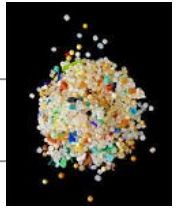




Performance Task: Microplastics



PART 1: Research Student Directions:

Your Assignment:

Microplastics pose a serious threat to our sea life and yet people are generally unaware of this problem. You have been asked to explain what microplastics are and how they threaten our ocean environments. You will explore several print and video sources to gather information. Then you will use this information to answer three research questions and write an explanatory essay. A notetaking template is provided for you to capture important information from each of the sources.

Steps You Will Follow:

To plan and write your essay, you will do all the following:

1. Read two articles and a question and answer sheet
2. Watch three videos
3. Answer three questions about the readings and the videos
4. Plan and write your essay

Directions for Beginning:

You will now watch the videos and read the articles. Take notes because you will want to refer to your notes while answering the three research questions and writing your essay. You may refer to any of the sources as often as you like.

Source Information:

Reading #1:	<i>What We Know About Plastic Marine Debris</i> NOAA, September 2011
Reading #2	<i>Microplastics in ocean causing rising concern amongst leading scientists</i> Press Release, SEA Semester, July 2014
Reading #3:	<i>Bathroom shelf may be source of microplastics in Sound</i> Tom Watson
Video #1:	<i>Ocean Confetti!</i> (2:56) https://www.youtube.com/watch?v=C2b8PKuPZfg&feature=youtu.be
Video #2:	<i>The Growing Problem of Microplastics</i> (3:01) https://www.youtube.com/watch?v=qxJr0TncVNU
Video #3:	<i>What you need to Know about Microbeads, Speaking of Chemistry Ep 10</i> (2:37) https://www.youtube.com/watch?v=O3fKW6qTDOs



Performance Task: **Microplastics**

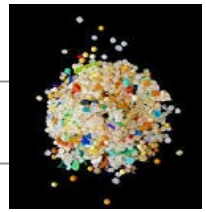


Note-Taking Template: Video Resources

Source	What microplastics are	Why microplastics are a problem for marine life	What we can do to help solve this problem
Video #1: <i>Ocean Confetti!</i>			
Video #2: <i>The Growing Problem of Microplastics</i>			
Video #3: <i>What you need to know about microbeads</i>			



Performance Task: **Microplastics**



Note-Taking Template: Text Resources

Source	What microplastics are	Why microplastics are a problem for marine life	What we can do to help solve this problem
Reading #1: <i>What We Know About Plastic Marine Debris</i>			
Reading #2: <i>Microplastics in ocean causing rising concern amongst leading scientists</i>			
Reading #3: <i>Bathroom shelf may be source of microplastics in Sound</i>			

Marine Debris



NOAA Marine Debris Program | Office of Response and Restoration | NOAA National Ocean Service

What We Know About: Plastic Marine Debris

<http://marinedebris.noaa.gov/info/plastic.html>

Introduction

One of the main types of marine debris that you hear about today is plastic marine debris. In many places, it is the main type of debris that you will see as you walk along a beach, though perhaps not underwater. As common as they are on our beaches and in our homes, how much do you really know about plastics?

What is plastic marine debris?

The word “plastic” is used to describe a collection of artificial or manmade chemical compounds

that come in about as many shapes, sizes, and colors as you can imagine! For example, foam carry-out containers (made of polystyrene) and bottle caps (made of polypropylene) are items that would be

considered plastic marine debris if found in our oceans or waterways.



Plastic bottle, such as those shown above, are some of the more common types of debris found on beaches in Hawaii.



One source of microplastics is through the fragmentation of larger pieces. *Photo courtesy of NOAA Restoration Center.*

Some common types of plastic:

Acronym	Full name	Common Example
PET (PETE)	Polyethylene terephthalate	soda bottles
PES	Polyester (yes, it's actually a plastic!)	polyester clothing
PE	Polyethylene	plastic bags
HDPE	High-density polyethylene	detergent bottles
PVC	Polyvinyl chloride	plumbing pipes
PP	Polypropylene	drinking straws
PA	Polyamide (aka nylon)	toothbrushes
PS	Polystyrene	take-out food containers

Why is plastic marine debris so common?

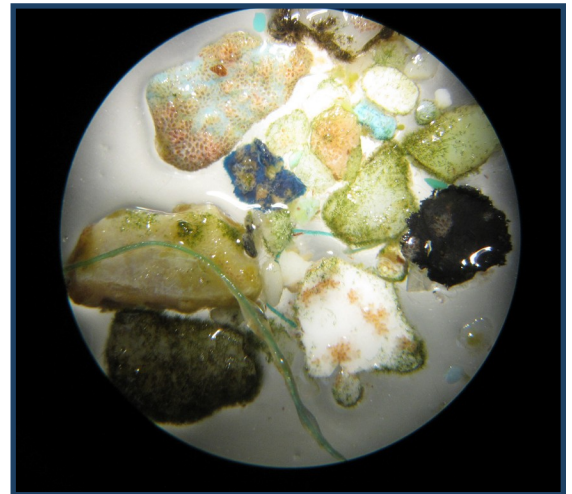
Plastics are used in many aspects of daily life, are a big part of our waste stream, and can last a long time. Many

plastics are colorful and will float in water, which makes plastic debris a very visible part of the marine debris problem. However, an accurate estimate does not yet exist for how much debris is composed of plastic materials.

Do plastics “go away”?

Plastics will **degrade** into small pieces until you can't see them anymore (so small you'd need a microscope or better!). Because the ocean is a cold, dark place, this process happens slower in water than on land. But, do plastics fully “go away?” Full degradation into carbon dioxide, water, and inorganic molecules is called **mineralization**. Most commonly used plastics *do not* mineralize (or go away) in the ocean and instead break down into smaller and smaller pieces. We call these pieces “microplastics” if they are less than 5mm long.

Bio-based and truly biodegradable plastics break down in a compost pile or landfill but are generally not designed to degrade as quickly in the ocean.



Microplastics skimmed from the North Pacific Ocean.
Photo courtesy of J. Foley, C-MORE.

Can plastic marine debris harm fish?

Plastic has the potential to harm fish and other wildlife in two main ways.

Direct Impacts - Studies have shown that fish and other marine life do eat plastic. Plastics could cause irritation or damage to the digestive system. If plastics are kept in the gut instead of passing through, the fish could feel full (of plastic not food) and this could lead to malnutrition or starvation.

Indirect Impacts - Plastic debris accumulates pollutants such as PCBs (polychlorinated biphenyls) up to 100,000 to 1,000,000 times the levels found in seawater. PCBs, which were mainly used as coolant fluids, were banned in the U.S. in 1979 and internationally in 2001. It is still unclear whether these pollutants can seep from plastic debris into the organisms that happen to eat the debris and very difficult to determine the exact source of these pollutants as they can come from sources other than plastic debris. More research is needed to help better understand these areas.

What can we do?

- Get involved! Participate in local cleanups in your area.
- Remember that the land and sea, no matter where you are, are connected.
- Reduce the amount of waste you produce.
- Reuse items whenever possible. Choose reusable items over disposable ones.
- Recycle as much as possible. Bottles, cans, cell phones, ink cartridges, and many other items can be recycled.

For more information visit

www.MarineDebris.noaa.gov/info/plastic.html

www.MarineDebris.noaa.gov/projects/microplastic.html

Microplastics in ocean causing rising concern amongst leading scientists

Press Release: SEA Semester



(Woods Hole, Mass- July 18, 2014) Microplastics – microscopic particles of plastic debris – are of increasing concern because of their widespread presence in the oceans and the potential physical and toxicological risks they pose to organisms.

This is the view of two of the world’s most eminent authorities on the subject, Professor Kara Lavender Law, of Sea Education Association (Woods Hole, MA), and Professor Richard Thompson of Plymouth University (UK).

In an article published today in the journal [Science](#), the two scientists have called for urgent action to “turn off the tap” and divert plastic waste away from the marine environment.

Microplastics have now been documented in all five of the ocean’s subtropical gyres – and have even been detected in Arctic sea ice – with some of the highest accumulations occurring thousands of miles from land. These plastic bits have been found in organisms ranging in size from small invertebrates to large mammals and are known to concentrate toxic chemicals already present in seawater. This raises concern about the potential consequences to marine organisms.

“Our scientific understanding of this environmental problem is accelerating rapidly, with many new research efforts that go well beyond simply documenting the presence of plastic in the ocean,” said Professor Law, who led a 2008 paper in Science describing widespread plastic contamination in the North Atlantic Ocean from more than 25 years of data collected by Sea Education Association faculty and undergraduate students.

Most studies of ocean microplastic focus on the debris that floats at the sea surface, but this leaves other potential collections of plastic unaccounted for.

“Major unanswered questions remain about the amounts of microplastic debris that might be accumulating on the seafloor,” said Professor Thompson, whose 2004 paper in Science first coined the term ‘microplastics’. “We also know very little about where, geographically, are the largest inputs of plastic to the marine environment.”

Despite open questions such as these, the authors say that microplastics are already something to worry about, and that efforts are needed to divert the source of this debris away from the ocean, or to “turn off the tap”. This was the message that Professor Thompson delivered to Senator John Kerry last month at the US State Department’s Our Oceans Conference: Marine Pollution. Both say that plastic waste should be viewed as a valuable resource to be captured and re-used, which would simultaneously reduce the amount entering the environment.

Policy initiatives have been gaining momentum at municipal, state, and national levels in the U.S. In June this year Illinois passed legislation banning microbeads (microplastics used in cosmetic products that enter the environment through wastewater), with similar legislation pending New York and California, and recently introduced in the U.S. House of Representatives. In April this year the European Parliament voted to reduce the consumption of single use plastic carrier bags and phase out bags that fragment rather than degrade.

“We have been conducting an unintended experiment with the addition of large amounts of this man-made material into the environment,” said Law. “But this is a solvable problem. By each of us making small changes in our daily habits – by carrying reusable water bottles and coffee mugs, for example – we can collectively reduce our dependence on ‘disposable’ items that might ultimately be lost to the environment.”

Source:

http://www.sea.edu/sea_news/press_release/microplastics_in_ocean_causing_rising_concern_amongst_leading_scientists

Bathroom shelf may be source of microplastics in Sound

Originally published October 21, 2011 at 9:00 pm *Updated*
October 22, 2011 at 8:47 am, Tom Watson, Author

Even if we don't all agree that tiny pieces of plastic in Puget Sound are a problem, at least we should be made aware when they come from our own bathroom.



Many cosmetics contain particles known as microplastics, so when you use a facial-scrub product, for example, you send them down the drain. These particles are so tiny they don't easily get captured at wastewater-treatment plants and may end up in the Sound, along with tiny plastic fragments from other sources.

Q: That seems outrageous. Can't companies be stopped from putting microplastics in their products?

A: Companies that use these plastic particles, often called microbeads, say they perform effectively in cosmetic products and haven't been shown to harm consumers or wildlife. The presence of microplastics in cosmetics has been reported since at least 2007 but hasn't caught on with the public as a pressing environmental issue.

Q: Is it possible microplastics do not harm marine life?

A: Researchers say that even though no fish kills, or other major problems have been directly linked to microplastics, they worry about the buildup of these plastics and the effects on aquatic creatures.

Warning signs abound. For example, mussels can ingest microplastics and the plastic can be incorporated into their tissue, according to professor Joel Baker of the University of Washington, Tacoma. An internationally known expert on microplastics, Baker is science director at the Center for Urban Waters in Tacoma.

Q: Do we really need microplastics in our cosmetics?

A: Baker doesn't think so and says his family tries not to use those products. Not that long ago, facial and body washes contained natural materials such as finely ground walnut shells, seeds or oatmeal as exfoliants, and many still do.

Q: How can I find which products contain microplastics?

A: It's not easy but start by searching a product's ingredients list for "polyethylene," one main form of plastic microbeads. The federal government's Household Products Database lists more than 90 personal-care products containing polyethylene including toothpaste.



Major brands with products containing microplastics include Olay, Dove, Avon, Revlon, Secret, Cover Girl, Colgate and Crest, but that database may not be all-inclusive.

Q: Are cosmetics the main source of microplastics?

A: Probably not, although it's impossible to tell for sure. Baker says many microplastics that researchers find in and around Puget Sound are created when larger items such as plastic bags, boat cushions and coolers break down into tiny bits.

Microplastics also turn up on beaches and in soil, and in other bodies of water besides oceans. To reduce the proliferation of microplastics, Baker recommends consumers avoid unnecessary use of plastics, including certain single-use packaging.

He advises against using "biodegradable" plastic bags unless they are an approved type going to a composting facility, such as specified bags for food scraps. Many so-called biodegradable bags generate microplastics, says Baker.

Industrial operations also send microplastics into the oceans, although this appears to be less of a problem in North America than it used to be. New research also points to fibers of synthetic fabrics, which go down the drain during clothes washing, as a significant portion of microplastics in oceans.

Q: Don't plastics eventually break down?

Plastics get brittle and break into tiny pieces but do not totally degrade in the ocean, Baker says.

Q: What other implications does microplastics waste have for us humans?

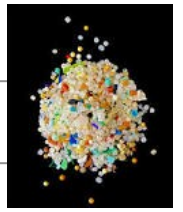
A: Research indicates that certain microplastics act like magnets or sponges, "sopping up toxic chemicals that are widely present in the oceans," writes California-based science journalist Susan Freinkel in her 2011 book, "Plastic: A Toxic Love Story." Species all the way up the food chain could ingest these microplastics and toxins.

Although other plastic waste, especially bags, has attracted attention lately, this tiny but prolific manifestation of plastic debris has largely been ignored. Microplastics need to rise to the surface as a potential problem, and we can help by carefully considering our everyday purchasing decisions.

Tom Watson is project manager for King County's Recycling and Environmental Services. Reach him at tom.watson@kingcounty.gov



Performance Task: **Microplastics**



Part 2: Field Investigation

If feasible, teachers are encouraged to take the students to a location where there is water and/or sand to be tested for microplastics. The teacher and/or students can collect samples of water and sand/dirt to inspect under a microscope to determine the presence of microplastics. Students can also participate in a product scavenger hunt at a local store to see which products contain microplastics.

Discussion questions might include the following:

- Why should we be concerned about microplastics?
- What products include microplastics as an ingredient?
- How are people working to rid the oceans of microplastics?
- What actions might we take to rid the environment of microplastics?

In addition, teachers may want to consider one or more of the following field investigations:

- <https://marinedebris.noaa.gov/info/plastic.html>
- Aquatic WILD Plastic Voyages p 189
- Pacific Shellfish Institute Curriculum
- Microplastic webpage describing doing a Microplastic survey:
<https://civiclaboratory.nl/2015/07/25/microplastic-survey/>

Other ideas for field investigations:



Performance Task: Microplastics



Part 3: Essay Student Directions:

You will now review your notes and sources, plan, draft, and revise your essay. You may use your notes and refer to the sources. You may also refer to the answers you wrote to questions at the end of part 1, but you cannot change those answers. Now read your assignment and the information about how your essay will be scored, then begin your work.

Your assignment:

Researchers are discovering an increased level of microplastics in our ocean waters, worldwide. You have been asked to help raise the public's awareness of this environmental problem by writing an explanatory essay that will be published in a local magazine.

Your job is to explain what microplastics are and why they are a problem for marine life. Provide at least two actions that humans can take to reduce the presence of microplastics in the oceans. Use information from both print and video sources in your essay, citing your sources.

An essay planning sheet is provided to help you organize your writing.

How your essay will be scored:

The people scoring your essay will be assigning scores for

- **Statement of Purpose / Focus**– how well you clearly state and maintain your controlling idea or main idea
- **Organization**– how well the ideas progress from the introduction to the conclusion using effective transitions and how well you stay on topic throughout the essay
- **Elaboration of Evidence**– how well you provide evidence from sources about your topic and elaborate with specific information
- **Language and Vocabulary**– how well you effectively express ideas using precise language that is appropriate for your audience and purpose
- **Conventions**– how well you follow the rules of usage, punctuation, capitalization, and spelling

Now begin work on your essay.

Manage your time carefully so that you can:

- Plan your essay
- Write your essay
- Revise and edit for a final draft





Performance Task: **Microplastics**



Planning My Essay

Essay Components

Introduction: Capture the reader's attention

Statement of purpose or controlling idea:

What microplastics are:

Why microplastics are a problem for marine life:

Actions humans can take to reduce the presence of microplastics in the oceans:

Conclusion:



Informative / Explanatory Writing Rubric (Grades 6-11)

Scoring Version



Score	4	3	2	1
Statement of Purpose/Focus	<p>The response is fully sustained and consistently and purposefully focused:</p> <ul style="list-style-type: none"> consistent or main idea of a topic is clearly communicated, and the focus is strongly maintained for the purpose, audience, and task 	<p>The response is adequately sustained and generally focused:</p> <ul style="list-style-type: none"> controlling or main idea of the topic is clear, and the focus is mostly maintained for the purpose, audience, and task 	<p>The response is somewhat sustained and may have a minor drift in focus:</p> <ul style="list-style-type: none"> controlling or main idea of a topic may be somewhat unclear, and the focus may be insufficiently sustained for the purpose, audience, and task 	<p>The response may be related to the topic but may provide little or no focus:</p> <ul style="list-style-type: none"> controlling or main idea of the topic may be somewhat confusing or ambiguous; response may be too brief or the focus may drift from the purpose, audience, and task
Organization	<p>The response has a clear and effective organizational structure creating unity and completeness:</p> <ul style="list-style-type: none"> consistent use of a variety of transitional strategies to clarify the relationships between and among ideas effective introduction and conclusion logical progression of ideas from beginning to end; strong connections between and among ideas, with some syntactic variety 	<p>The response has an evident organizational structure and a sense of completeness, though there may be minor flaws and some ideas may be loosely connected:</p> <ul style="list-style-type: none"> adequate use of transitional strategies with some variety to clarify the relationships between and among ideas adequate introduction and conclusion adequate progression of ideas from beginning to end; adequate connections between and among ideas 	<p>The response has an inconsistent organizational structure, and flaws are evident:</p> <ul style="list-style-type: none"> inconsistent use of transitional strategies with little variety introduction and conclusion, if present, may be weak uneven progression of ideas from beginning to end; and/or formulaic; inconsistent or unclear connections between and among ideas 	<p>The response has little or no discernible organizational structure:</p> <ul style="list-style-type: none"> few or no transitional strategies are evident introduction and conclusion, if present, may be missing frequent extraneous ideas may be evident; ideas may be randomly ordered or have an unclear progression
Elaboration of Evidence	<p>The response provides thorough and convincing support/evidence for the controlling idea and supporting idea(s) that includes the effective use of sources, facts, and details.</p> <ul style="list-style-type: none"> comprehensive evidence from sources is integrated; references are relevant and specific effective use of a variety of elaborative techniques* 	<p>The response provides adequate support/evidence for the controlling idea and supporting idea(s) that includes the use of sources, facts, and details:</p> <ul style="list-style-type: none"> adequate evidence from sources is integrated; some references may be general adequate use of some elaborative techniques* 	<p>The response provides uneven, cursory support/evidence for the controlling idea and supporting idea(s) that includes uneven or limited use of sources, facts, and details:</p> <ul style="list-style-type: none"> some evidence from sources is weakly integrated, imprecise, or repetitive; references may be vague weak or uneven use of elaborative techniques*; development may consist primarily of source summary 	<p>The response provides minimal support/evidence for the controlling idea and supporting idea(s) that includes little or no use of sources, facts, and details:</p> <ul style="list-style-type: none"> evidence from the source material is minimal or irrelevant; references may be absent or incorrectly used minimal, if any, use of elaborative techniques*
Language	<p>The response clearly and effectively elaborates ideas, using precise language:</p> <ul style="list-style-type: none"> vocabulary is clearly appropriate for the audience and purpose effective, appropriate style enhances content 	<p>The response adequately elaborates ideas, employing a mix of precise with more general language:</p> <ul style="list-style-type: none"> vocabulary is generally appropriate for the audience and purpose generally appropriate style is evident 	<p>The response elaborates ideas unevenly, using simplistic language:</p> <ul style="list-style-type: none"> vocabulary is uneven or somewhat ineffective for the audience and purpose inconsistent or weak attempt to create appropriate style 	<p>The response is vague, lacks clarity, or is confusing:</p> <ul style="list-style-type: none"> vocabulary is limited or ineffective for the audience and purpose little or no evidence of appropriate style

Score	2	1	0
Conventions	<p>The response demonstrates a command of conventions:</p> <ul style="list-style-type: none"> adequate use of correct sentence formation, punctuation, capitalization, grammar usage, and spelling 	<p>The response demonstrates partial command of conventions:</p> <ul style="list-style-type: none"> limited use of correct sentence formation, punctuation, capitalization, grammar usage, and spelling 	<p>The response demonstrates little or no command of conventions:</p> <ul style="list-style-type: none"> infrequent use of correct sentence formation, punctuation, capitalization, grammar usage, and spelling

NS	Unintelligible, in a language other than English, off-topic, insufficient evidence (incomplete) or copied text. (Off-purpose writing will still receive a score in Conventions.)
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*Elaborative techniques may include the use of personal experiences that support the controlling idea.