that includes county population data over time.
	▪ **Video:** "World Population" (populationeducation.org).
	    ▪ **Link:** https://populationeducation.org/curriculum-and-resources/world-population-video/
	▪ **Web Map:** "Plastic Waste Generation Per Person 2010" (ourworldindata.org; University of Oxford).
	    ▪ **Link:** https://ourworldindata.org/grapher/plastic-waste-per-capita

Whole Group Discussion Questions: • *Review & Discuss the questions in the Student Workbook*	

4. Activity: "Waste Reduction Roundabout"

Students will:	Materials & Resources
☐ Explore alternative choices for the consumption and disposal of common plastic items through a musical-chairs inspired activity.	▪ *Notecards or pieces of sturdy paper* (scrap paper will work too). Have at least one card for every student. ▪ *Marker or pen* ▪ A variety of *clean plastic waste.*
Whole Group Discussion Questions: ▪ Will each alternative waste reduction choice be appropriate for every item? ▪ What do these items have in common (besides that they are all made of plastic)? ▪ What are some short-term and long-term impacts these items could have on Earth's systems? ▪ How might changes in **per-capita** use of plastic items change these impacts?	

Activity: "Waste Reduction Roundabout"

Description: Students explore alternative choices for the consumption and disposal of common plastic items through an activity inspired by the game, 'musical chairs' Students will be prompted to critically, creatively, and collaboratively brainstorm and discuss choices for reducing plastic waste.

Materials:

- ☐ *Notecards or pieces of sturdy paper* (at least one card for every student)
- ☐ *Marker or pen*
- ☐ *A variety of clean plastic waste* (representing a variety of categories. For example, water bottles, plastic caps, plastic bags, food containers, to-go containers, to-go cups, plastic straws, food wrappers, product packaging, mailing packaging, etc.)

Prior to Beginning the Activity:

1. Divide the notecards into four piles. On one side of the card write either "***reduce***," "***reuse***," "***recycle,***" or "***refuse***," making sure that there are equal proportions of each. The other side of the card should be blank.
2. Spread the plastic waste around the classroom or other area with enough space for students to move around *(Note: this activity may also be done outside).*
3. Distribute the notecards around the room in proximity to the plastic waste items. This can be done randomly, or the facilitator can intentionally set certain "R" cards near certain items to create more challenging scenarios. Make sure that the blank side of the card is facing up.
4. Have music ready to play in the classroom. Alternatively, the lights of the classroom can be used to start and stop activity rounds instead of (or in addition to) music.

Procedures:

1. Explain that the mission is to explore alternative options to the plastic items in the room**.**
2. When the music is playing (or the lights are off), students should walk around the room. When the music stops (or lights come on), students should stop in place and pick up 1-2 plastic items and the nearest notecard. They should read the card to themselves and brainstorm ways that their item(s) could be recycled, re-used, reduced or refused depending the word written on their card. *(Note: this may be done individually, in pairs, or groups).*
3. Briefly engage students in discussions about the meaning of each choice for mitigating the harmful effects of plastic waste.
4. After everyone has had some time to privately brainstorm, allow a few students to share:
   a. The item
   b. The choice written on their card
   c. The alternative choices they brainstormed.
5. The activity may continue for several rounds.

> **Definitions**
> - **Reduce** - preventing something from becoming waste by reducing the need or use for it;
> - **Refuse** - related to 'reduce', refusing to use items that you really don't need;
> - **Reuse** – using an item again, delaying its entry into landfills, recycling centers, or ecosystems;
> - **Recycle** - sending it to a facility where it may be converted back into reusable material;
> - **Other ideas** – encourage students to discuss other choices (examples could include removing plastic waste from the environment, rallying others, redesigning products or lifestyle choices, etc.)

Facilitator Tips: To spark more engaging and thought-provoking discussion, once a student has shared their ideas, open the discussion for other students to contribute additional ideas, thought processes, etc. Additional questions for the group or individuals could include:

- *Does anyone else have ideas how this item could be 'r_____'?*
- *What if the card had been 'r   ' instead?*
- *Are there any labels on the item to provide disposal instructions or other information?*
- *What purpose did this item have before it was trash?*
- *Do alternatives to this plastic item exist?*

Wrap-up and Making Connections:
The following are suggested discussion questions to conclude the activity:

- Will each alternative waste reduction choice be appropriate for every item?
- What do these items have in common (besides that they are all made of plastic)?
- Did you observe any trends while we discussed these options?
- What are some short-term and long-term impacts these items could have on Earth's systems?
- How might changes in *per-capita* use of plastic items change these impacts?

Extensions:
The plastic items used for this activity can also be collected by asking students to bring in a few items from their personal waste inventory. It is still recommended that the facilitator have some available to ensure that a variety of items are represented.

Part 3 – Application: Applying What We Learned Through Informed Action

Objectives:
- o   We will take action by engaging our communities with 'public service announcements' in the form of persuasive posters, flyers, or social media posts.

5. Engaging Others:

| Students will:	Materials & Resources
☐ Create public service announcements in the form of posters, flyers, or social media messages to persuade others to consider choices regarding the consumption & disposal of plastic waste.	▪ *Optional*: Posters, paper, markers, art supplies, etc. for creating flyers and posters.

Whole Group Discussion Questions:

- Review the list of choices in your student workbook, do you agree with the order in which the choices are listed? (reduce, refuse, recycle, reuse, other). Why or why not? What changes would you make to the order of the choices?
- Specifically, why do you think the choice, 'recycling' was listed lower than some of the other choices?

Sample Public Service Announcements:
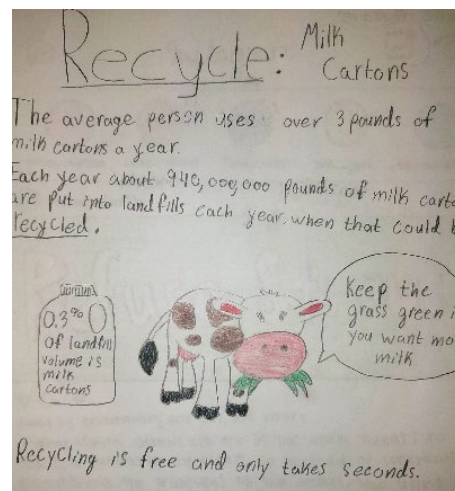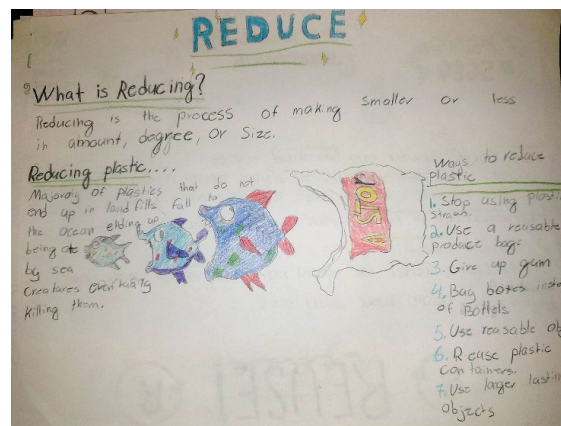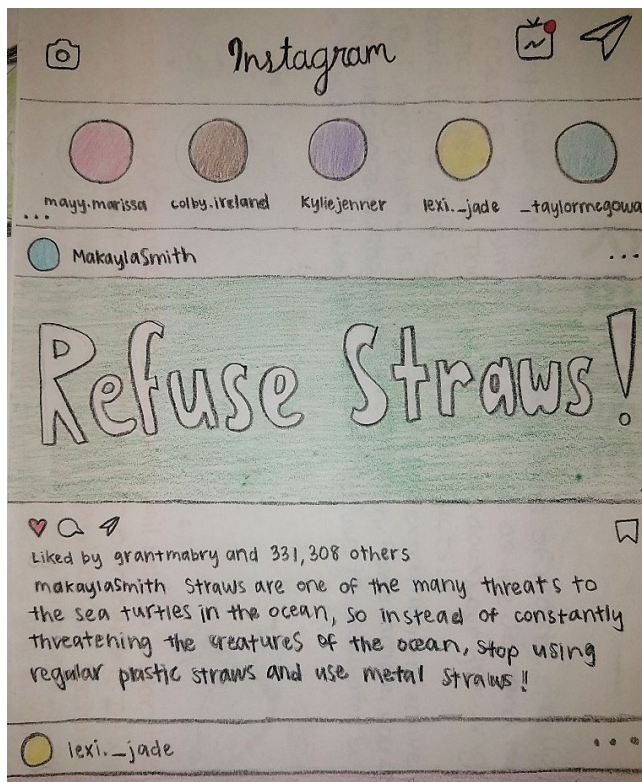
Part 4- Assessment: Demonstrating Our Understandings

Objectives:

o   Students will construct a convincing argument, supported with evidence, that supports or refutes claims for either explanations or solutions.

o   Students describe a chain of reasoning that includes increases in the size of the human population, or the per-capita consumption of a given population cause increases in the consumption of resources, such as plastics.

o   Students will describe choices and the impact of the disposal of plastics.

Claim/Evidence/Reasoning Writing Rubric				
	0	1	2	3
Claim – statement or conclusion that answers the original question/problem.	Does not make a claim.	Makes an inaccurate claim.	Makes an accurate but incomplete claim.	Makes an accurate and complete claim.
Evidence – scientific data that supports the claim. The data needs to be appropriate and sufficient to support the claim.	Does not provide evidence.	Only provides inappropriate evidence (Evidence that does not support the claim.).	Provides appropriate, but insufficient evidence to support claim. May include some inappropriate evidence.	Provides appropriate and sufficient evidence to support claim.
Reasoning – justification that links the claim and evidence and includes appropriate and sufficient scientific principles to defend the claim and evidence.	Does not provide reasoning	Only provides reasoning that does not link evidence to claim.	Repeats evidence and links it to some scientific principles, but not completely.	Provides accurate and complete reasoning that links evidence to claim. Includes appropriate and sufficient scientific principles.

Use the Claim, Evidence, Reasoning model.

Construct an argument supported by evidence to describe the connections between the number of people in a society and the amount of plastic waste that they generate.