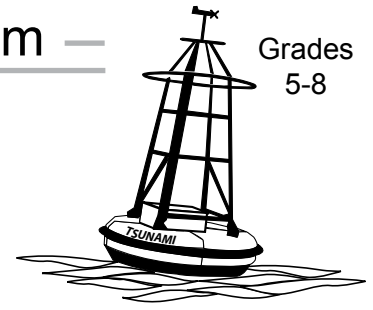


GPS - Using the Global Positioning System —

Grades
5-8



Overview:

Students learn about the global positioning system and how to use a GPS to determine their location. After acquiring satellite coverage with their GPS, students mark, name and save a waypoint.

Targeted Alaska Grade Level Expectations:

Geography

[A1] A student should be able to make and use maps, globes, and graphs to gather, analyze, and report spatial (geographic) information. A student who meets this content standard should use maps and globes to locate places and regions.

Technology

[A2] A student should be able to operate technology-based tools. A student who meets this content standard should use technological tools for learning, communications, and productivity.

[C1] A student should be able to use technology to explore ideas, solve problems, and derive meaning. A student who meets this content standard should use technology to observe, analyze, interpret, and draw conclusions.

Objectives:

Students will:

- identify the buttons on a GPS;
- switch pages on a GPS; and
- mark, name and save a waypoint.

Materials:

- GPS receiver
- STUDENT INFORMATION SHEET: "GPS - Using the Global Positioning System"
- STUDENT WORKSHEET "Using the Global Positioning System"

Science Basics:

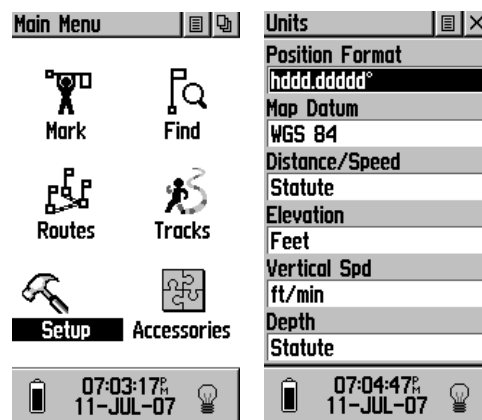
Maintained by the U.S. Department of Defense, the Global Positioning System (GPS) is a network of satellites that orbit Earth. There are a minimum of 24 satellites that provide coordinate information anywhere in the world. A GPS receiver, such as a those made by Garmin and Magellan, can be used to display location coordinates and elevation data. Depending on the model of GPS receiver used, most GPS units will provide current speed, distance traveled, and other useful information. GPS units have the ability to mark routes for navigation.

A GPS will provide elevation, but it may not match a topographic map. In general, use the elevation as a ballpark figure (close estimate). A GPS determines elevation using a mathematical ellipsoid model of Earth to approximate the surface of Earth. USGS maps use a geoid model. The difference between the ellipsoid and geoid varies, but a GPS should be within 15 feet of the USGS elevation.

An often-overlooked aspect of the GPS system is the accuracy of its time. Each satellite has 4 atomic clocks that are accurate to nanoseconds. GPS signals travel at the speed of light (186,000 miles/second). If there is a 1/1,000th of a second error, the positioning will be off by 186 miles.

Activity Preparation:

1. Before class, become familiar with the GPS model the students will be using. This lesson uses the Garmin Legend. To save time when working with students, take the GPS receivers outside and turn them on 24 hours prior to use. If the GPS has not been used in a while or has been moved for several hundred miles, it will take longer for it to acquire data from the satellites.
2. If this is the first time the GPS has been used, go to the **Main Menu** □ **Setup** and select the time zone.
3. On the **Setup** page, select the position format for the coordinates, which can be displayed in decimal degrees (hddd.dddd), degrees decimal minutes (hddd mm.mmm), or degrees minute seconds (hddd mm ss.s). They are equally accurate, just displayed differently. Leave the map datum in WGS 84. If desired, metric units can be displayed instead of feet.



Activity Procedure:

1. Distribute GPS units to students.
2. Inside the classroom, lead students through the STUDENT INFORMATION SHEET. Show students how to switch between different pages on the GPS and describe each of the pages. When turned on, the GPS will search for satellites. If the GPS is being used inside, it will not be able to lock onto satellites. When it does not find satellites, a box will pop up asking if the GPS should continue acquiring satellites or use the GPS without searching for satellites. Inform students to select Use with GPS off. After students have explored the pages, use the power button to turn off the GPS.
3. Take students outside with their GPS receivers. When they are in a location that has a clear view of the sky, ask students to turn on the GPS. After acquiring a position, navigate to the map page.
4. Ask students to walk around while observing the map page. When they get to a location they would like to save, ask them to mark, name and save the waypoint for that location.

Answers:

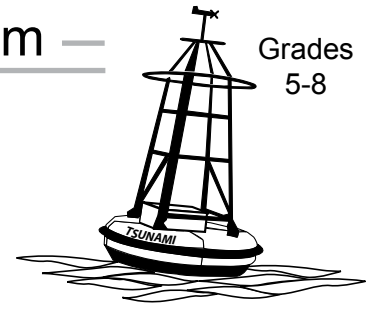
1. At least 24.
2. Identify the buttons.
3. Answers will vary.



GPS - Using the Global Positioning System —

Student Information Sheet

Grades
5-8



Maintained by the U.S. Department of Defense, the Global Positioning System (GPS) is a network of satellites that orbit Earth. There are a minimum of 24 satellites that provide coordinate information anywhere in the world. A GPS receiver, such as those made by Garmin and Magellan, can be used to display location coordinates and elevation data. Depending on the model of GPS receiver used, most GPS units will provide current speed, distance traveled, and other useful information. GPS units have the ability to mark routes for navigation.

Materials:

GPS receiver

Garmin Legend:

Familiarize yourself with the buttons on the GPS.



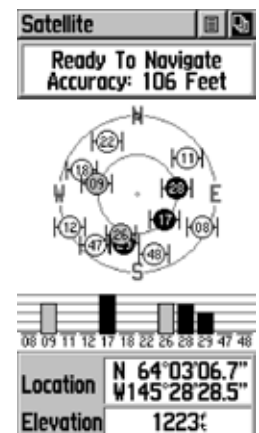
Turn on the GPS

Press and hold the power button located on the right side. Release the power button when the **startup screen** is seen on the display.

The GPS will take a few seconds to go through the startup screens. When startup is complete, the **Satellite page** will display.

The **Satellite page** shows the positions of the satellites overhead.

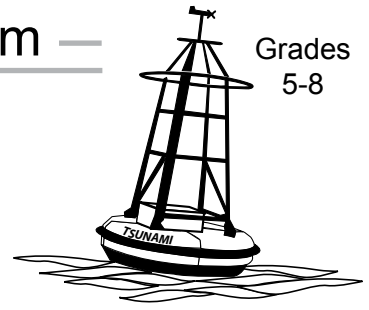
A GPS needs a clear view of the sky. It will not work inside a building. When the GPS gets a signal from a satellite, a gray-filled bar can be seen at the bottom. When it acquires positioning information from the satellites, the bars will fill in with black.



GPS - Using the Global Positioning System —

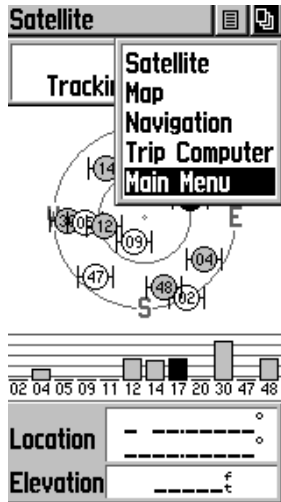
Grades
5-8

Student Information Sheet



The time it takes the GPS to lock on satellites will depend on how long it has been since the GPS was last used. If the GPS has not been used recently or has been moved over 300 miles, it will take longer for it to get positioning information.

A GPS needs at least 4 satellites to give useable location coordinates. If there is a clear view of the sky, the Garmin Legend should have an accuracy of at least 20 feet.



GPS Pages

Press the **page button** on the right side to move from one screen to another. The **click stick** can also be used to jump between screens. Highlight the page and press the **click stick** down to jump to the page.

The pages on a Garmin Legend are:

Satellite – provides a visual reference of the satellite being tracked.

Map – displays your movements and nearby map features. The black triangle indicates your current position and points to the direction of travel.

Navigation – provides guidance to your destination.

Trip Computer – provides a variety of trip and navigation data.

Main Menu – a directory of features and settings.

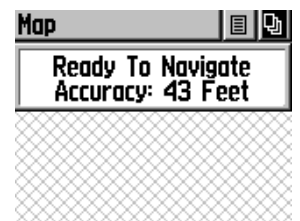
Map Page

Press the **page button** until the **map page** is displayed. The **map page** is the screen after the **satellite page**. The **click stick** can be used to display the **map page**. Practice using both methods.

Press the **zoom in button** until the GPS is zoomed in as much as possible. The scale on the lower left side of the display should be at 20 feet. When the term “overzoom” appears, no additional information is available beyond that scale.

Your location is the black triangle. Walk around and watch the triangle change directions as you change your direction. The triangle will leave a dotted line track that shows the path traveled.

Try zooming out until Alaska is visible. Generally, a GPS is not used at that scale. Use the zoom button until it displays 120 feet in the scale bar on the lower left of the screen.



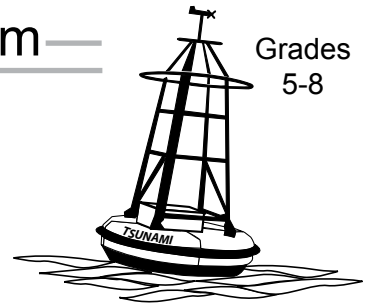
Marking a waypoint

A waypoint is the GPS term used to describe a position: the latitude and longitude of the GPS when the waypoint was taken. A GPS can store hundreds of waypoints. These can be places where you caught a fish, parked a snow machine, or any place that you want to find the latitude and longitude.

GPS - Using the Global Positioning System

Grades
5-8

Student Information Sheet



There are three steps to follow:

1. Mark Waypoint

To mark a waypoint, press down and hold the **click stick**. This will bring up the **mark waypoint screen**.

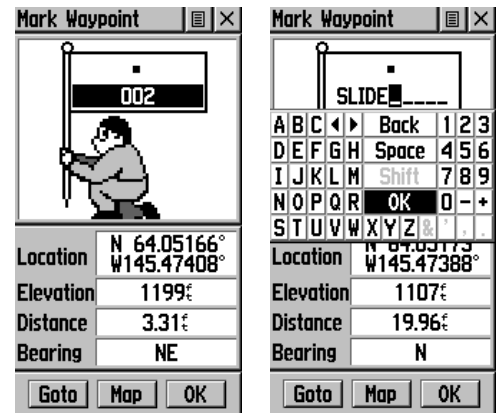
2. Name Waypoint

Use the **click stick** to name the waypoint. If you don't give the waypoint a name, it will be given a number. It is good GPS practice to give the waypoint a meaningful name and avoid using numbers that are meaningless or hard to remember.

With the number highlighted, press the **click stick** down to bring up the alphabet and number keys pad.

Use the **click stick** to write a descriptive name for the waypoint. For example, the slide on the school playground could be called "slide."

When you are finished entering the name, click **OK**.



3. Save Waypoint

At the bottom of the screen, click **OK** to save the waypoint.

If you don't want to save the waypoint, press the **page button**.

Use the **page button** or **click stick** to go to the **map page**. The waypoint that you just marked should be visible on the map.

Finding Waypoints on the Waypoint List

If you need to find the list of waypoints, use the **find button** on the left side of the GPS. Press the **find button**.

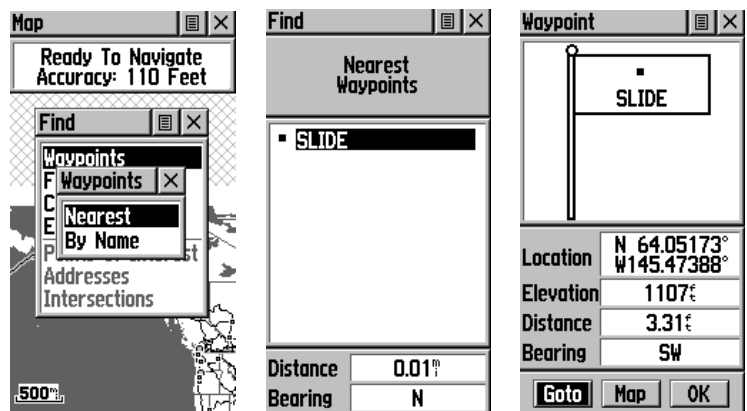
Press down on the **click stick** to select waypoints.

Press down on the **click stick** again to select nearest.

Highlight the waypoint to see the coordinates for that waypoint.

After finishing, click **OK**.

(NOTE: If "Goto" is selected, the GPS will show a dark line on the map page from your current location to the waypoint. It will also show an arrow on the compass page pointing toward the waypoint. If the Map option is selected, it will show the waypoint location on the map page.)

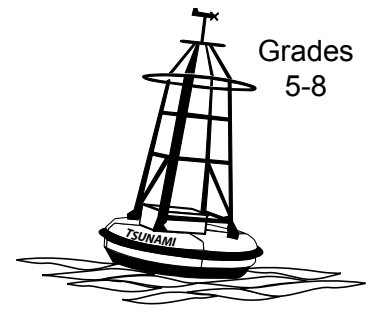


Name: _____

Student Worksheet

GPS - Using the Global Positioning System

Grades
5-8



Directions: Using the STUDENT INFORMATION SHEET, go over the basic operation of the GPS along with your teacher.

1. How many Global Positioning Satellites are in orbit around Earth? _____
2. Identify the buttons.



3. Walk around your school and mark waypoints for 4 locations. List the waypoint name, latitude, longitude and elevation.

Waypoint Name	Latitude	Longitude	Elevation