

## ACIDITY AND CLIMATE CHANGE IN THE ARCTIC

### **Purpose:**

- To apply prior knowledge of chemistry to the acidification of our oceans
- Computer lab or library based activity

### **Time**

**Preparation:** Previous knowledge of fundamental concepts of chemistry

**Class time:** One class period of research, followed by 30 mins of presentation/discussion

### **Materials**

- Computer lab or library, lab or classroom
- Aquarium or container to grow algae
- Algae
- pH paper (the more sensitive, the better)
- younger students may require safety glasses
- Student Worksheet

### **Procedure**

1. Set up a glass tank in your classroom and grow a population of algae in water. Local pet supply stores will most likely give you some for free from their fish tanks!
2. Set up a chart and record the pH of the water for several days. It should be fairly stable.
3. Add a couple of drops of vinegar every 3 or 4 days.
4. Record the pH in the chart
5. Note any changes in the size of the algae population

### **Discussion**

6. Make a graph showing pH vs time.

*\*pH should decrease with time. Therefore, the slope should be negative.*

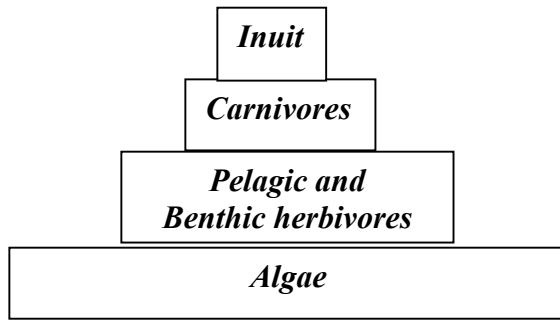
7. State the effect of lowered pH on the algae population

*\*Algae populations tend to increase with acidity, whereas animal populations may decrease, as well as marine biodiversity.*

8. Where in the Arctic, are populations of algae formed?

*\*Ice algae grows on the undersurfaces of ice, both annual and multi-year ice.*

9. Neatly, draw a food web that contains algae – include Inuit people in the web



***\*Benthic refers to the ocean floor, whereas pelagic refers to the ocean water.***

10. It is thought that 40% of fossil fuel emissions end up in the ocean. The surface of our oceans is now approximately 30% more acidic than before our use of fossil fuels.

a) What are fossil fuels?

***\*Fossil fuels include natural gas, coal and oil, and are formed from the decay of plants and animals.***

b) How are fossil fuels used?

***\*They are used as energy sources, for example, to provide heat, motion, and to generate other sources of energy such as electricity.***

c) How do fossil fuel emissions (as a result of burning fossil fuels) end up in the oceans?

***\*Burning of fossil fuels produces carbon dioxide (a major greenhouse gas) and water. Other gases are produced, such as those found in the following table. Natural gas is the “cleanest” fuel to burn.***

d) How do fossil fuels contribute to the lowering of the pH of the ocean?

***\*Gaseous pollutants combine with water to form acids, which fall as acid rain in the oceans, as well as on land.***

e) How might the lowering of the ocean’s pH affect the Inuit people?

***\*Lowering of pH levels alters marine and terrestrial food chains. If the bottom of the food chains are affected this eventually affects the Inuit people, who are at the top of the food chains.***

## Extensions

- What are methane hydrates and how are they involved in the ocean's "carbon sink"?  
*\*Methane hydrates are sources of "frozen methane". It can float on water or even sink. They are found deep in the ocean floors and in permafrost. If they melt, the methane is released, which would contribute a major source of a greenhouse gas. Methane is a significant greenhouse gas and degrades into carbon dioxide.*
- What are possible "drivers" that may cause the ocean to act as a "carbon sink"?  
*\*"Carbon sinks" include anything that absorbs carbon dioxide – including oceans, as well as green trees. Anything that encourages the absorption of carbon dioxide would be considered "drivers", encouraging the uptake of carbon dioxide. A "driver" for the absorption of carbon dioxide into the ocean might include increased plant life or increased atmospheric carbon dioxide. Oceans are estimated to have absorbed almost half of human CO<sub>2</sub> emissions. Increased acidity of the ocean endangers marine plant and animal life.*

How might the ocean act as a carbon "source"?

*If the organic material decomposes or rots, carbon dioxide is released into the water. This process requires oxygen.*

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#### Data and Observations

Day	pH	Observations in Algae Growth
1		
2		
3		
4		

#### Discussion

6. Make a graph showing pH vs time.



7. State the effect of lowered pH on the algae population.

Time (days)



