

GPS Mapping

Levels V-VI



Grades 9-12

Overview:

Scientists use Global Positioning System (GPS) receivers to map sea ice and glacier movement. GPS data are compiled by computer Geographic Information System (GIS) software into a digital map. Digital maps can help forecast the advancement or retreat of glaciers and sea ice. During this lesson, students will use GPS receivers to map the perimeter of their school grounds, then create a paper map of the grounds using the GPS data.

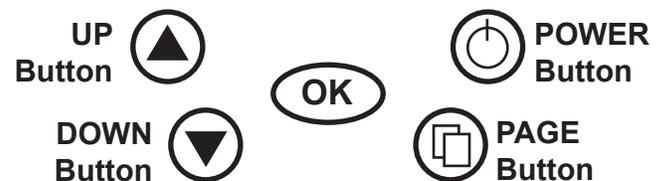
Objectives:

The student will:

- identify that scientists use GPS receivers to map glaciers and sea ice;
- use a GPS receiver to mark waypoints around the perimeter of an area; and
- create a paper map using GPS data.

Materials:

- STUDENT WORKSHEET: “Using a GPS”
- STUDENT WORKSHEET: “GPS Mapping”
- GPS receivers
- Rulers



Activity Preparation:

Teacher’s Note: Universal Transverse Mercator (UTM) is a grid mapping system in which the surface of a globe is projected onto a single plane map. UTM uses Eastings and Northings in one-meter increments instead of using latitude and longitude in increments of degrees, minutes, and seconds. UTM divides Earth into rectangular zones to minimize map distortion. Each UTM unit is equal to 1 meter.

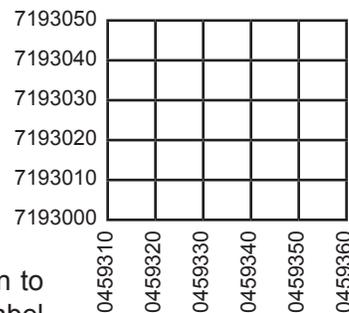
1. Select an outside area such as a playground in which to conduct this activity. The area must be less than 200 meters on each side, and should not be heavily forested or closely surrounded by buildings, because GPS units must have a clear view of the sky to receive signals from satellites. Select a starting point for students, who will walk the perimeter of the area with a GPS unit, marking a waypoint each time they change directions.
2. Prepare each GPS unit for student use. This includes installing batteries by lifting the flap on the back of the unit, setting the position format, map datum, and unit system. (See steps 3-12)
3. Press and hold the POWER button to turn on the GPS unit.
4. Press the PAGE button until the *Menu* page is displayed.
5. Use the UP/DOWN buttons to highlight *Units*. Press the OK button.
6. Use the UP/DOWN buttons to highlight the *Position Format* bar. Press the OK button.
7. Use the UP/DOWN buttons to highlight *UTM/UPS*. Press the OK button.
8. Use the UP/DOWN buttons to highlight the *Map Datum* bar. Press the OK button.
9. Use the UP/DOWN buttons to highlight *WGS 84*. Press the OK button.
10. Use the UP/DOWN buttons to highlight the *Units* bar. Press the OK button.
11. Use the UP/DOWN buttons to highlight *Statute*. Press the OK button.
12. Press and hold the POWER button to turn the GPS unit off. Repeat steps 3-8 for each GPS unit.
13. Depending upon your students, you may wish to train a few students to serve as the “GPS Expert Crew” for the class activity.

Activity Procedure:

1. Explain that scientists use hand-held Global Positioning System (GPS) receivers to map sea ice movement. GPS data are compiled by computer Geographic Information System (GIS) software into digital maps. These maps can help forecast the advancement or retreat of sea ice. During this activity, students will use GPS receivers to map a section of the school grounds.
2. Give each student the STUDENT WORKSHEET: "Using a GPS," and review the instructions. Divide students into groups and give each group a GPS unit.
3. Demonstrate how to turn the unit on and off and practice navigating to the "Mark a Waypoint" page by holding the OK button down for two seconds. Direct student attention to the numbers that appear at the bottom of the screen. These numbers represent the Easting and Northing of the waypoint. Students will be responsible for recording the Easting and Northing of each of their waypoints on the "GPS Data Chart" at the bottom of the STUDENT WORKSHEET: "Using a GPS."
4. Take students outside to show them the area you chose for the mapping activity. Walk with students to the starting point. Ask them to follow the instructions on the STUDENT WORKSHEET: "Using a GPS," to map the perimeter of the area. To create an accurate map, students must mark a waypoint each time they change directions.
5. After students have successfully recorded waypoints around the area, return to the classroom and explain that students will use data they gathered to create a map. Distribute the STUDENT WORKSHEET: "GPS Mapping." Demonstrate how to label the x- and y-axes using the Easting and Northing data students recorded on the "GPS Data Chart." See sample below.
6. Compare and discuss student maps.

Sample GPS Data Chart

Waypoint	Description	Easting	Northing
001	Starting point	0459582	7193172
002	Picnic table	0459311	7193187
003	Basketball hoop	0459321	7193007
004	Trash bin	0459570	7193028



Find the lowest Easting (0459311) on the GPS Data Chart. Round this down to the nearest 10 (0459310). Write this number at the origin of the x-axis then label the x-axis in increasing increments of 10 meters.

Find the lowest Northing (7193007) on the GPS Data Chart. Round this down to the nearest 10 (7193000). Write this number at the origin of the y-axis then label the y-axis in increasing increments of 10 meters.

Extension Ideas:

1. 3-D Topo Maps: Begin with a topographic map of your village. Help students create a three-dimensional topographic map by cutting foam core along topo lines, then gluing the layers together.
2. GPS Scavenger Hunt: Hide objects on the school grounds. Find the coordinates of the objects using a GPS receiver. Give students the coordinates and ask them to use GPS receivers to find the hidden objects.

Answers:

Using a GPS:

Answers on GPS Data Chart will vary.

GPS Mapping:

1. b) Global Positioning System (GPS) receiver
2. Maps will vary according to area.

Name: _____

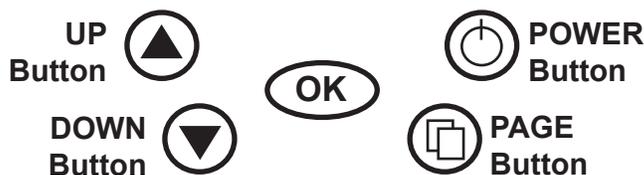
Using a GPS

Student Worksheet



Introduction: Scientists use hand-held Global Positioning System (GPS) receivers to map sea ice movement. GPS data are compiled by computer Geographic Information System (GIS) software into a digital map. These maps can help forecast changes in ice cover. In this activity, you will use a GPS receiver to map an area outside your school. Please follow the steps below to map your area.

1. Press and hold the POWER button to turn the GPS unit on.
2. Wait while your GPS receiver locates satellites. You may need to move away from structures and trees to get a good satellite signal. Your GPS unit needs to receive information from at least four satellites in order to accurately pinpoint your location. When your receiver has located four satellites continue with step 3.



3. Go to the starting point designated by your teacher and mark this spot as a waypoint on your GPS. A waypoint is a location on a route. To mark a waypoint, press and hold the OK button for two seconds. When a person holding a numbered flag appears, release the OK button.
4. Record the number on the flag, a waypoint description, and the Easting and Northing of the waypoint on the "GPS Data Chart" below, then press OK again to confirm the waypoint.

Note: the Easting and Northing are the seven-digit numbers at the bottom of the waypoint screen. The Easting is above the Northing.

5. Walk around the perimeter (outside edge) of the area. Mark a waypoint each time you change directions. Record each waypoint number, description, Easting and Northing on the chart below.

GPS Data Chart

Waypoint #	Description	Easting	Northing
<i>Example</i>	<i>Picnic table</i>	<i>0459582</i>	<i>7193172</i>

Name: _____

GPS Mapping Student Worksheet



1. What hand-held instrument that receives satellite signals do scientists use to map sea ice movement?
 - a) Tiltmeter
 - b) Global Positioning System (GPS) receiver
 - c) Seismometer
 - d) Correlation Spectrometer (COSPEC)

2. Use a ruler and the GPS Data Chart on the Student Worksheet: "Using a GPS" to draw a map.

Use the GPS data you collected to create a map on the grid below. Begin by finding the lowest Easting you recorded (the smallest number) in your chart. Round this down to the nearest 10 meters, then write it at the origin of the x-axis. The distance between each grid line represents 10 meters, so label the x-axis in increasing increments of 10 meters, starting with the Easting you wrote at the origin. Find the lowest Northing you recorded. Round this number down to the nearest 10 meters and write it at the origin of the y-axis. Label the y-axis in increasing increments of 10 meters. Plot and label each of your waypoints, then draw a line connecting each waypoint to the previous one.

