

GPS Mapping

Overview:

Scientists use Global Positioning System (GPS) receivers to map lava flows. GPS data are compiled by computer Geographic Information System (GIS) software into a digital map. Digital maps can help forecast the path of the lava flow. 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:

- understand that scientists use GPS receivers to map lava flows;
- use a GPS receiver to mark waypoints around the perimeter of an area; and
- create a paper map using GPS data.

Materials:

- GPS receivers
- Rulers
- Student Worksheet: “Using a GPS”
- Student Worksheet: “GPS Mapping”

Note: Universal Transverse Mercator (UTM) is a grid mapping system based on the metric system of measurement. 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. The Hawaiian Islands are in UTM Zones 4 Q and 5 Q. Scientists use UTM instead of latitude and longitude when mapping lava flows because it is easy to convert UTM units to distance. Each UTM unit is equal to 1 meter.

Answers to Student Worksheets:

Using a GPS:

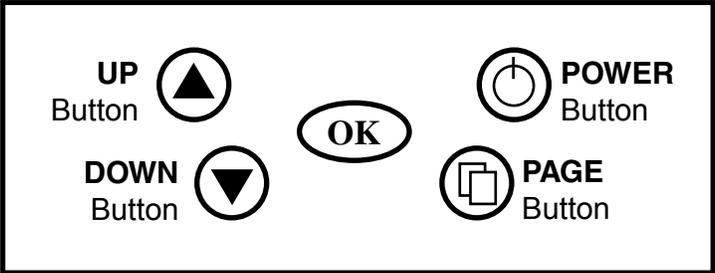
Answers on GPS Data Chart will vary.

GPS Mapping:

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

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Activity Preparation:

1. Select an outside area such as a playground or football field 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.
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UP Button 

 POWER Button 
 DOWN Button 

 OK 

 PAGE Button 
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, the map datum, and the unit system (see steps 3 through 12).
 3. Press and hold the POWER button to turn the GPS unit on.
 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 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.

Extension Ideas: 1) *3-D Topo Maps:* Begin with a topographic map of your island. Help students create a 3-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, then give students the coordinates and ask them to use GPS receivers to find the hidden objects.

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Activity Procedure:

1. Explain that scientists use hand-held Global Positioning System (GPS) receivers to map lava flows. GPS data are compiled by computer Geographic Information System (GIS) software into digital maps. These maps can help forecast the path of a lava flow. 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 instructions, then 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

7. 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.
8. 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.

