Lesson: Applying Separation Techniques

Grades: 5-6

Objective:

Students will understand the historical methods used by Indigenous peoples for separation and extraction. They will apply scientific concepts to design and create a water filtration system. Students will predict and observe changes in water clarity and pH after filtration. Lastly, they will evaluate the effectiveness of their filtration systems based on clarity and pH level.

Skills:

- Use equipment and materials safely
- Learn and understand Indigenous perspectives and knowledge
- Observe, measure and record data
- Compare observed data with predictions

Concepts:

- Understanding the importance of water quality
- Learning about natural sources of water filtration and how they work
- Learning about and understanding the pH scale

Materials:

- 500ml of "dirty" water per student pair (prepared in advance with mud/sand/rocks for heterogenous filtration)
- Filtration materials (e.g., cotton balls, sand, gravel, coffee filters, etc.)
- Containers for filtration (e.g., empty plastic bottles or clear glass jars)
- pH strips
- Water sources for collecting dirty water (optional)

Background Information:

Historical Separation and Extraction Methods

In the past, Indigenous people and ancient civilizations used creative techniques to separate things and get useful stuff from nature. They used special tools like strainers or woven baskets to separate grains, extracted healing compounds from plants for medicines, and knew boiling water made it safe to drink.

Water Quality and Its Importance

Water quality is vital for human health and the environment. It means having clean and safe drinking water, free from pollution, sediment, and extreme pH levels. Contaminated water can make us sick, and it can also be harmful to aquatic life. We must protect our water sources to ensure access to clean water for everyone.

Modern Water Filtration Methods:

Water can be cleaned on big and small scales using filtration. It's like a strainer that removes impurities from the water using physical (sand, gravel, charcoal, filter paper) and chemical processes. This gives us clean and safe drinking water.

Heterogenous Filtration:

Heterogeneous filtration is important in our activity because it involves filtering water with solid particles and impurities. The materials we use, like sand and gravel, act like traps, catching and removing the dirt and unwanted stuff from the water. This type of filtration helps us create effective filters that clean water in real-life situations. Understanding heterogeneous filtration will show us how well our filters work to give us safe and clean water at the end of the activity.

pH Scale:

The pH scale measures how acidic or alkaline a substance is. The pH scale ranges from 0 to 14, where a pH of 7 is neutral, meaning the substance is neither acidic nor alkaline. If a substance has a pH below 7, it is acidic, while a pH above 7 indicates it is alkaline. The pH level of water is vital because it affects its taste and safety for drinking and other uses. Clean drinking water usually has a pH close to 7, which is best for our health and the environment. Understanding pH helps us know if the water is safe and balanced, making sure we can use it for different purposes while keeping ourselves and nature healthy.

Procedure:

Introduction *(15 minutes)**:***

- Begin by discussing the historical methods used by Indigenous Peoples for separation and extraction. Explain that today, we use similar methods for similar purposes but with advancements in science and technology.

- Introduce the activity:
    - Students will work in pairs to design and create a water filtration system to clean dirty water, like how historical methods separated substances for various purposes.
- Discuss the end goal for the filtered water: It should be clearer, have a similar volume to the initial amount, and have a pH close to neutral (pH 7).

Preparing the Filtration Materials *(15 minutes)**:***

- Provide students with various filtration materials (cotton balls, sand, gravel, coffee filters, etc.).
- Allow students to explore and discuss how these materials might be used to create an effective water filter.
- Encourage students to come up with creative ideas and discuss them with their partners.

Designing the Filtration System *(20 minutes)**:***

- In their pairs, students should create a detailed plan for their water filtration system. They should decide on the order of materials they will use, the amount of each material, and how they will secure the filter in their container.
- Students should also make predictions about how their filter will affect the water's clarity and pH.

Note: You can separate the students into larger groups within their pairs, splitting the class equally between modern and historical filtration techniques. Come together as a class after the experiment to compare the effectiveness of each type of filtration technique.

Filtration Day *(30 minutes)**:***

- Distribute 500ml of "dirty" water to each student pair, making sure it has rocks/sand or other solid particles for heterogenous filtration.
- Before filtration, have students observe the "murkiness" of the water and test its pH using pH strips.
- Instruct students to pour the water through their filtration systems and collect the filtered water in a separate container.
- Once the filtration is complete, students should observe the clarity of the filtered water and test its pH using pH strips.

Evaluation and Conclusion *(15 minutes)**:***

- Have students compare their predictions with the actual results of their water filtration systems. Discuss any discrepancies and possible reasons for them.
- Students should evaluate the effectiveness of their filters based on water clarity and pH level. They can also calculate the percentage of water successfully filtered.
- Facilitate a class discussion where students share their findings and discuss the similarities and differences between historical separation methods and modern filtration techniques.
- Summarize the importance of understanding historical practices and applying scientific knowledge to solve real-world problems.