

GPS Basics



The letters GPS stand for Global Positioning System and even though GPS is a system with complex components, people use the acronym GPS to refer to the receiver device. A GPS receiver is a technologically advanced piece of equipment that can precisely pinpoint its own location on planet earth. For those people who get lost easily on city streets looking for a restaurant, a GPS device is a valuable tool for finding their way around.

There are a wide variety of GPS devices on market today; what once was the domain of the military is now available to anyone. Easy to use GPS systems can be simple hand-held portable devices that are great for all types of adventure-minded people, like hikers, hunters, or mountain climbers in remote areas, or they can be complex systems on board automobiles.

While the first satellite went into orbit a mere sixty years ago, today a large number of communication satellites orbit the earth. The U.S. Department of Defense launched a system of 27 communication satellites (24 active and 3 back-up) that are in orbit about 10,900 nautical miles above the earth. These satellites continuously transmit high-frequency, low power radio waves that broadcast information about the satellite and its location. Each satellite makes two rotations around the earth each day. Their orbits are set up such that at any time and anywhere on earth a GPS receiver can access at least four satellites.

A GPS receiver picks up these signals from the satellites and calculates how far away they are by counting how long it takes to obtain the signal from each satellite. Through a process known as trilateration, the signals returned from three of the satellites are enough to pinpoint the receiver's location on earth. Using information from the fourth satellite provides an even more accurate result.

The calculation gives the latitude and longitude location of the receiver as well as the altitude. Since we don't use longitude and latitude often, a GPS receiver translates the coordinates onto a map displayed on the receiver's screen.

Name: _____ Date: _____

Multiple Choice Questions

Circle the correct answer.

1. The purpose of a GPS receiver is to
 - a. Calculate longitude and latitude
 - b. Calculate its current location
 - c. Receive signals from communications satellites
 - d. All of the above

2. The Global Positioning System was first developed for
 - a. On-board computers in cars
 - b. The U.S. military
 - c. Commercial sales of GPS devices
 - d. Hikers in remote areas

3. How many satellites make up the Global Positioning System?
 - a. 3
 - b. 4
 - c. 24
 - d. 27

4. What type of radio waves do the GPS satellites transmit?
 - a. High-frequency, low power
 - b. Low-frequency, high power
 - c. High-frequency, high power
 - d. Low-frequency, low power

5. A GPS receiver calculates position by
 - a. Triangulation
 - b. Trilateration
 - c. Trilinear
 - d. Trifunctional

6. A GPS receiver calculates
 - a. Latitude
 - b. Longitude
 - c. Altitude
 - d. All of the above

Name: _____ Date: _____

Short Answer Questions

1. What is an acronym? Construct an acronym for the United States Department of Agriculture.
2. Give four examples of how ordinary people can use a GPS receiver.
3. Why is the Global Positioning System composed of 27 satellites?
4. One nautical mile equals 6076 feet. What is the orbit of GPS satellites in (American) miles?
5. How many satellites are required for a GPS receiver to calculate its position on earth? How many are optimum?
6. Would you like to work on advanced communications like GPS? Explain why or why not.
7. Describe some ways that a GPS device would be useful for you or your family.

Answer Key

Multiple Choice

1. d.
2. b.
3. d.
4. a.
5. b.
6. d.

Short Answer

1. An acronym is created by taking the first letter from each of a series of words and using these to create a new term.

United States Department of Agriculture -> USDA

2. The reading covers more than four: people who get lost easily in urban areas; hikers, hunters, or mountain climbers in remote areas, or automobile drivers and passengers.

3. It takes 24 satellites to cover the earth and 3 are back-ups.

4. Orbit is 10,900 nautical miles

$10,900 \text{ nautical miles} * 6076 \text{ feet/nautical mile} = 66,228,400 \text{ feet}$

$66,228,400 \text{ feet} / 5280 \text{ feet/mile} = 12543 \text{ miles}$

5. The signals returned from three of the satellites are enough to pinpoint the receiver's location on earth. Using information from the fourth satellite provides an even more accurate result.

6. Individual response

7. Individual response