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Engagement: Aliens Aren't Always From Outer Space

Mathematics Readiness Assessment

Mathematics and science go hand-in-hand. Many times mathematics is necessary to understand and work with science concepts. In order to fully understand the science and be successful with investigations and activities in this module it is important for your teacher to know if you already know some mathematics computations and skills. On pages 4–11 of the Student Data and Response Booklet (SDRB) is a mathematics readiness assessment designed for this module. Complete it to the best of your ability. It will not be marked; it will be used to help your teacher create strategies so that you can successfully complete the activities.

Do You Already Know This Science?

In preparation for the main performance task in this module, it is important to understand what you already know about ecosystems, water, watersheds and exotic, invasive species. Answer the questions on pages 12–17 of the SDRB. Your responses are not marked and, correct or not, will help guide the lessons in this module.

Materials Needed

Red texta or coloured pencil.

What is an Alien?

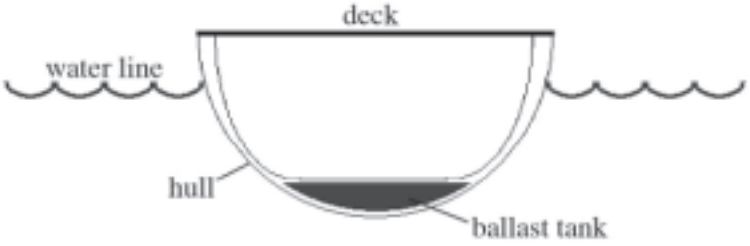
Assume that the drawing to the left represents a **habitat** (a natural environment where an organism lives). The habitat to the left represents a home to small creatures like frogs. These creatures have lived there for many, many years and are considered **native** to this habitat.

Suppose someone brought an alligator from another habitat and let it swim in the frog's habitat. The alligator is considered **non-native**, **exotic** or **alien** to the frog's habitat. This puts the frogs and other small creatures at risk. The alligator could become an invader of this habitat.

Are Aliens Always Big in Size?

Alien species are not always large. Aliens can fit in the palm of your hand or can even be microscopic. It is easier for small alien plants and animals to move from one habitat to another, because they can unknowingly travel in or on vehicles or even other animals. For instance, many alien species have travelled in cargo ships that travel the world's oceans. When a ship docks in a distant port, water is released from the ballast tank. As water is released, a ship rises in the water which allows for navigation in shallow waterways. The **ballast water**, released into the waterway, could contain small plants and animals from far-away places.

Cross Section of a Ship



Activity 1: Hitchhikers Create Menace

Activity Description

In this activity, you will explore the environmental issue of exotic, invasive species and the problems they create in ecosystems.

Materials Needed

Materials to make a poster.

Hitchhiking Brown Tree Snake

Brown Tree Snake

Guam, an island located in the western Pacific Ocean, is a territory of the United States. Although this island is on the other side of Earth, it is experiencing a problem that can be found anywhere on our planet—aliens. In this case, the alien is the brown tree snake which is not native to this island.

How did the brown tree snake get to an island in the middle of an ocean? A likely explanation is that brown tree snakes hitched a ride on U.S. military cargo ships shortly after World War II ended. When these stowaway snakes arrived on Guam, they found a paradise where there were no **predators** (organisms that exist by preying upon other organisms) of the snake on the island. In addition, an abundance of **native fauna**—birds, mammals and lizards that lived on the island provided a food source for the brown tree snake.

When one significant change occurs in an ecosystem (an area that contains organisms interacting with one another and their non-living environment), it impacts everything else in that ecosystem and this can be disastrous to a fragile environment. Before the introduction of the brown tree snakes, there were eleven native bird species. Today, nine of those species no longer survive on the island. In other words, most of the birds on the island are gone because of the brown tree snake.

Explore "Frankenfish"

As stated earlier, exotic species can be found anywhere on Earth. Closer to home is the exotic, invasive **Northern Snakehead fish**. This fish threatens a number of areas in the United States.

It has been nicknamed "frankenfish" and starred in two science fiction movies.

1a Do an Internet search and find out more information about the Northern Snakehead fish.

On page 20–21 of the SDRB, you will find space to respond to the following questions about the Northern Snakehead fish. You should learn most of this information from your Internet search.

1b The Northern Snakehead fish is native to what countries?

1c When and where was it introduced in the United States?

1d How was it introduced into natural waterways?

1e What is the length an adult Northern Snakehead fish can grow?

1f What do Northern Snakehead fish eat?

1g What characteristics make the Northern Snakehead fish so invasive?

4d. Think about the information in the previous paragraph and *describe* how you would calibrate your hydrometer with three more lines that would indicate a salinity of 20 ppt, 30 ppt and 40 ppt. On page 41 of the SDRB, *describe* your procedure. A diagram would be helpful. Then, *calibrate* your hydrometer for the above salinities. The accuracy of your calibration will be determined in the next exploration.

How Accurate Was Your Calibration?

Your teacher has prepared two samples of saltwater—Sample A and Sample B—with an unknown salinity for each sample. Your task is to use your "calibrated hydrometer" to determine the salinity for each sample.

4e. *Determine* the salinity of Samples A and B. *Record* your results on the chart on page 41 of the SDRB.

4f. To reduce the percentage error in results, *collect* the results of each of your team members and *record* their results on the same chart on page 41 of the SDRB.

4g. *Compute and record* the group average for each sample.

4h. Before you learn the actual salinity values for each sample, compare your group's average to the rest of your class. On page 42 of the SDRB, *record* the results from other groups. *Compute* the class average.

4i. Next, *compare* the averages to the actual salinity and *describe* your comparison on page 42 of the SDRB.

Compare Your Results as Scientists Would

Scientists often compare the results of different measurements. However, merely reporting the difference between the values may be of very little use to them. To just report your results or your group's results is not helpful, but it is important to know how "far off" the results were. To express the "magnitude" of the error (or deviation) between two measurements scientists invariably use "**percentage error**".

Compute Percentage Error

If you are comparing your value to an accepted value, you first subtract the two values so that the difference you get is a positive number. This is called taking the *absolute value of the difference*. To do this, you divide this result (the difference) by the accepted value to get a fraction, and then multiply by 100% to get the **percentage error**.

$$\%\ \text{error} = \frac{\text{your result} - \text{accepted value}}{\text{accepted value}} \times 100\ \%$$

The lower the number for % error, the more accurate the response.

4j. *Determine* which group had the lowest % error. Once your teacher has given you the actual salinity for each sample, use the above formula to *compute* the percentage error for your results, your group's averages and the class averages. There is a chart and space for computation on page 42 of the SDRB.

Think About This

4k. From what you have learned in this exploration, what might help to reduce the % error when performing future experiments or investigations? Respond to this question on page 43 of the SDRB.

Check Your Understanding

On pages 44–45 of the SDRB, *respond* to the five questions that will test your understanding of Activity 4.

Activity 5: The Chesapeake Bay and Its Watershed

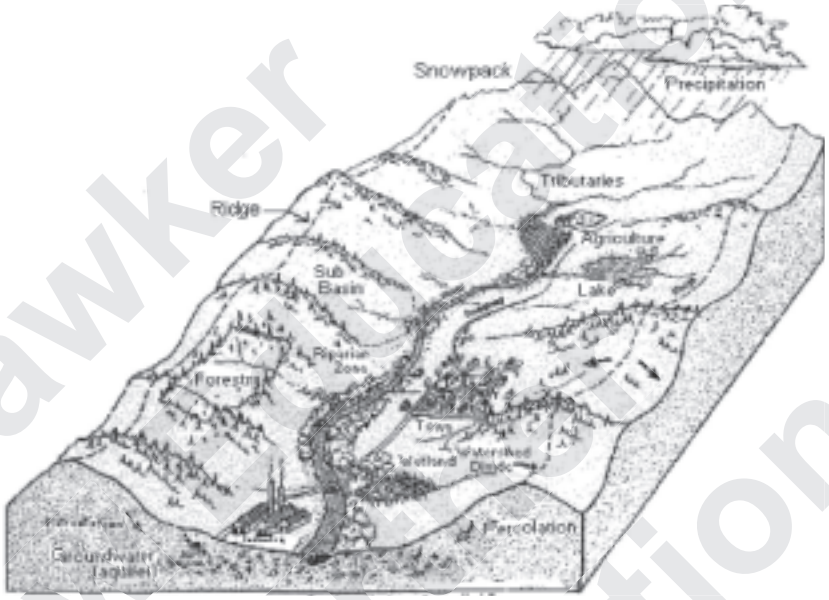
Activity Description

In this activity, you will learn about the source of freshwater in the Chesapeake Bay and three important physical characteristics (abiotic factors) that affect the aquatic animals that call the Bay their home.

What is a Watershed?

A **watershed** is an area of land that drains down-slope to the lowest point. The water runs off and drains into a stream, river, lake, estuary or other body of water, such as the Chesapeake Bay.

The following diagram is a typical watershed and shows the kinds of landscape and land use that might affect the water that runs off of it.



Chesapeake Bay and Its Watershed

The Chesapeake Bay is 313 kilometres long and measures between 6 to 48 kilometres wide. The Bay's surface area covers about 6275 square kilometres, but its watershed covers about 103,000 square kilometres. The watershed includes six U.S. states and the District of Columbia.

5a. Using the map to the right, name the six states included in the Bay's watershed. Write your responses on page 46 of the SDRB.

The Bay is very shallow with an average depth of 6 metres. This makes it vulnerable to the impact of human activities and development.

Over 50 rivers and numerous tributaries flow into the Bay, but the Susquehanna River is the largest river in the watershed and supplies the Bay with 50% of its freshwater. Most of the Susquehanna River, except where it empties into the Chesapeake Bay, would have a salinity level of less than 0.5 ppt. Freshwater and