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Plastic Properties: Student Worksheet Answer Key

Station 1: Plastic Decomposition

Instructions:

- Look at the composition kit with decomposing materials on both sides. One side of the kit has organic materials and the other side has plastic materials.
- Using what you understand about decomposition, answer the following questions.

1. What is decomposition?
   the state or process of rotting; decay.

2. Describe what the two sides look like. If left untouched, predict what each side would look like in 10 years. In 100 years.
   Organic side: Looks like dirt
   Plastic side: Looks like plastic

3. How long do you think it takes a banana to decompose? How for paper to decompose? (Do not look this up on the internet!)
   Student guess.

4. How long do you think it takes a plastic water bottle to decompose? (Do not look this up on the internet!)
   Student guess.

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Using the internet, research how long it takes the following items to decompose:

Item	Number of Years to Decompose
Banana Peel	*2 years*
Newspaper	*2-6 weeks*
Metal Can	*Tin can steel: 50 years; aluminum can: 200-500 years*
Glass	*One million years*
Baby Diaper	*500 years*
Polyester T-shirt	*20-200 years*
Tennis Shoe	*30-40 years*
Plastic Bottle	*450 years*
Plastic Shopping Bag	*10-20 years*
Styrofoam cup	*500 years*

5. Which item takes the longest time to decompose? Which takes the shortest time to decompose?
   Glass – longest time to decompose
   Newspaper – shortest time to decompose

6. What surprised you about the numbers?
   Student guess.

7. Why do you think plastic causes such a problem when thrown away as garbage, even though other items take longer to decompose?
   Student guess.

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Station 2: Microplastics and Microbeads

Instructions:

- To extract microbeads from face wash, first line the funnel with one coffee filter and place the funnel tip into an empty beaker.
- Squirt a small amount of face wash onto the coffee filter.
- Fill another beaker with water and then gently flush the facewash through the filter. (Note: The microbeads should remain on the filter.)
- Gently pull out the filter and examine the microbeads with a magnifying glass or with a microscope.
- Read this article and answer the following questions: https://www.chemistryworld.com/news/us-bans-microbeads-from-personal-care-products/9309.article?fbclid=IwAR0wfnJ2M0r5gxsmWwQTWBf6yJJBDKrzcGxOIJaI1KkCVxoZrIpoZ7VQdYo

1. What are microbeads and where are they found?

Microbeads are defined in the US rule as any solid plastic particle less than 5mm in size and intended to be used to exfoliate or cleanse. They are often used in products like toothpastes and facial cleansers, but end up in waterways.

2. What does marine life mistake the beads for?

Some species of marine life mistake the plastic beads for food

3. How many years do microbeads take to break down?

hundreds of years

4. How many microbeads enter US aquatic systems every day?

Recent research by US scientists estimated that more than 8 trillion microbeads enter US aquatic habitats each day.

Many microplastics over many years entered the ecosystem as microbeads that were contained in cosmetic products such as make-up, face wash, and toothpaste. Today these microbeads are banned in the United States. Some other countries still use them. However, the

microbeads that came from these products before the ban have already made their way into all our major waterways.

Station 3: Microfiber and Microfilaments

Instructions:

- Watch the video from the Story of Stuff and answer the questions: https://storyofstuff.org/movies/story-of-microfibers/
- Complete the microfiber activity and draw your observations.

1. What type of clothes are made from polyester?
   dress shirts, yoga pants, fleeces, and even underwear

2. What is polyester made from?
   synthetic materials, plastics

3. What problems are associated (big and small) with reusing plastic bottles?
   People might use more plastic if they think it's being recycled safely

4. What are microfibers, how many are produced in a single wash, and how do they make their way to our water systems?
   When microfibers are washed, they release tiny plastic bits — called microfibers — that flow down our drains, through water treatment plants, and out into our rivers, lakes and oceans by the billions.

   Hundreds of thousands of microfibers can be released in a single wash.

5. How many microfibers are believed to be in our oceans as of now?
   1.4 million trillion

6. What happens to these microfibers once they are in the waterways? What happens to fish and eventually people?
   Microfibers suck up other pollutants; fish eat them and eventually people eat those fish.

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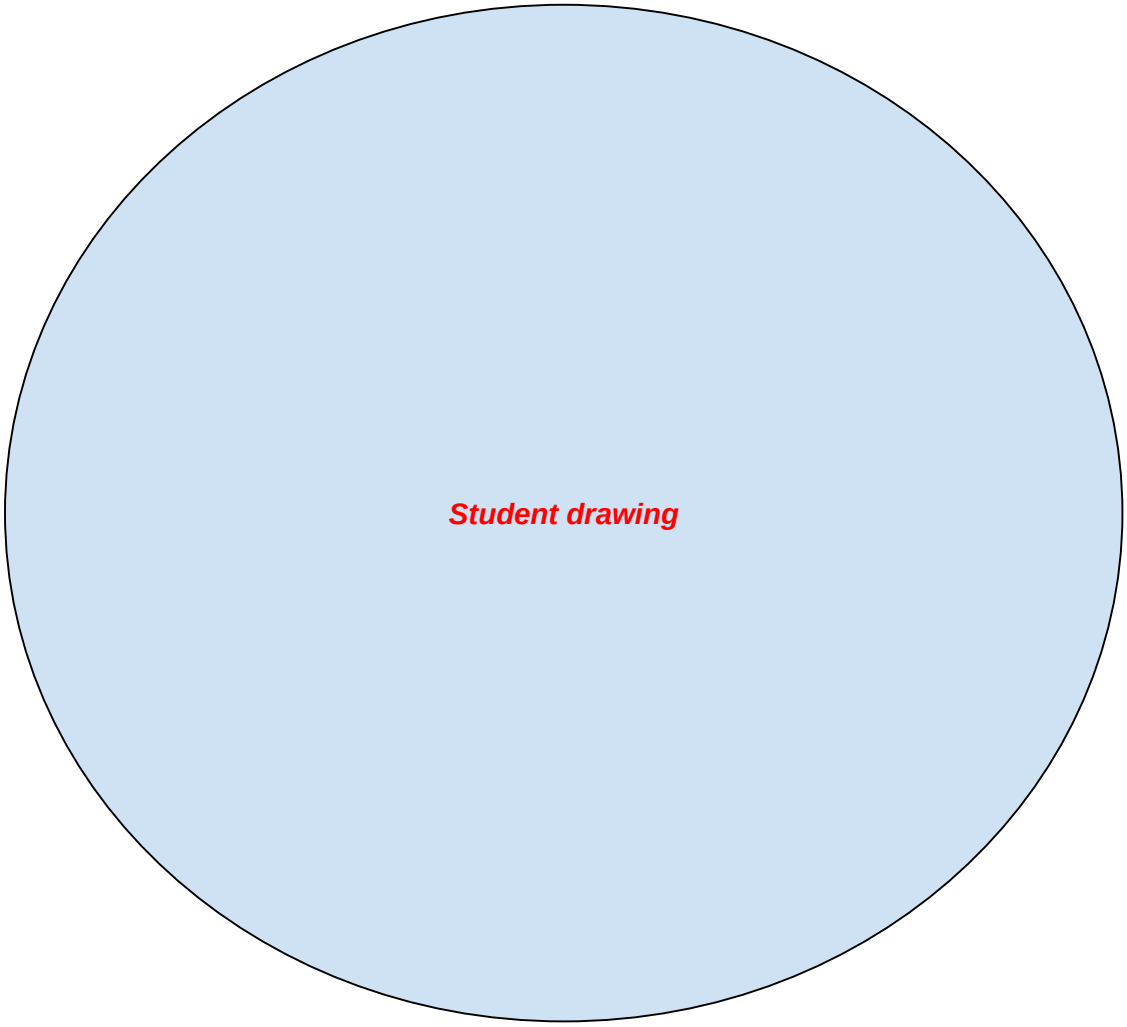
Instructions for the microfiber activity:

- Take a sample of the microfiber material
- Place the sample into bowl and pour one cup of water over the sample.
- Simulate washing (e.g., scrub the sample)
- Take a water sample out after “washing” for 1 minutes.
- Examine the sample under a microscope and locate fiber strands.

7. Draw what you see in your microscope.



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Station 3: Density of different plastics

Determining the type of plastic can also help determine which marine animals could be affected by its presence in the ecosystem. Using density, you can determine which plastics can be present in different water ecosystems and then make predictions to which marine animals could be affected.

Refer to the Background Sheet on the different densities of plastic. Then answer the following questions:

1. What is a water column?
   Column of water from the surface of a sea, river, or lake to the bottom sediment level

2. What is density?
   Density is defined as mass divided by volume (d = m / v).

3. Will an object of density 1.09 sink or float in a lake? (remember that fresh water is 1.0)
   Sink.

4. What is an SPI resin code and how many exist for plastic?
   Code for identifying plastics; there are 7 codes.

Use the density table provided and make a prediction of whether the items will sink or float. Document your prediction in the data table. After you make your prediction add water the jar, place the item in the jar, and observe. Document in data table whether the item floats or sinks.

Plastic Item	Resin Code (SPI code)	Prediction (sink or float)	Results
1. ***Student observations; answers may vary***			
2.			
3.			
4.			
5.			

5. Which plastic do you think would most likely affect plankton and zooplankton?

Student observations; answers may vary

6. Which plastic do you think would most likely affect organisms at the bottom of the ocean?

Student observations; answers may vary

Station 4: Plankton and Microplastic

Instructions:

- Carefully pick up the jar containing both plankton and microplastic.
- Observe the differences and similarities between the plankton and microplastic.
- Pour sample into petri dish.
- Place under the microscope and focus.

1. Can you tell the two apart?

   Student observations; answers may vary

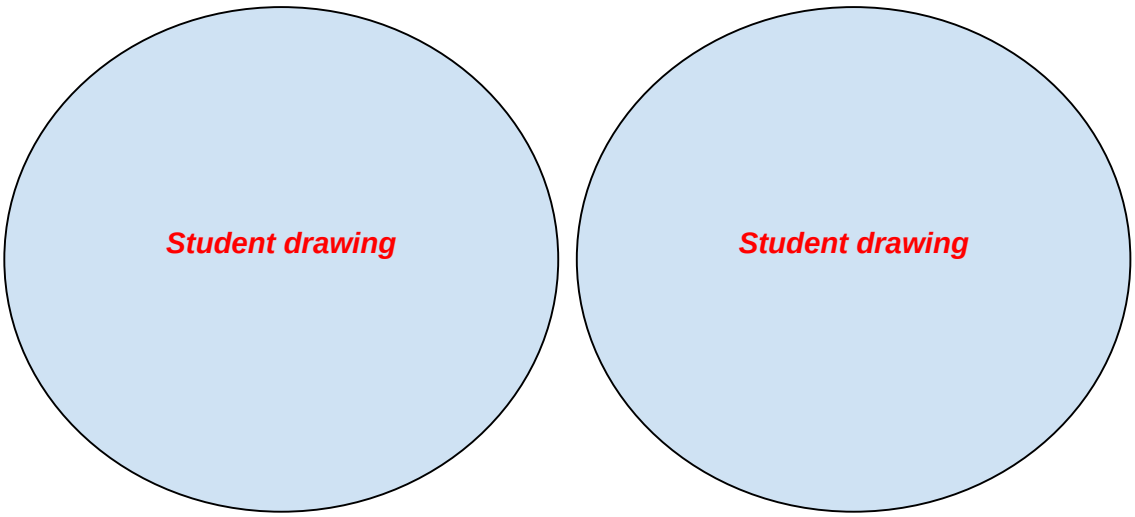
2. How are they alike?

   Student observations; answers may vary

3. How are they different?

   Student observations; answers may vary

4. Draw what you observe:



5. Do you think that live plankton eat microplastic? (circle) Yes or No

Watch the following video and answer the questions:
https://www.youtube.com/watch?v=FAi1okMUdQ8
What type of zooplankton are they studying in this experiment?

copepods

1. What is the hypothesis? Is it correct?
   Copepods eat microplastics. Filter feeding copepods do eat microplastics under lab conditions.

2. What other animals are also eating plastic?
   Mussels and crabs

3. Do they know how plastic affects these organisms yet?
   No.

4. Create a food chain that shows the effects of plastic:
   Microplastics → Mussels → Crabs … maybe to humans

Read the article: "Great Pacific Garbage Patch"
https://www.nationalgeographic.org/encyclopedia/great-pacific-garbage-patch/

1. What is the Great Garbage Patch of the North Pacific?
   The Great Pacific Garbage Patch is a collection of marine debris in the North Pacific Ocean.

2. What kind of plastic is found in the Great Garbage Patch?
   microplastics

3. What kind of effects does it have on wildlife? Give three examples
   Some examples:
   a. ***Loggerhead sea turtles often mistake plastic bags for jellies, their favorite food.***
   b. ***Albatrosses mistake plastic resin pellets for fish eggs and feed them to chicks, which die of starvation or ruptured organs.***
   c. ***Seals and other marine mammals can get entangled in abandoned plastic fishing nets, which are being discarded largely due to inclement weather and illegal fishing. Seals and other mammals often drown in these forgotten nets—a phenomenon known as "ghost fishing."***

d. *Marine debris can block sunlight from reaching plankton and algae below the surface of the ocean. Algae and plankton are the most common autotrophs, or producers, in the marine food web. Autotrophs are organisms that can produce their own nutrients from carbon and sunlight.*
e. *If algae and plankton communities are threatened, the entire food web may change. Animals that feed on algae and plankton, such as fish and turtles, will have less food. If populations of those animals decrease, there will be less food for apex predators such as tuna, sharks, and whales. Eventually, seafood becomes less available and more expensive for people.*
f. *These dangers are compounded by the fact that plastics both leach out and absorb harmful pollutants. These chemicals can then enter the food chain when consumed by marine life.*

Final Assessment

Summary Discussion:
Now that you have observed different properties of plastic, describe in your own words why plastic has such an effect on ecosystems and why it is so hard to eliminate the garbage that it creates?

Some examples:

Too much plastic pollution is created.
Plastic takes a long time to decompose.
Plastic breaks down into microplastics.
Microplastics are hard to remove from the ocean because they are so small.
Microplastics enter the food chain.