

Class: Grade 10 Science

Lesson Title: Bioaccumulation Kinulation

Class Size: 20
Time: 20-25 mins

Curriculum Outcomes:

318-2 Describe the mechanisms of bioaccumulation, and explain its potential impact on the viability and diversity of consumers at all trophic levels.

Learning Objectives:

1. Students will understand the effects of bioaccumulation on ecosystems and organisms at various trophic levels
2. Students will be aware of pesticides and other toxins that exist in ecosystems (mercury, arsenic, lead, etc.)

Materials:

- Coloured paper crumpled into pieces to represent different toxins, pesticides and other elements (you can use 4 different colours to represent arsenic, mercury, lead, pesticides)
- Posters to designate the different landmarks in the ecosystem (water, marshland, hazardous waste, field)
- Tape –to create the landmarked areas (you can use 4 colours for the 4 different landmarks)
- Organism name tags for students to wear (see the list at the end of this document)
- 4 different coloured pinnies and name tags to identify student roles (organisms from different trophic levels- see at the end of this document)
- Zip lock bags for students to hold pesticides and other toxins they accumulate (the bag represents their body)

Preparation beforehand:

- Move desks, chairs, tables to the sides of the classroom to create an open space. Set up taped areas for the landmarks you have chosen to use. The area can be taped as one giant square divided into 4 smaller squares to represent water, marshland, hazardous waste and a field).
- Have the different coloured paper pre-crumpled before the lesson to represent the pesticides, toxins and elements that will be contaminating the different landmarks
- Have nametags for the organisms prepared (grass, maple, birch, hawk, trout, human, deer, coyote, beaver, etc.)
- Have posters for landmarks prepared

NOTE: This kinulation is a great follow up to the “Food Web” kinulation and can be done in the same lesson. For the Food Web activity, the students are divided up into 4 trophic levels (different coloured pinnies) with name cards. They can keep the same name cards and pinnies to continue into the bioaccumulation kinulation (refer to Food Web lesson plan if you plan to do both activities in the same lesson). **Skip to #5 if you are combining the food web with the bioaccumulation activity.**

Introduction:

1. Have students form a circle in the room so they can see one another.
 - a. Explain to the students that they are going to create an ecosystem.
 - b. Explain what a kinulation is (broken up into kinesthetic and simulation). Tell them that these are used to help students learn difficult concepts that are otherwise difficult to picture. It allows students to become part of the demonstration, and therefore easier to remember and learn. Ask students if they would like to try one.
2. Introduce the topic. Possible prompt questions include:
 - a. What is an ecosystem? How is it organized? What are trophic levels?
 - b. What’s at the bottom of the trophic levels? What are examples of organisms in that level? Where do they get their energy?
 - c. What is the next trophic level? What types of things eat just plants? Examples?
 - d. What is the next trophic level? What can eat primary consumers and producers? Examples?
 - e. What kinds of things would be at the top (3rd level consumers)? Examples?

Begin Activity:

3. Begin handing out name tags to students (randomly). They can wear the name tags around their necks for the rest of the activity.
4. Put the coloured pinnies in the center of the circle. Tell students that they're going to help divide colours into trophic levels.
 - a. Producers can be green. Tell students that if they think they are producers they can come grab that colour pinny. Have students look around and see if anyone else should grab a green pinny. Discuss.
 - b. Primary consumers (herbivores) can be yellow. Have students take a yellow pinny if they think they are at this trophic level. Discuss.
 - c. Secondary consumers can be blue. Have students take a blue pinny if they think they are at this level. Discuss.
 - d. Tertiary consumers can be red. Have the remaining students take a red pinny. Discuss.
 - e. Have students look around the circle and decide if each organism is in the correct trophic level. This can create a lot of discussion since there are grey areas for certain animals and what they actually eat. If there is uncertainty for certain organisms, have students vote for which level they think the organism should belong in.
 - f. Now, all students should have a coloured pinny and a name tag.
5. Place the posters for the landmarks in one of the four squares that was taped before the lesson started (one square can be water, one can be hazardous waste, a field and marshland).
6. Ask students to go stand in the area that they think their organism would live
 - a. Explain that the hazardous waste area would be similar to a landfill or a place where hazardous toxins would be disposed of (mercury, lead, etc.)
7. Hand out a zip-lock bag to each student
 - a. The bag represents their body (digestive system, circulatory system, respiratory system, etc.)
8. Explain what the crumpled up paper represents (4 different colours used)
 - a. Throw some mercury, arsenic and lead in the hazardous waste area. Explain where each chemical could come from.
 - b. Throw some pesticides on the field area. This will probably be where the majority of the students have chosen to stand (in #6). Explain what pesticides are used for.
 - c. Explain that sometimes we can put toxic substances and pesticides in places but they may not stay in that place. These substances can spread to places they shouldn't be (show this by dumping the rest of the crumpled pieces of paper all over the 4 squares including in the water and the marshland).
 - d. Ask students what are some mechanisms that these toxic chemical and pesticides could spread? Discuss.
9. Ask students to pick up 3-4 pieces of crumpled paper in the area they are in and add it to their bag (their body)
10. Next, the students are going to simulate a food chain. Have students who are wearing yellow (primary consumers) link arms with students wearing green (producers) to show that the primary consumer has eaten the producer.
 - a. Next, have students wearing blue pinnies (secondary consumers) link arms with the yellow pinnies to show they have eaten the primary consumers that just ate a producer (a chain that is blue-yellow-green)
 - b. If there are any students who could not form a chain, they didn't find anything to eat and they are "dead", have those students step outside the squares.
 - c. Next, have the red pinnies (tertiary consumers) link to a blue-yellow-green chain of organisms

11. Ask students to dump their crumpled pieces of paper into the bag of the top level consumer
 - a. For example, if there was a chain of students that was sunflower→squirrel→raccoon→hawk (green→yellow→blue→red) the students would put all of their pieces of paper from their own zip-lock bag into the hawk's zip-lock bag.

Conclusion – Possible wrap-up questions:

1. What could we do to change the impact of bioaccumulation on organisms to better protect them?
2. Ask students what they just simulated? Why are all of the contents now at the end of the chain?
 - a. Why is it all at the top level consumer? Why was it passed on?
 - b. What does accumulate mean? (Biological hoarders—bioaccumulation)
 - c. Ask students what they have eaten in the last week that could have accumulated something and is now inside of them? (Ex: roast beef came from a cow, what did the cow eat?)
 - d. Ask students to come up with a longer chain they would have eaten (chicken, beef, pork, fish)

Pinny Colours/Trophic Levels for Organisms

Grass, Sunflower, Clover, Birch, Maple

Deer, Bee, Rabbit, Caterpillar, Grasshopper, Squirrel, Beaver

Duck, Owl, Robin, Snake, Frog, Fox, Mouse, Raccoon, Trout, Fly, Ant,

Salamander, Mosquito, Crow

Coyote, Hawk, Human