

Applicable standards

National Geography Standards, Second Edition

Grade 9-10 Geography	Lessons						
	1	2	3	4	5	6	7
Element of the curriculum							
The World in Spatial Terms							
Standard 1: How to use maps and other geographic representations, tools, and technologies to acquire, process, and report information from a spatial perspective.	✓		✓	✓	✓	✓	✓
Places and Regions							
Standard 4: The physical and human characteristics of places.	✓					✓	
Standard 6: How culture and experience influence people's perceptions of places and regions.					✓		
Physical Systems							
Standard 8: The characteristics and spatial distribution of ecosystems on Earth's surface.	✓					✓	✓
Human Systems							
Standard 13: How the forces of cooperation and conflict among people influence the division and control of Earth's surface.					✓		
Standard 14: How human actions modify the physical environment.	✓	✓					
Environment and Society							
Standard 15: How physical systems affect human systems.	✓						
The Uses of Geography							
Standard 17: How to apply geography to interpret the past.			✓				
Standard 18: How to apply geography to interpret the present and plan for the future.		✓	✓	✓			✓

SCHEME OF WORK

Lesson 1: What is ocean acidification?

Overview

An introduction to the issue of ocean acidification, this lesson uses a combination of video, theory and practical demonstrations to develop students' understanding of the 'other carbon problem'.

Learning outcomes

- Understand the process of ocean acidification
- Demonstrate how increased carbon dioxide increases acidity in water

Resources

**Slideshow 1:**

Ocean acidification process

**Student Sheet 1a:**

Ocean acidification in a cup

Student Sheet 1b:

Do you like your oceans still or sparkling?

Student Sheet 1c:

Reflect and connect

**Subject Update:**

Learn more: Ocean acidification process

Lesson 2: Ocean acidification: Research in action

Overview

The Arctic Ocean is known as a 'sentinel system'. This is because ocean acidification is happening more rapidly in these cold waters. Students will learn about the research that is currently being undertaken in this remote region.

Learning outcomes

- Understand why ocean acidification is happening at different rates in different places
- Understand why scientists are going to the Arctic to study ocean acidification
- Demonstrate understanding of the realities of remote field research
- Understand that scientists have to make a case when they apply for funding

Resources

**Student Sheet 2a:**

Dissolving sea shells in acid

Student Sheet 2b:

Scientist tweet sheet

Student Sheet 2c:

Blog post

Student Sheet 2d:

Storyboard template

**Diagram:**

Sea surface temperature

Diagram:

Changing sea surface pH

**Video:**

Channel 4 News reports from the Arctic

**Gallery:**

Water sampling

Gallery:

Trawling for copepods

Gallery:

Making an ice hole

Gallery:

Ice Base science

SCHEME OF WORK

Lesson 3: Ocean acidification: Data analysis

Overview

One of the most used data sets to show the trend in ocean acidification over the past 20 years is from the Hawaii Ocean Time-series. Students will use real data from a series of research 'cruises' to analyse the information and identify trends. There are options to use ICT to examine the data set, as well as using print outs of graphs and data tables.

Learning outcomes

- Understand the use of data in geographical enquiry
- Create a graph from a data set
- Interpret data and draw conclusions

Resources

**Slideshow 3:**

Using Excel to create graphs

**Student Sheet 3a:**

Ocean acidification data and question sheet

Student Sheet 3b:

Ocean pH graph

Student Sheet 3c:

Ocean carbon dioxide graph

Student Sheet 3d:

Ocean acidification graph and question sheet

Student Sheet 3e:

Ocean acidification Excel and question sheet

**Data Set:**

Ocean acidification data spreadsheet (students)

Data Set:

Ocean acidification data spreadsheet (teachers)

**Subject Update:**

Learn more: About the Hawaii Ocean Time-series

Lesson 4: Conference in a classroom

Overview

One of the most used data sets to show the trend in ocean acidification over the past 20 years is from the Hawaii Ocean Time-series. Students will use real data from a series of research 'cruises' to analyse the information and identify trends. There are options to use ICT to examine the data set, as well as using print outs of graphs and data tables.

Learning outcomes

- Understand how field research teams communicate results
- Be able to explain the main issue and science of ocean acidification
- Discuss research topics with peers

Resources

**Student Sheet 4a:**

Research poster template

**Subject Update:**

Learn more: Research posters

SCHEME OF WORK

Lesson 5: The issue of Arctic ice




Overview

An introduction to the issue of Arctic sea ice, this lesson uses a combination of satellite imagery, Google Earth, video and online research to examine what is happening to sea ice extent in the Arctic. Students will continue by investigating the potential environmental, political and economic impacts of a reduction in Arctic sea ice.

Learning outcomes

- Understand that summer sea ice coverage is decreasing in the Arctic
- Understand the climate-related and habitat-related impacts of Arctic sea ice loss
- Understand the political and economic impacts of Arctic sea ice loss
- Demonstrate understanding of interrelated impacts of environmental change

Resources

-  **Student Sheet 5a:**
Arctic ice impacts
-  **Diagram:**
Political map of the Arctic
-  **Video:**
Ocean circulation

Lesson 6: Sea ice: Research in action




Overview

Measuring the thickness of sea ice has not been possible via satellite until very recently and even now the Cryosat satellite can only survey up to a latitude of 88° north and south. The other way to measure sea ice thickness is by hand, walking for days across the frozen ocean in temperatures down to -40°C. Students will learn how the data they will be studying was collected.

Learning outcomes

- Understand that measuring sea ice thickness is difficult and important
- Understand what it would be like to be an Arctic explorer
- Get familiar with the techniques used for collecting snow and ice thickness data
- Demonstrate understanding of the realities of remote field research
- Debate the issue of what kind of people can collect scientific data

Resources

-  **Student Sheet 6a:**
Catlin Arctic Survey 2009
- Student Sheet 2b:**
Scientist tweet sheet
- Student Sheet 2c:**
Blog post
- Student Sheet 2d:**
Storyboard template
-  **Video:**
Drilling the ice
- Video:**
Ann's food bag
- Video:**
Catlin Arctic Survey expedition trailer
-  **Gallery:**
Wonders of ice

SCHEME OF WORK

Lesson 7: Sea ice: Data analysis

Overview

During the Catlin Arctic Survey 2009, the expedition team gathered snow and ice thickness data that will contribute to an understanding of the overall state of the Arctic sea ice. Students will use real data from the expedition to create ocean snow and ice profiles.

Learning outcomes

- Understand the variability of snow and ice thickness on the Arctic Ocean
- Know how the data was collected and what it can show
- Use data to create a visual representation
- Demonstrate ability to interpret and analyse data
- Judge the method of data collection
- Know how field research teams communicate results
- Be able communicate the issue and science of Arctic sea ice
- Discuss research topics with peers

Resources

**Student Sheet 7a:**

Using snow and ice data from the Arctic Ocean

Student Sheet 7b:

Monthly sea ice data and questions

Student Sheet 7c:

Monthly data record

Student Sheet 7d:

Daily sea ice data and questions

Student Sheet 7e:

Daily data record

Student Sheet 4a:

Research poster template

**Gallery:**

Wonders of ice