Lesson 1: Introduction to REACH & What is Biodiversity?

LEARNING OBJECTIVES:

- To introduce the topics of environmental science and environmental health
- To define the following terms: biodiversity, habitat, biome, ecosystem, and endangered species
- To explain how biodiversity impacts human health
- To identify and match animals to their habitats using common biodiversity terms (a matching game)
- To engage in a hands-on activity that reinforces caring for the environment through potting a plant and helping it grow over time!

WHY: To introduce students to environmental science and explain how it impacts their own health. They will learn to recognize different environmental issues and increase their confidence in becoming future environmental leaders.

MATERIALS:

Required: basil seeds, potting soil, plastic cups, water, biodiversity matching game cards

DETAILED PLAN:

1. **Introduction:** The lead volunteer(s) for the day will introduce themselves and explain why they are passionate about environmental science. They will also share a fun fact about themselves.
    - Go in a circle with all the students present and have each student state their name, something they are excited to learn about, and a fun fact about themselves
2. **Group Presentation:** Volunteer(s) will present the 'Biodiversity' slide deck with the whole class – **make this interactive and ask questions throughout!**
    - The slideshow will feature 6 of the major biomes. Instructors will ask students how they think each biome helps keep humans alive with answers to follow.
3. **Split into 2 groups:** Each group will do one of the activities and then switch.
    - *Biodiversity Matching Game*
        - Print out the matching game and cut out the squares on the sheet labeled "Print- Outs and Answer Key." Option to attach Velcro to the cut-outs so that students can physically stick them onto the biomes.
        - This interactive activity will allow students to match animals to their biomes and identify terms that relate to environmental health. Instructors will allow students to complete the activity on their own first and **can provide feedback as needed!**
    - *Basil plant potting activity*

- Instructors and students will first discuss the necessary elements for plants to grow, including sunlight, water, and soil. Students will then pot their own basil plant.

Lesson 2: What is Energy? Renewable vs. Non-Renewable

LEARNING OBJECTIVES:

- To describe what we use energy for in the real world
- To explain the differences between renewable and non-renewable energy
- To list examples of renewable and non-renewable energy
- To explain the health impacts of fossil fuels
- To create an "oil spill" and brainstorm ways to clean it up

WHY: We would not be able to turn on the lights or take the bus without energy sources. This lesson will teach students about the importance of energy while also highlighting some of the negative impacts of fossil fuels for human and animal health. With this information, students can start to get involved in efforts for change!

MATERIALS:

Required: Cooking oil, tin pans, cups, spoons, dish soap, cocoa powder, feathers, water, energy matching game cards
Optional: Rocks

DETAILED PLAN:

1. **Group Presentation:** Volunteer(s) will present the 'Energy' slide deck –**make this interactive and ask questions throughout!**
    - The slide deck will feature various examples of renewable and non-renewable energy. Emphasize the **advantages of using renewable energy and the disadvantages of non-renewable energy. Relate this back to human health while presenting!**
2. **Split into 2 groups:** each group will do one of the activities and then switch.
    - *Oil Spill Activity*
        - For set-up prior to the activity, mix oil with cocoa powder in a cup. Fill tin pans with water and insert a feather representing bird life - one pan and feather per student. (Note: You may choose to have students pair up depending on the number of students).
        - Ask the students what they think will happen when you pour the oil mixture into their tin pan with water. After taking guesses, pour the oil in. **Explain that oil and water do not mix well due to differences in their chemical make-up. Make sure to emphasize that it is <u>NOT</u> for eating.** Emphasize again that the feathers represent animals that have been hurt by the oil spill.

        - **Allow the students to brainstorm how they want to clean their feathers.** This can include using water, soap, spoons, or paper towels. After brainstorming, let the students try out their ideas to clean their feathers.
        - Discuss how in real-life, fancy versions of soap are used to clean oil spills.
        - **Emphasize that no matter the cleaning method, it is costly and time consuming.** Explain that the **<u>best</u>** method is to avoid **causing pollution** in the first place!
        - Following completion of the oil spill activity, dispose of the pans accordingly**.** The students may keep their newly cleaned feathers!
    - *Matching game involving energy terms, their pictures, and their definitions*
        - This interactive activity will allow students to demonstrate what they learned from the slide deck and oil spill activity by matching energy vocabulary to their definitions. Volunteer(s) will first allow the students to attempt this activity on their own and will provide feedback as needed.

Lesson 3: What is Pollution? Air, Water, and Land Pollution

LEARNING OBJECTIVES:

- To describe what pollution is and its impact on the Earth
- To differentiate between air, water, land, noise, and light pollution and to provide examples of each
- To explain how different types of pollution affect human health
- To demonstrate the production of air pollution from motor vehicles via an interactive activity with marshmallows
- To observe and explain the production of acid rain via an interactive activity with phenol red indicator

WHY: Many of the energy sources we discussed in lesson 2 create pollution, often without us even realizing it. This activity will teach students about different types of pollution that can affect their health and the health of the Earth. With this knowledge, students can try to limit activities that cause pollution in their own lives and feel empowered to push for change at a larger level as they learn more.

MATERIALS:

Required: Multi-colored marshmallows, pretzel sticks, Skittles or M&M fun packs, print-out photo of factory fumes, print-out photo of the sun, transparent cup, water, phenol red, reusable straw

DETAILED PLAN:

1. **Group Presentation:** Volunteer(s) will present the 'Pollution' slide deck. **Make this interactive and ask questions throughout!**
    - The slide deck will explain the different types of pollution and their impacts on the Earth and our health. Before presenting each type of pollution, have the students brainstorm ideas on their negative impacts. **Words like "asthma" and "infection" may be new for some kids. This is a great opportunity to break down these terms.**
2. **Activity 1 – Ground-level ozone simulation with marshmallows!**
    - Designate two different colors of marshmallow to represent the atoms oxygen and nitrogen. **Briefly explain that these are all elements that make up our world. Elements combine to make different molecules.**
        - Example: White = oxygen, Yellow = Nitrogen
    - Have students assemble the following molecules with marshmallows by using pretzel sticks to connect the different colors **(volunteer(s) should assemble their own molecules to work along with the students):**
        - Nitrogen dioxide – NO_2 (example: Yellow – White – Yellow)
        - Oxygen – O_2 (example: White – White)

- **Volunteer(s) demonstration- have students mirror these steps AFTER the volunteer(s)**
    - Using the picture of a factory, explain how nitrogen dioxide arises from the smoke that is released from non-renewable energy sources like fossil fuels. **Volunteer(s) should place <u>their own</u> nitrogen dioxide molecule next to the factory picture.**
    - Volunteer(s) will then place the picture of the sun next to the nitrogen dioxide molecule. Take one of the oxygen marshmallow 'atoms' off the nitrogen dioxide molecule to form nitric oxide (example: Yellow-White). **Emphasize how this chemical reaction happens when energy from the sun splits nitrogen dioxide in the pollutant.**
    - Volunteer(s) will place the oxygen molecule next to the nitric oxide molecule and the lone oxygen marshmallow. Then, connect the oxygen molecule (O_2) with the lone oxygen marshmallow to form **O_3, or ozone** (example: White – White – White). **Explain how this is a chemical reaction that occurs when three oxygen atoms connect. The product is called ground-level ozone, which is harmful to our health and can make it harder for us to breathe.**
    - Next, the volunteer(s) will select a few skittles or M&Ms of different colors and place them near the ozone marshmallows. **Explain that these colors represent the other components of smog. These other components can include carbon monoxide and sulfur dioxide.**
- Have the students replicate the marshmallow pollution activity. As students replicate the production of air pollution have students answer the following:
    - **How can we reduce air pollution?**
    - **How is this form of pollution harmful for human health?**
- Following completion of this activity, **students may eat their marshmallows and candy!**

3. **Activity 2 – Acid Rain Demonstration**
    - To set up this activity, pour some water into a transparent cup and mix in a few drops of phenol red. The water should turn a pale red color.
    - Ask the students what they remember about how acid rain forms from the slide deck. **Explain that the pale red water represents normal rainwater in the sky.**
    - Using a reusable straw, blow into the water solution until the phenol red reacts and begins to turn the solution yellow. The solution turns yellow because carbon dioxide that you breathe out turns the indicator solution acidic. **Explain that this represents pollutants mixing with rainwater to form acid rain.**
    - Have students brainstorm:
        - **How can we reduce acid rain?**
        - **Why is acid rain harmful to the Earth?**
    - **Safety Note: Make sure that only the instructor is blowing into the water solution so that kids do not swallow any phenol red. This should be a demonstration only.** *The students may participate by answering questions throughout.*

Lesson 4: Solar Oven & Campaign Poster Creation

LEARNING OBJECTIVES:

- To demonstrate how solar energy works by building a personal solar oven for cooking s'mores.
- To recall and define the different types of energy, specifically renewable vs. non-renewable
- To engage in a hands-on creation of a working solar oven
- To demonstrate advocacy skills by making "campaign posters" on a topic of their choosing related to environmental health.

WHY: In the last two lessons, students have learned about different forms of energy and pollution. Students will tie these concepts together and explain how they relate by creating their own reusable solar oven! While the s'mores are cooking on the solar ovens, students will learn more about advocacy and how they can promote sustainable actions by making their own campaign posters on a topic of their choosing.

MATERIALS:

Required: Cardboard pizza boxes, glue, box cutter, aluminum foil, black cardboard paper, plastic wrap, graham crackers, marshmallows, chocolate, wooden sticks, poster paper, coloring utensils

Optional: *Rulers* (While exact measurement is not required, this can be a great skill for students to learn!)

DETAILED PLAN:

1. **Assembling the solar oven**
    - See 'Solar Oven' video material on how to make a solar oven! Show this video to students. You can also refer to the 'REACH Solar Oven Slideshow' for written instructions and pictures that can be displayed while students are making the ovens.
    - **Volunteer(s) should do ALL the box cutting for the students.** Students may do the rest of the assembly themselves.
2. After assembling the solar ovens, have students assemble their smores ingredients into their oven and leave them out in the sun.
3. **Activity - Campaign posters**
    - As marshmallows are cooking in the solar ovens (~20 minutes), begin the campaign poster activity.
    - Depending on the number of students involved, students may make their own poster or get into groups of three to four.
    - Have each student or group produce the following ideas for their campaign poster:

        - **Topic:** What aspect of environmental health do you want to focus on? Examples can include: saving wildlife, reducing air pollution, preventing acid rain, etc.
        - **Solution:** What solution are you proposing to prevent a negative outcome/promote a positive outcome?
        - **Content:** How are you going to represent this on your poster?
        - **If students are working in groups, make sure EVERYONE can share their ideas before moving on. Help divide up roles for each student, so they are all involved!**
    - Keep this fun! Students should have free reign over how they want their poster to look.
    - Make sure to answer any questions students or groups may have. If anyone is stuck on what they want to make, volunteer(s) can provide some feedback to guide students!
    - **After students are done making their posters, they may go outside to eat the smores they cooked in their solar ovens!**
4. **Volunteer(s) should hold onto the posters that each student/group makes and save them for the final session.**

Lesson 5: Final Session - Jeopardy & Campaigning

LEARNING OBJECTIVES:

- To demonstrate the cumulation of knowledge from all sessions of REACH through an interactive Jeopardy-style game
- To advocate for environmental science by presenting the posters (made in the previous lesson) to their classmates and instructors

WHY: The final session of REACH allows students to demonstrate what they have learned by competing in a Jeopardy-style game. After finishing this activity, students can present their campaign posters. This will help teach advocacy and provide a spark to allow students to recognize and speak out on environmental science issues in their futures!

MATERIALS:

Required: Big candy bars for the winning team, smaller candy for all other participants **(emphasize that EVERYONE is a winner!!) Make sure that any food allergies are confirmed before acquiring prizes.**

DETAILED PLAN:

1. **REACH Jeopardy**
    - Volunteer(s) will walk students through the 'REACH Final Jeopardy' slide deck.
        - Have students get into groups of 4-5. Each team should give themselves a team name!
        - Follow the game rules in the 'REACH Final Jeopardy' slide deck. Each group should only be allotted 1 minute per question before moving on to other groups to answer.
        - If no groups can answer any particular question, **volunteer(s) should walk the students through the topic and answer any lingering questions that students may have!**
    - Whichever team has the most points at the end of the slide deck will win the grand prize! Other teams will be given smaller forms of candy!

2. **Poster Presentation**
    - Have each group present their campaign poster to the rest of the class (~5 minutes).
        - **KEEP THIS FUN! Emphasize important concepts after each group's presentation and congratulate them on completing REACH!**
        - Try to make sure that **EVERY** member of a group has a chance to speak!

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