Plankton to Plastic Pollution STEM Kit Use Instructions

Note: This kit is intended for students 4th grade and higher in a supervised classroom setting. It is strongly recommended that instructors try the kit themselves before using it in class. This kit covers the scientific practices of Developing & Using Models; Analyzing & Interpreting Data; Using Mathematics & Computational Thinking; Constructing Explanations & Designing Solutions; and Engaging in Argument from Evidence.

(https://www.nap.edu/read/13165/chapter/7#50)



Kit Contents

Each individual kit should contain:

- 3D Ocean Basin Model
- 50 mL Beaker
- Color Pencils
- Food Chain Baggies
- Jar of Small Plastic Beads
- Microscope
- Pipettes (2)

- Plankton Slides

 Foraminifera
 Marine Diatoms
- Settling Model
- Strainer
- Blank Graph Templates (1 per student)
- Blank Vial Templates (1 per student)
- Plankton to Plastic Pollution Booklet



Room Setup

1. Arrange tables and chairs so students can work in pairs



- 2. Make sure to have the following supplies on hand:
 - Water
 - Paper Towels
 - Science Notebook
 - Tape (for taping graphs and templates in Science Notebooks)
- 3. Have each pair of students obtain a kit, paper towel and beaker full of water (roughly 50 mL).

Begin Lesson

- 1. Students should start by opening their science notebooks to a new page. Notebook should be labeled "Plankton to Plastic Pollution" with the date and the name of their lab partner.
- 2. They should then open the kit and take out the Plankton to Plastic Pollution booklet and begin reading on page 3.



- 3. The words 'Science Notebook', accompanied by a pencil icon, are located throughout the booklet, which indicates that the students should **<u>stop and respond</u>** to the prompt in their notebooks.
- 4. Graph and vial templates that are supplied in the kit can be used by the students and taped into their science notebooks in the appropriate place. Extra copies of the data table can be downloaded from the EOC website at <u>https://www.cns-eoc.colostate.edu/national-park-service-partnership/plankton-to-plastic-pollution-stem-kit/</u>.
- 5. Pairs of students should be allowed to proceed at their own pace. Make sure to encourage students to read the text rather than just looking at the pictures.
- 6. Walk around the classroom and check on students, especially if they are younger. Clarify any questions that the students do not understand.



Part 1: Plankton to Petroleum

1. Students should be properly introduced to the microscope. Make sure they know how to manipulate it correctly in order to get the full experience and be able to see the specimens (page 4). <u>Students should</u> <u>turn off microscope when not in use in order to conserve the battery.</u>



2. Make sure that students are recording their discoveries when shaking the settling model and providing the correct times when doing so (page 6-7). Have students tape blank vial template inside their science notebooks prior to recording their findings.



Part 2: Petroleum to Plastic

- 1. Students should be able to correctly identify monomers and polymers and relate it to plastic.
- 2. Students should make sure that the graphs are correctly labeled, including axes labels with units and a title (page 10). Have students each tape the blank graphs to the inside of their science notebooks.

Part 3: Plastic to Pollution

- 1. Students should correctly identify what waves, currents and gyres are and how they play a role in how polymers accumulate in certain regions around the world.
- 2. When students are using the ocean basin model to observe how plastics travel in the ocean, make sure they are using the right technique in order to get the full experience. The two pipettes should be at opposite corners within the world model (page 14).



Part 4: Problems with Pollution

- 1. When dissecting the organisms, students should be able to identify how micro-plastics move from one organism to the next and how that can affect an ecosystem.
- 2. Students should correctly label the axes and title when creating bar graph. Students can have fun with it by coloring the bar graph (page 18).

Clean Up

1. Pour the water from the ocean basin model through the strainer into the beaker, thus *reusing* the plastic beads. *Note: Make sure students are reading the instructions and understanding how to properly cleanup the plastic beads using the strainer!*



- 2. Dry the beads with a paper towel and put them back into the small jar. Make sure the jar lid is tight to ensure no beads fall out.
- 3. Dry the model and rinse out the pipettes before packing back into the box.
- 4. Place the food chain organisms in the right order before moving onto packing instructions. **Phytoplankton inside Zooplankton inside Herring inside Cod**



5. Make sure that the microscope light is off.

Packing Instructions

Step 1: Place the ocean basin model (<u>should be dry first!</u>) to the left inside the case and the plankton slides upside down to the right of the ocean basin model - <u>this will prevent the slide from getting scratched</u>.



Step 2: Place the small jar of plastic beads inside the 50mL beaker and place the strainer on top



Step 3: Place the microscope horizontally in the upper left corner of the case on top of the ocean basin model. Put the 50mL beaker containing the beads and strainer on top of the plankton slides. The settling model should be put right next to the 50mL beaker. The 2 pipettes should be placed at the very bottom of the case.



Step 4: Lastly, place the food chain baggies, colored pencils, and booklet on top of everything and carefully close the lid without pinching any of the items. <u>CAUTION</u>: *Do not force the case shut – it should close with ease!*



Class Discussion Questions

Note: The questions provided below are guide questions that students can discuss as a class in order to determine what they learned/took away from the kit.

Part 1: Plankton to Petroleum

- 1. What did you observe when looking at the diatoms and foraminifera?
- 2. How do plankton play a role in the formation of petroleum? Petroleum is formed when plankton die and fall to the seafloor. Once on the seafloor, the dead plankton get trapped under very thick layers of sand and mud.
- 3. How does the settling model relate to the formation of petroleum? *The settling model helps show the formation of petroleum and how long it takes for plankton to make it to the seafloor and get trapped under sand and mud*

Part 2: Petroleum to Plastic

- 1. What are monomers and polymers? A monomer is a single molecule and a polymer is a chain of monomers. Polymers are used to make plastic.
- 2. Name some examples of monomers and polymers other than plastic. Examples of monomers include monosaccharaides (carbohydrates), glycerol and fatty acids (lipids), nucleic acids (nucleotides), and amino acids (protein). Examples of polymers include silk, rubber, cellulose, wool, amber, keratin, collagen, DNA, and starch.
- 3. What trends do you see when observing the data table regarding the amount of plastic produced every year?

The amount of plastic being produced every year is increasing at an accelerating rate.

4. What do you predict will happen to the amount of plastic produced as the years go on? Explain your reasoning.

The amount of plastic being produced will continue to increase as years increase due to an increased population and increase in demand. In addition, plastic is a cheap, versatile, and lightweight material that is easy to mass-produce, but difficult to recycle.

5. Why are non-biodegradable plastics unable to decompose? Non-biodegradable plastics do not decompose due to the polymer molecules being unable to decay at an atomic level. Instead, the polymer breaks down into smaller and smaller pieces of plastic that get littered into our rivers and oceans.

Part 3: Plastic Pollution

- 1. How does plastic travel to different oceans around the world? *Waves, currents, and gyres*
- 2. Explain how waves, currents and gyres effect the movement of plastic.

Waves are generated through the movement of wind dragging on the surface of the water. Waves help carry objects on top of the water to different locations. Currents are larger than waves and are similar to large rivers of water that help carry things very quickly. Currents help form gyres, which are located in the North and South Atlantic Ocean, North and South Pacific Ocean, and Indian Ocean. Each gyre moves in a circular motion. When debris and plastic get caught in one, it becomes trapped and beaks down into small pieces of plastic.

Part 4: Problems with Pollution

1. Because phytoplankton make their own food through photosynthesis, how do zooplankton obtain plastic when consuming the phytoplankton?

Due to plastic being present throughout the ocean, when zooplankton are feeding on phytoplankton they also pick up pieces of the polymer.

- 2. What trends do you see as you move up the food chain from phytoplankton to the cod? *As you move up the food chain, more and more plastic is consumed.*
- 3. What trends can you observe from the bar graph? Explain your findings. More and more plastic is consumed. This is because the zooplankton consumes the polymer that is present in the water. Once the herring eats the zooplankton, the herring inherently eats plastic from the water and from the zooplankton. This trend increases as you move up the food chain.
- 4. How can you as an individual help with plastic pollution? Refuse to use plastic bags, straws, lids, etc. and instead as for non-plastic alternatives. In addition, choose to buy more durable items that will last and if you are unable to avoid using plastic, reuse it whenever able to. Lastly, recycle!



Teacher Feedback Survey:

http://dat.cns-eoc.colostate.edu/STEMkits/stem_kit_survey.php

Thank You!